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Nutrient Values in Indigenous Wild Berries Used by the Nuxalk People of Bella Coola, British Columbia

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The nutrient composition for 23 different species of wild berries used for food by native Indian people of Western British Columbia, Canada, are reported. Proximate composition includes moisture, protein, lipids, ash, and computed carbohydrate and energy values. Neutral detergent fiber values are given. Mineral values are given for calcium, phosphorus, sodium, magnesium, iron, zinc, copper, manganese, and strontium. Vitamin determinations are given for thiamine, riboflavin, niacin, ascorbate, carotene, and folate. This is the first comprehensive report for any of these species and the first report of any nutrient data in edible portions of *Cornus canadensis, Ribes bracteosum, Ribes laxiflorum, Shepherdia canadensis, Vaccinium alaskense,* and *Vaccinium membranaceum.* It is the first report on strontium, folate, and neutral detergent fiber in edible wild berries of the west coast of North America.

INTRODUCTION

Although it is recognized that traditional food species of native Indian people are rapidly being replaced by marketed foods in the food systems of Indian people, there are few attempts to document these valuable traditional resources in the scientific literature. Ethnographers (anthropologists, ethnobotanists, ethnonutritionists) are best known for their efforts to define the traditional foodstyle of native people, usually by interviewing the oldest members of the group who have a perspective on past uses, preparation, and flavor of traditional food items. While the ethnographic literature available on a specific group refers, often in great detail, to food species harvest and preparation procedures, the scientific compositions of these are less frequently documented because of the rigors of field sampling and the expense of analyses.

The traditional food resources of the Nuxalk people of Bella Coola, British Columbia, Canada, are an example of this phenomenon. Ethnographic descriptions of Nuxalk foods were reported by Smith (1928), McIlwraith (1948), and Turner (1973). The contemporary uses of the traditional species were reported by Kuhnlein (1984) and in a publication prepared for the Nuxalk people by the Nuxalk Food and Nutrition Program Staff (1984). In this paper, a compilation of the wild berry[1] species used by the Nuxalk people is presented, and their composition is presented in units useful for the evaluation of dietary data by dietitians, nutritionists, and others in the public health network.

The ethnographic literature documents the subsistence pattern of "West Coast" Indian people as being that of hunting and gathering, and with a predominance of

[1] For convenience, the term "berry" is used here to refer to any of various types of small, fleshy fruits. Botanically they are referable to several classes, including drupes, aggregate fruits, pomes and true berries.

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wild berries (Drucker, 1965; McIlwraith, 1948; Smith, 1928). The extent of the variety of edible wild berries used by British Columbia native people has been shown with the publications of Turner in 1973, 1975, and 1978. However, there has not been a systematic evaluation of the literature on nutrient values of these many varieties of fruit, nor have there been any reports on the nutrient composition of the multiple species of berries used by any specific group of native people in Western British Columbia.

The people of the Nuxalk Nation live at the mouth of the Bella Coola River on a deep sea inlet at the eastern end of Burke Channel, which is located on the central west coast of British Columbia. The west coast environment is mild (average of 250 frost-free days/year) and wet (average 165-cm precipitation/year) and thus well suited to many types of wild berries. Most of the wild edible berries available and used by native people in any part of coastal British Columbia are available in the valley of the Bella Coola River.

Berries are harvested from mid-April (the earliest to be harvested being salmonberries) to mid-October, or after heavy frost (as is the case for highbush cranberries) (Kuhnlein, 1984). In earlier days berries were eaten fresh, sun-dried, smoke-dried or after storage under a thick fish oil called ooligan grease (Kuhnlein *et al.*, 1982a). Today they are eaten fresh, frozen, or preserved in jars or as jam and they are also incorporated into bread products and fruit salads (Kuhnlein, 1984).

Table 1 is a compilation of common names, botanical names, and the use and taste popularity of the 23 fruits presented in this report. The data are extrapolated from previous reports (Kuhnlein, 1984; Nuxalk Food and Nutrition Program Staff, 1984; Kuhnlein, in press).

