BONE MINERAL CONTENT OF THE ESKIMOS
OF POINT HOPE AND BARROW: PRELIMINARY REPORT

by

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Direct photon absorptiometry was used to determine the bone mineral content of Eskimo natives of the north coast of Alaska during the summers of 1968-1970. This is a preliminary report of measurements of the bone mineral content of the inhabitants of Point Hope and Barrow, Alaska collected in 1970. Measurements made in Wainwright, Alaska have been previously reported (Mazess, 1968; Mazess, 1970).

METHODS

Bone mineral content on two sites of both the radius and ulna was determined by the method of direct photon absorptiometry developed at the University of Wisconsin (Cameron and Sorenson, 1963; Cameron et al., 1968; Sorenson and Cameron, 1967). The Point Hope and Barrow measurements were made with a portable system allowing immediate digital readout of bone mineral content and bone width (Mazess and Cameron, 1969). Calibration of absorptiometric scans of the radius and ulna using an I-125 source (28 keV) was made with a 3-chambered bone phantom of saturated dipotassium hydrogen phosphate solution (Witt et al., 1970).

Measurements of 61 elderly subjects were made at Barrow. There were 26 males and 35 females age 40 to 89. At Point Hope a total of 188 subjects were measured: 117 children age 5 to 19, 43 adult females and 28 adult males. As in Wainwright the average of 4 determinations was taken at each site. The coefficient of variation of the determination at each site was 2 to 4%, decreasing with larger bone size and older subjects. A high correlation ($r \approx 0.80$) was found between the coefficient of variation of mineral and width measurements on children indicating systematic variation due to subject movement.

Table 1 gives results of measurements of the 3-chambered bone phantom in Alaska and in Madison. Mean values differed in the field from those obtained in the laboratory, presumably due to the less than reliable line frequency produced by the small village generators. The ratio of bone mineral divided by bone width was identical in Point Hope and in Barrow for all 3 chambers of the phantom, and the Alaska ratios were systematically about 0.02 units higher than the Madison ratios for the 3 chambers. The mean integral values of the bone phantom as measured in each of the villages were used to calculate separate regression equations in order to obtain the bone mineral content in gram/centimeter of the subjects studied. For the scans performed on the bone phantom there was a tendency for the coefficients of variation

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of the mineral and width values (coefficient of variation per occasion) to be higher in Alaska than in the Madison laboratory. The coefficients of variation of the mean mineral and width values determined at each occasion (coefficient of variation among occasions) were higher at Barrow than in Madison and 3-6 times larger at Point Hope. This reflected the fluctuation in line frequency: at Barrow measurements were done in the hospital with a generator independent from village use; in Point Hope the generator was more subject to line frequency fluctuation from usage by the entire village.

Measurements of adults (age 20-49) and elderly (age ≥ 50) from Point Hope and Barrow were pooled after t-tests revealed no significant differences in the bone mineral content, bone width, mineral to width ratio, height, and weight of any of the age and sex groups except the bone mineral content of females 50 to 59.

RESULTS

Table 2 gives heights and weights of Eskimos measured in Point Hope and Barrow and U.S. whites measured at the University of Wisconsin Bone Mineral Clinic over the past several years (Cameron, 1969). Eskimo children, adults, and elderly of both sexes appeared to have comparable weights but shorter stature. Determinations of bone mineral content, bone width and mineral to width ratio are presented in Table 3.

The bone mineral of Point Hope Eskimo children appeared somewhat reduced from that of whites until about age 20 when they were similar. Adjustment for bone width and stature would make Eskimo children normal with respect to U.S. whites.

At Point Hope male and female Eskimo adults age 20-49 did not demonstrate an increase in bone mineral past age 19 whereas white females and males increased 5 and 10%. However the sample of adult males was rather small and may not be representative; for example, the average weight of this group was 10% less than 17-19 year olds.

Eskimo elderly, both males and females, apparently lost bone mineral at a faster rate than whites. Female Eskimo 60-69 and over 70 had 15 and 28% less mineral than whites of comparable age; 62% of the female Eskimos were below the 0.70 gram/centimeter bone mineral content level associated with a high rate of fracture (Mazess, 1970).

DISCUSSION AND CONCLUSIONS

The bone mineral content of Eskimos at Point Hope and Barrow showed the same sort of pattern as found earlier at Wainwright. Children followed a course of mineralization similar to whites; adults (with possible errors associated with small sample size) had slightly lower mineral values than whites, and elderly Eskimos, especially females, had a much lower mineral content.

