

## Vitamin C in the Diet of Inuit Hunters From Holman, Northwest Territories

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**ABSTRACT.** During the spring and summer months the diet of three Inuit families living in a seal hunting camp south of Holman, N.W.T., was studied. A total of 13 food items including the most commonly eaten mammal, bird and plant species were analysed for Vitamin C in both the raw and cooked state. We document a daily intake of ascorbic acid of between 11 and 118 mg and estimate a mean does of at least 30 mg. This is well above the levels documented in larger transitional culture villages by a recent Nutrition Canada report.

**RÉSUMÉ.** On a étudié pendant le printemps et l'été, le régime de trois familles Esquimaux qui vivaient dans un camps de chasse au phoque, au sud d'Holman, N.W.T.

Au total, 13 types de nourriture, comprenant les mammifères, le plus souvent mangés, des espèces d'oiseaux et de plantes, étaient analysés pour la recherche de vitamine C, soit à l'état cru, soit à l'état cuit. Le resultat est une prise journalière d'acide scorifique de 11 à 118 mg, en moyenne de 30 mgs. Ceci est bien au dessus de ce qui a été constaté dans le villages de culture de transition (rapport Canadien sur la nutrition.)

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### INTRODUCTION

Early arctic explorers recognized the value of adopting the traditional Inuit diet of raw or boiled fish and meat, with only occasional ground plants and berries (Nansen, 1897). Those who could not or would not endure the change fell victim to malnutrition (Stefansson, 1918). Scurvy, caused by a deficiency of vitamin C, was observed in the arctic for the first time among white explorers and trappers who persistently ate "southern" foods. Ironically, the intrusion of southern white culture into northern communities led to the inevitable adoption of processed foods by the Inuit. This, combined with the consolidation of small hunting communities into large villages from which there may be little access to native foods, has gradually resulted in a decline in nutritional status among the Inuit (Draper, 1977).

Subacute scurvy, attributed to the absence of fresh meat, was noted in 28 of 30 Eskimo children examined in Point Barrow, Alaska (Levine, 1940). "Only reindeer killed several months before, was available." A study in 1947 by the Alaska Department of Health, showed that ascorbic acid was consistently lacking in native diets. Of 117 plasma ascorbic acid determinations, 96 were rated poor, 16 fair, and only 5 were within a normal range (Heller, 1949). In a recent study of four major Inuit settlements in the Northwest Territories

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(Eskimo Point, Pelly Bay, Frobisher Bay and Coppermine), a Nutrition Canada survey reported that vitamin C intake was adequate only in children under five years of age, and clearly low in women over 54 years of age. Between 50 and 80 percent of adults were placed in high risk categories (Anon., 1975a).

Small hunting settlements were necessarily overlooked in the Canada-wide nutritional survey, yet unlike the larger settlements these small communities have retained much of the traditional culture and healthful life style recognized by the early explorers. We undertook this study, as part of a larger investigation into vitamin C in the arctic food chain, to determine the adequacy of vitamin C in the summer diet of three Inuit families from Holman, a hunting community of approximately 250 people. Though commercially prepared foods are available and utilized, a large variety of native foods forms the bulk of the diet.

#### MATERIALS AND METHODS

Information on the diet of the three Inuit families was gathered by one of us (T.G.S.) while living at Kutuervik, a seal hunting camp 30 miles southeast of Holman, N.W.T., during July-September 1975. Records were maintained on types, frequencies and approximate quantities of foods consumed. Small samples of each raw food item were taken and frozen, usually within 2 hours, in an electric freezer at a field laboratory. The frozen samples were then shipped to Guelph where they were maintained at  $-70^{\circ}\text{C}$  for 2 months. They were analyzed, in duplicate, for total ascorbic acid according to the method of Roe and Kuether (1943). Where applicable, sub-samples of each food item were boiled for 10 minutes, then re-analyzed, roughly simulating the simple method of cooking.

#### RESULTS AND DISCUSSION

The most common meat item in the hunting camp was caribou. Ringed seal is the most abundant marine mammal, yet it was not consumed to nearly the same extent as the less common but preferred bearded seal or "ugyuk". The flesh of both seal species, caribou and muskox was eaten either fresh-boiled, or dried by draping thinly sliced pieces over rocks or driftwood frames.

Typically, the daily feeding pattern consisted of four meals. The first three were generally of 200-250 g portions of dried meats known as "MIPKO," or of dried arctic char, "BEEFY". These were eaten with tea and bannock, a form of bread with refined flour. The fourth and largest meal of the day was usually a stew, made with flesh, bones, marrow and selected viscera of terrestrial and marine mammals and birds. These were generally eaten in portions of 500-600 g by adult males, less by the females, and proportionally less by the children. The broth was always consumed as part of the meal. Few plants are available in the vicinity of Kutuervik; they formed an incidental part of the diet.