METHODS

Identification and Harvesting

Berry species were identified as being edible and where available by a group of six Nuxalk elders during several meetings. During the harvest seasons over 1981–1983, one or more of the elders accompanied collectors of the berries to where they were routinely harvested. Berries identified as ripe or otherwise ready for harvest and preparation were picked from at least 10 different bushes to get a minimum of 500 ml for each sample. They were picked free of plant leaf and stem litter and frozen in new plastic bags in a household freezer (−20°C) within 24 h of picking and were held frozen until transportation to the laboratory. The number of independently harvested samples of each species is given in Table 2. Each species harvested was botanically identified by a botanist with the Royal B. C. Museum from pressed plant voucher specimens. When berries were consumed only cooked, the cooking process was verified by a Nuxalk elder as being appropriate to the Nuxalk tradition.

Analyses

Berry samples were shipped frozen by air (2 h) to the laboratory in well-packed insulated boxes and kept at −20°C until analysis. Unless otherwise noted in the tables, values are for raw, frozen fruit.

The samples were thoroughly mixed and homogenates were prepared from about three-fourths of each sample. Equal weights of fruit tissue and distilled, deionized

TABLE I

WILD BERRIES USED BY THE NUXALK

COMMON NAME	BOTANICAL NAME	USE[A]	TASTE POPULARITY[B]
BLACKCAP	RUBUS LEUCODERMIS	• FRESH, DRIED, JAM	4.5
BLACK HAWTHORN	CRATAEGUS DOUGLASII	• MASHED, STRAINED, BOILED, JAM	3.6
BOG BLUEBERRY	VACCINIUM ULIGINOSUM	• FRESH, DRIED, JAM	N/A
BUNCHBERRY	CORNUS CANADENSIS	• FRESH WITH SUGAR AND OOLIGAN GREASE, DRIED, JAM	3.7
CROWBERRY	EMPETRUM NIGRUM	• MASHED AND STRAINED TO REMOVE SEEDS, JAM	N/A
GREY BLUEBERRY	VACCINIUM OVALIFOLIUM	• FRESH, DRIED, JAM	4.1
HIGHBUSH CRANBERRY	VIBURNUM EDULE	• COOKED, JARRED, MIXED WITH OOLIGAN GREASE AND SUGAR	3.9
KINNICKINNICK BERRY	ARCTOSTAPHYLOS UVA-URSI	• DRIED AND SOAKED BEFORE COOKING, COOKED IN DUMPLINGS	3.5
MOUNTAIN BILBERRY	VACCINIUM MEMBRANACEUM	• FRESH, DRIED, JAM	4.3
RED ELDERBERRY, COOKED	SAMBUCUS RACEMOSA	• ALWAYS COOKED, ADDED SUGAR AND OOLIGAN GREASE, JAM	3.6
RED HUCKLEBERRY	VACCINIUM PARVIFOLIUM	• FRESH, DRIED, JAM	4.1
ROSEHIP	ROSA NUTKANA	• FRESH AFTER DISCARDING SEEDS OR DRIED FOR TEA	3.6
SALMONBERRY	RUBUS SPECTABILIS	• FRESH, DRIED, JAM	4.3
SASKATOON BERRY	AMALANCHIER ALNIFOLIA	• DRIED AND SOAKED, JAM	3.9
SOAPBERRY, FRESH	SHEPHERDIA CANADENSIS	• DRIED OR JARRED, MADE THICK WHIP WITH ADDED SUGAR	4.2
STINK CURRANT	RIBES BRACTEOSUM	• FRESH, DRIED, JAM	4.0
SWAMP GOOSEBERRY	RIBES LACUSTRE	• DRIED	3.5
THIMBLEBERRY	RIBES PARVIFLORUS	• FRESH, DRIED, JAM IN PORRIDGE	4.0
WATERY BLUEBERRY	VACCINIUM ALASKENSE	• FRESH, DRIED, JAM WITH SUGAR AND OOLIGAN GREASE	4.1
WILD BLUE CURRANT	RIBES LAXIFLORUM	• COOKED BRIEFLY	3.8
WILD BLACK GOOSEBERRY	RIBES DIVARICATUM	• FRESH, JAM	3.6
WILD "GREEN" GOOSEBERRY AND LEAVES	RIBES DIVARICATUM	• GREEN BERRIES COOKED WITH THEIR LEAVES	3.6
WILD RASPBERRY	RUBUS IDAEUS	• FRESH, DRIED, JAM	4.3
WILD STRAWBERRY	FRAGARIA VESCA	• FRESH	4.2