A final evaluation of the skeletal status of the northern Alaskan Eskimo population will be made from an incorporation of all data from Point Hope, Barrow, and Wainwright. We will measure Eskimos of the Canadian Arctic in the fall of 1971 for a comparison of Eskimo populations.

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Table 1. Averages of measurements on 3-chambered bone phantom in Wisconsin and in Alaska.

		SMALL			MEDIUM			LARGE		
		Barrow	Pt. Hope	Madison	Barrow	Pt. Hope	Madison	Barrow	Pt. Hope	Madison
MINERAL	Mean Integral	.673	.662	.629	1.120	1.106	1.077	2.406	2.375	2.346
	% Coefficient of Variation	1.62	2.92	1.11	1.30	2.63	.86	.81	2.37	.43
	among occasions of Variation { per occasion	1.88	1.53	1.18	1.53	1.01	1.14	.84	.78	.85
WIDTH	Mean Integral	.694	.683	.664	1.358	1.340	1.335	1.667	1.644	1.642
	% Coefficient of Variation	.92	2.24	.67	.44	2.04	.33	.39	1.98	.29
	among occasions of Variation { per occasion	1.59	1.07	.71	.92	.68	.56	.67	.54	.51
MINERAL/WIDTH		.970	.969	.947	.825	.825	.807	1.443	1.445	1.428

Table 2. Average heights and weights of Eskimo and White subjects by age.

	AGE	NUMBER		HEIGHT (cm)		WEIGHT (kg)	
		<u>Eskimo</u>	<u>White</u>	<u>Eskimo</u>	<u>White</u>	<u>Eskimo</u>	<u>White</u>
MALES	5-7	14	41	117	125	23.1	24.5
	8-9	9	47	131	138	31.4	31.0
	10-11	14	55	139	147	33.2	37.7
	12-14	13	45	150	160	46.9	52.2
	15-16	6	43	164	175	56.3	68.1
	17-19	7	37	172	182	72.9	74.5
	20-49	14	168	166	178	67.2	77.5
	50-59	10	24	166	176	75.4	77.0
	60-69	18	35	164	175	70.2	75.4
	70+	10	32	162	175	70.2	71.2
FEMALES	5-7	14	32	119	126	25.4	24.3
	8-9	13	36	128	136	29.2	29.4
	10-11	8	43	142	147	37.9	38.0
	12-14	8	46	150	162	53.2	48.6
	15-16	5	37	157	166	59.2	56.2
	17-19	8	62	157	166	59.6	58.3
	20-49	30	121	153	163	61.6	62.5
	50-59	19	37	154	162	64.6	64.9
	60-69	18	43	152	160	65.2	61.5
	70+	11	103	141	160	48.6	57.7

Table 3. Bone mineral content, bone width, and ratio of mineral to width of the radius (1/3 length from distal).

	AGE	BONE MINERAL CONTENT (g/cm)		BONE WIDTH (cm)		MINERAL/WIDTH (g/cm ²)	
		<u>Eskimo</u>	<u>White</u>	<u>Eskimo</u>	<u>White</u>	<u>Eskimo</u>	<u>White</u>
MALES	5-7	0.46	0.50	0.96	0.98	0.48	0.50
	8-9	0.55	0.57	1.02	1.03	0.54	0.55
	10-11	0.60	0.67	1.09	1.12	0.55	0.60
	12-14	0.72	0.81	1.20	1.25	0.61	0.65
	15-16	0.94	1.08	1.30	1.41	0.73	0.76
	17-19	1.19	1.20	1.43	1.46	0.83	0.82
	20-49	1.20	1.31	1.51	1.49	0.80	0.88
	50-59	1.12	1.33	1.52	1.51	0.74	0.88
	60-69	1.00	1.24	1.48	1.56	0.68	0.79
	70+	1.04	1.23	1.50	1.56	0.69	0.79
FEMALES	5-7	0.44	0.45	0.92	0.92	0.47	0.49
	8-9	0.48	0.52	0.97	0.95	0.49	0.55
	10-11	0.58	0.61	1.00	1.04	0.58	0.59
	12-14	0.71	0.78	1.12	1.16	0.63	0.67
	15-16	0.84	0.87	1.20	1.20	0.70	0.73
	17-19	0.89	0.92	1.21	1.23	0.74	0.75
	20-49	0.89	0.97	1.24	1.27	0.72	0.76
	50-59	0.81	0.86	1.31	1.23	0.62	0.70
	60-69	0.68	0.80	1.28	1.25	0.53	0.63
	70+	0.51	0.71	1.26	1.28	0.40	0.55