TABLE 1. Vitamin C content of raw and boiled food items of the Inuit diet (mg/100 g as mean of duplicate determinations on one sample of each food item).

Food item	Vitamin C (mg/100 g)	
	Raw	Boiled (10 min)
<b>MAMMALS</b>		
Ringed seal ( <i>Phoca hispida</i> )		
flesh	3	2.5
liver	35	13.6
Bearded seal ( <i>Erignathus barbatus</i> )		
flesh	1	0.9
intestine	1	0.9
Beluga whale ( <i>Delphinapterus leucas</i> )		
("Muktuk") epidermis	38	—
dermis	3	—
blubber	5	—
Polar bear ( <i>Ursus maritimus</i> )		
flesh	1	0.8
Muskox ( <i>Ovibos moschatus</i> )		
flesh (fresh)	1.5	0.5
flesh (dried)	1	—
Caribou ( <i>Rangifer tarandus</i> )		
flesh	1.4	0.9
fat	1.8	0.3
Arctic hare ( <i>Lepus arcticus</i> )	1.3	0.8
<b>BIRDS</b>		
Arctic loon ( <i>Gavia arctica</i> )		
flesh	2	0.9
ptarmigan ( <i>Lagopus mutus</i> )		
flesh	1.2	0.5
King eider ( <i>Somateria spectabilis</i> )		
flesh	1.6	0.3
<b>FISH</b>		
Arctic char ( <i>Salvelinus alpinus</i> )		
whole fish	5.8	0.8
flesh (dried)	1.8	—
<b>PLANTS</b>		
"MASU" ( <i>Hedysarum alpinum</i> )		
licorice root	21	4.5
Mountain sorrell ( <i>Oxyria digyna</i> )	36	5.3

Table 1 shows the vitamin C content of the raw and boiled food items eaten during the six-week period beginning 10 July 1975. Some vitamin degradation may have occurred in the interval between sampling and analysis, thus the values reflect minimum vitamin C content at the time of eating. Nevertheless, the values are equivalent to or higher than those reported for the same or similar food items by Høygaard and Rasmussen (1939).

The three minor meals of dried meat or fish, totalling approximately 700 g for the average adult male, provided at least 7 mg (muskox) to 13 mg (char) of vitamin C per day. The 500 g main meal of boiled meat provided an additional minimum 1 mg (king eider) to 68 mg (ringed seal liver) of the vitamin. According to Høygaard (1941), 35 percent of the vitamin C leached from boiling bird and seal flesh is recoverable in the stock, which is Kutuervik was always consumed as part of the meal. The broth in this case would have provided an additional 2 to 37 mg of the vitamin.

Certain foods which are not abundant but are eaten when available can augment vitamin C intake. This is particularly true of such items as licorice root, mountain sorrel and "muktuk." Muktuk is undoubtedly the most prized delicacy. It consists of the skin of the beluga whale, with about 2-4 cm of attached blubber. The thin epidermis contains 38 mg/100 g of vitamin C, and is one of the richest sources of the vitamin in the Inuit diet; its antiscorbutic properties were first recognized early in this century (Bertelsen, 1911). During the study period, muktuk was consumed for seven days, at an adult average of 1 kg/day, thus providing a variably high quantity of vitamin, depending on the proportion of skin and blubber in the serving.

From these figures, we estimate that the adult daily intake of vitamin C varied between at least 11 and 118 mg during the summer period, with as much as 50 to 100 mg extra when such sources as muktuk were available. Women and children consumed proportionally less of the vitamin. Though vitamin intake was generally sporadic, a conservative estimate would place the mean intake level at or above the 30 mg adult daily allowance established by the Canada Department of National Health and Welfare (Annon., 1975b), and well above the 10 mg minimum dose found to prevent and cure scurvy in adult males (Bartley et al., 1953). On a practical note, Høygaard (Høygaard and Rasmussen, 1939) found that only 15 mg of vitamin C per day was adequate to prevent scurvy on long sledging journeys in the arctic.

The winter diet of the Holman Inuit consists primarily of animal flesh and fat, particularly raw-frozen char and caribou, and stews containing fresh and thawed viscera and meat. This differs from the summer diet principally in that two major meals are consumed rather than one. The winter diet was not analyzed for vitamin C, but extrapolating from our findings on summer foods, eating habits, and the availability of fresh meats, vitamin C in winter is at least as plentiful as during the summer months. The Holman Inuit seem to enjoy a healthy and robust way of life and it is doubtful that vitamin C deficiency presents a problem, at least not to the extent reported in the large transitional culture settlements, where native foods are either unavailable or not utilized.

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