[A] Most common processes used by Nuxalk families.

[B] Evaluated by 60 Nuxalk women on a 5-point hedonic taste appreciation scale where 5 = best, no improvement possible; and 1 = terrible, not liked.

water were used to prepare homogenates with a glass and stainless steel blender. Blending was usually less than 30 s. These were then portioned for proximate (moisture, N/protein, lipids, ash) analysis and minerals. Thiamine, riboflavin, niacin, ascorbate, carotene, and folate analyses were completed from separate standardized aliquots of the whole fruit, which were kept frozen until the day of analysis. Since the samples were harvested at different periods, the time in frozen storage varied. Vitamin analyses were completed within 1 year of harvesting, and the fruit remained frozen during this time.

Standard techniques of the AOAC (1980) were used for moisture (7.003), ash (7.009), fat (16.059), thiamine (43.024), riboflavin (43.039), and niacin (43.044). Car-

TABLE 2

PROXIMATE COMPOSITION AND ENERGY VALUES PER 100 g FRESH NUXALK BERRIES (MEAN AND STANDARD DEVIATION)[a]

COMMON NAME	N[b]	MOISTURE G	PROTEIN G	FAT G	CARB. G	APPROX. ENERGY KCAL	KJ
BLACKCAP	3	79 (4.7)	1.2[c]	1.4 (.41)	17.5	79	330
BLACK HAWTHORN	4	84 (2.8)	0.3	1.4 (.01)	14.9	52	217
BOG BLUEBERRY	1	88	0.7	0.6	10.6	45	187
BUNCHBERRY	3	81 (7.9)	0.6 (.04)	0.8 (.12)	16.6	52	217
CROWBERRY	2	89 (2.9)	0.2 (.08)	0.7 (.22)	9.5	35	145
GREY BLUEBERRY	4	87 (1.5)	1.1	0.5 (.12)	11.3	49	203
HIGHBUSH CRANBERRY	5	89 (0.8)	0.1 (.09)	0.4 (.03)	9.4	39	161
KINNICKINNICK BERRY	3	75	0.7 (.07)	1.1 (.04)	22.4	92	385
MOUNTAIN BILBERRY	3	86 (2.1)	0.6 (.03)	0.5	13.1	54	224
RED ELDERBERRY, FRESH	7	78 (0.4)	1.1	5.6 (1.9)	14.6	103	430
RED ELDERBERRY, COOKED	5	78 (3.1)	2.9	4.8	13.9	100	418
RED HUCKLEBERRY	5	87 (1.8)	0.8 (.17)	0.5 (.10)	12.0	50	209
ROSEHIP (NO SEED)	1	79	1.6	0.6	17.6	74	308
SALMONBERRY	4	88 (4.0)	1.4 (.30)	0.8 (.29)	9.9	47	195
SASKATOONBERRY	4	76 (1.8)	0.7	1.2 (.23)	21.4	90	375
SOAPBERRY, FRESH	4	81 (3.5)	1.8	0.7	16.6	72	300
STINK CURRANT	5	83 (3.7)	0.8 (.08)	1.2 (.31)	13.9	63	263
SWAMP GOOSEBERRY	1	86	1.5	2.3	9.7	59	248
THIMBLEBERRY	4	74 (1.0)	1.7	1.2	23.0	99	412
WATERY BLUEBERRY	3	82 (6.7)	0.9	0.6 (.18)	16.2	66	276
WILD BLUE CURRANT	3	84 (4.4)	0.7 (.11)	0.6 (.26)	14.2	59	247
WILD BLACK GOOSEBERRY	4	82 (4.9)	1.1	1.5 (1.3)	14.7	69	290
WILD "GREEN" GOOSEBERRY AND LEAVES (COOKED)	3	85 (4.2)	1.7 (.59)	0.9 (.75)	12.5	58	243
WILD RASPBERRY	6	83 (2.2)	0.6 (.02)	0.8 (.22)	15.8	65	273
WILD STRAWBERRY	3	85 (1.3)	0.6	0.9 (.23)	12.5	54	227

[a] Standard deviation is reported when two or more independent samples were analyzed.
[b] Number of independently harvested samples.
[c] Only one sample analyzed, therefore no standard deviation.

bohydrate was computed by difference and protein was computed using $N \times 6.25$ following duplicate N determinations using the procedure of Fukomoto and Chang (1982). Minerals were analyzed on a nitric-perchloric acid digest with inductively coupled plasma atomic emission spectroscopy (ICPAES) as previously described (Kuhnlein *et al.*, 1982; McQuaker *et al.*, 1979). Neutral detergent fiber was completed with the procedure of Goering and Van Soest (1970). L-ascorbic acid and dehydroascorbic acid (vitamin C) analyses were completed using the manual procedure of the method of Pelletier and Brassard (1977). For carotene, samples (15 g) were digested 30 min in boiling ethanolic KOH containing pyrogallol as antioxidant. The digest was filtered through glass wool and extracted with diethyl ether/hexane. Extracts were evaporated and β-carotene was separated by HPLC as described elsewhere (Thompson *et al.*, 1985). Total folate activity was assayed microbiologically with *L. casei* (Hoppner *et al.*, 1972). All assays were completed in duplicate or triplicate. Variation in repeated assays was routinely less than or equal to 10%. A standard food sample (commercially frozen raspberries) was routinely included with the assays.

RESULTS AND DISCUSSION

Nutrient values per 100 g fresh weight of fruit are given in Tables 2 through 5. The range of values for each nutrient/species are available from the author upon request.

TABLE 3

FIBRE AND MINERAL COMPOSITION PER 100 g FRESH NUXALK BERRIES [a]

	FIBRE G	ASH G	CA MG	P MG	NA MG	MG MG
BLACKCAP	11.5	0.46 (.00)	38 (20)	40 (16)	0.8 (.19)	28 (8.2)
BLACK HAWTHORN	2.6	0.68	31 (2.4)	12 (6.0)	6.9	12 (4.2)
BOG BLUEBERRY	3.3	0.23	19	13	--[b]	8
BUNCHBERRY	5.2	0.50	52 (17)	19 (2.6)	0.4	12 (2.8)
CROWBERRY	5.9	0.71	9 (1.0)	11 (1.4)	2.5	4 (1.1)
GREY BLUEBERRY	3.3	0.23 (.01)	16 (1.0)	21 (2.8)	0.9 (.05)	9 (0.6)
HIGHBUSH CRANBERRY	3.8	0.53 (.08)	24 (2.4)	23 (6.9)	0.6	11 (4.2)
KINNICKINNICK BERRY	14.8	0.64	37 (8.3)	35 (8.0)	0.5	17 (2.6)
MOUNTAIN BILBERRY	2.0	0.14 (.03)	14 (3.1)	17 (3.7)	0.4 (.13)	8 (1.0)
RED ELDERBERRY, FRESH	9.3	0.94	98 (22)	84 (16)	1.3 (.58)	44 (5.3)
RED ELDERBERRY, COOKED	8.2	0.73 (.02)	89 (8.9)	77 (4.2)	1.9 (.35)	40 (2.8)
RED HUCKLEBERRY	3.9	0.13 (.06)	22 (5.8)	16 (3.2)	0.8 (.18)	7 (1.0)
ROSEHIP (NO SEED)	4.4	1.40	77	37	1.8	26
SALMONBERRY	2.6	0.16 (.04)	15 (0.2)	24 (2.5)	2.6 (1.2)	16 (1.2)
SASKATOONBERRY	6.4	0.65 (.09)	69 (6.3)	40 (2.2)	0.6 (.19)	26 (2.4)
SOAPBERRY, FRESH	5.3	0.35 (.02)	16 (5.6)	21 (8.2)	0.5 (.21)	8 (2.4)
STINK CURRANT	4.4	0.82 (.04)	98 (60)	47 (13)	1.8 (.69)	19 (5.9)
SWAMP GOOSEBERRY	3.5	0.90	68	47	0.6	22
THIMBLEBERRY	11.9	0.62 (.09)	89 (14)	62 (.87)	0.8 (.01)	44 (1.4)
WATERY BLUEBERRY	2.8	0.86 (.36)	24 (7.7)	21 (.98)	1.0 (.10)	9 (4.6)
WILD BLUE CURRANT	5.2	0.52 (.18)	51 (12)	23 (16)	1.8	18 (4.2)
WILD BLACK GOOSEBERRY	4.6	0.87 (.06)	111 (31)	53 (7.0)	0.6 (.15)	23 (2.4)
WILD "GREEN" GOOSEBERRY AND LEAVES (COOKED)	4.3	0.20	124 (13)	46 (9.4)	1.1 (.32)	26 (5.7)
WILD RASPBERRY	4.5	0.34 (.11)	36 (7.7)	38 (8.1)	0.4 (.20)	17 (9.2)
WILD STRAWBERRY	2.9	0.63 (.00)	64 (13)	35 (9.1)	0.6 (.09)	54 (36)

[a] Standard deviation is reported when two or more independent samples were analyzed.
[b] Not analyzed.

The values reported are compiled means of duplicate or triplicate analyses for the independently harvested samples of any one species. Standard deviations are used to report variance in assays between independently harvested samples. Any particular assay may not have been run on all independently harvested samples.

Values for moisture, protein, fat and ash are within values reported for most seed-containing fruits (Pennington and Church, 1980). Moisture was from 73.5 to 89.2%, protein varied from 0.23 to 2.90%, total lipids from 0.10 to 5.60%, and ash from 0.14 to 0.94 g/100 g fresh weight (gfw). Carbohydrate and neutral detergent fiber were also within a similar range for such fruits. Computed energy values for these berries thus fell within an expected range of 35 to 103 kcal/100 gfw (145 to 430 kJ).

Within the literature, carbohydrate is often reported as the difference of total weight minus the sum of moisture, ash, protein, and lipid, and fiber may or may not be taken into account. Until recently, if fiber was reported it was as crude fiber rather than total dietary fiber or one of its fractions. Neutral detergent fiber was selected for analysis in this study because it is closer to total dietary fiber than is acid detergent fiber or crude fiber. Crude fiber has been previously reported in three of these wild berry types. It was reported at 1.4 g/100 gfw in crowberry from the British Isles (Moss, 1968), and at 1.45 g/100 gfw in wild blueberries (*Vaccinium* spp., undefined) from New Brunswick (Barberie, 1946). This is the first report of neutral detergent fiber in Canadian wild berries.

The following minerals were determined: calcium (Ca), phosphorus (P), sodium (Na), magnesium (Mg), iron (Fe), zinc (Zn), copper (Cu), manganese (Mn), and

TABLE 4

MINERAL COMPOSITION PER 100 g FRESH NUXALK BERRIES

COMMON NAME	Fe MG	Zn MG	Cu MG	Mn MG	Sr MG
BLACKCAP	0.7 (.09)[A]	0.6 (.33)	0.2 (.03)	0.3 (.12)	.15 (.05)
BLACK HAWTHORN	0.5 (.25)	0.2 (.05)	0.3 (.03)	0.2 (.01)	.20 (.02)
BOG BLUEBERRY	0.2	0.3	0.2	2.7	.10
BUNCHBERRY	0.6 (.30)	0.1 (.01)	0.1 (.01)	0.1 (.03)	.20 (.02)
CROWBERRY	0.4 (.24)	0.1 (.07)	1.0 (.72)	0.4 (.21)	.03 (.01)
GREY BLUEBERRY	0.4 (.07)	0.2 (.03)	0.6 (.68)	1.3 (.40)	.05 (.04)
HIGHBUSH CRANBERRY	0.3 (.25)	0.1 (.05)	0.1 (.01)	0.1 (.01)	.13 (.04)
KINNIKINNICK BERRY	0.7 (.16)	0.5 (.10)	1.3 (1.2)	0.2 (.05)	.22 (.03)
MOUNTAIN BILBERRY	0.2 (.06)	0.1 (.04)	0.1 (.02)	2.5 (.27)	.03 (.01)
RED ELDERBERRY, FRESH	1.1 (.20)	0.5 (.22)	0.8 (.85)	1.0 (.59)	.58 (.12)
RED ELDERBERRY, COOKED	1.0 (.07)	0.7 (.36)	0.5 (.22)	0.6 (.29)	.48 (.05)
RED HUCKLEBERRY	0.3 (.03)	0.2 (.03)	0.4 (.36)	4.5 (.61)	.05 (.04)
ROSEHIP (NO SEED)	0.3	0.2	<.1[B]	0.9	.72
SALMONBERRY	0.6 (.10)	0.2 (.40)	0.5 (.48)	0.7 (.21)	.08 (.02)
SASKATOONBERRY	0.5 (.11)	0.4 (.16)	0.4 (.37)	2.2 (1.9)	.32 (.07)
SOAPBERRY, FRESH	0.5 (.15)	1.4 (2.3)	0.3 (.21)	0.2 (.05)	.07 (.04)
STINK CURRANT	0.8 (.43)	0.8 (.03)	0.7 (.95)	0.6 (.15)	.57 (.30)
SWAMP GOOSEBERRY	0.4	0.2	0.1	0.3	.56
THIMBLEBERRY	0.7 (.23)	0.4 (.25)	0.2 (.07)	1.8 (.85)	.40 (.20)
WATERY BLUEBERRY	0.5 (.16)	0.2 (.07)	0.3 (.09)	0.1 (.05)	.07 (.03)
WILD BLUE CURRANT	0.6 (.30)	0.4 (.15)	0.1 (.01)	1.2 (.88)	.46 (.24)
WILD BLACK GOOSEBERRY	0.7 (.30)	0.2 (.06)	0.4 (.03)	0.5 (.12)	.50 (.23)
WILD "GREEN" GOOSEBERRY AND LEAVES (COOKED)	0.9 (.32)	0.4 (.15)	0.4 (1.8)	0.4 (.05)	.67 (.06)
WILD RASPBERRY	0.7 (.22)	0.4 (.10)	0.6 (.13)	0.4 (1.2)	.16 (.02)
WILD STRAWBERRY	0.4 (.19)	0.2 (.04)	0.8 (1.1)	0.8 (1.2)	.41 (.07)

[A] Standard deviation is reported when two or more independent samples were analyzed.
[B] Indicates not detectable below this level.

strontium (Sr). The ranges of mean values/100 gfw were Ca 8–124 mg, P 11–83 mg, Na 0.4–2.4 mg, Mg 3.7–57.5 mg, Fe 0.2–1.1 mg, Zn 0.1–0.8 mg, Cu undetectable to 1.3 mg, Mn 0.01–4.4 mg, Sr 0.03–0.72 mg. Reported values for agricultural marketed berries fell within these ranges with the exception of Canadian blueberries (species undefined) which were reported to contain 9 mg Na/153 g (Pennington and Church, 1980; Health Services and Promotion Branch, 1987; Medical Services Branch, 1985).

Ca, P, Na, Fe, Cu, Mg, and Zn have been previously reported in some of these berries from other parts of the world. Unfortunately, comparing these is often not possible because distinct species may not be listed, and mineral values per dry weight without values for moisture do not permit computation to a fresh weight basis for comparison with the present data (for example, Erkama *et al.*, 1953). However, Keely *et al.* (1982) reported red huckleberries (per 100 gfw) from Washington to contain Ca, 22.6 mg; Fe, 0.4 mg; Mg, 5.7 mg; Zn, 0.2 mg; all which compare excellently with data reported here. These authors also reported these four minerals in salmonberry, thimbleberry, black gooseberry, and red elderberry which also compare well. Hooper's report on Alaskan red huckleberry and salmonberry compare well to the data reported here for Ca (salmonberry, 14 mg/100 gfw; huckleberry, 15 mg/100 gfw) and Fe (salmonberry, 0.6 mg/100 gfw and huckleberry, 0.3 mg/100 gfw) (Hooper, 1984). Alaskan salmonberries reported by Mann *et al.* (1962) contained 36.5 mg Ca, 34.3 mg P, and 0.8 mg Fe/100 gfw.

Vitamins reported here and their range of mean values are thiamine undetectable to 40 μg/100 gfw, riboflavin undetectable to 100 mg/100 gfw, niacin undetectable to

TABLE 5

VITAMIN COMPOSITION PER 100 g FRESH NUXALK BERRIES[A]

COMMON NAME	THIAMINE µG	RIBOFLAVIN µG	NIACIN MG	ASCORBATE MG	CAROTENE RE	TOTAL FOLATE µG
BLACKCAP	7 (2.5)[A]	1	0.7	6.5	0.4	20.9
BLACK HAWTHORN	--[B]	--	--	9.5	8.1	--
BOG BLUEBERRY	--	--	--	--	--	--
BUNCHBERRY	8	25	0.5	2.1	3.5	10.5
CROWBERRY	4	1	0.1	16.4	--	--
GREY BLUEBERRY	4 (1.0)	1 (.00)	0.4 (.10)	6.2	0.7	7.4
HIGHBUSH CRANBERRY	--	--	--	13.4 (4.3)	5.8	--
KINNICKINNICK BERRY	--	--	--	--	--	--
MOUNTAIN BILBERRY	--	--	--	6.6	0.5	--
RED ELDERBERRY, FRESH	--	--	--	36.7 (18)	3.0	68.3
RED ELDERBERRY, COOKED	--	--	--	30.9 (7.1)	2.2	--
RED HUCKLEBERRY	20	8	0.5	6.2 (2.0)	0.2	2.8
ROSEHIP (NO SEED)	--	--	--	413.8	18.0	--
SALMONBERRY	40	1	0.5	14.4	31.4	16.5
SASKATOONBERRY	<4	1	0.3	10.9	0.5	--
SOAPBERRY, FRESH	7	100	0.2	165.6	--	--
STINK CURRANT	--	--	--	27.5	3.7	--
SWAMP GOOSEBERRY	40	<1	<.1	58.2	3.0	--
THIMBLEBERRY	31	<1	<.6	63.6	--	--
WATERY BLUEBERRY	17 (.10)	1 (.00)	0.4	3.3	2.0	4.9
WILD BLUE CURRANT	4	<1	<.1	61.5	5.7	--
WILD BLACK GOOSEBERRY	20	2	1.0	40.2	1.5	19.9
WILD "GREEN" GOOSEBERRY AND LEAVES (COOKED)	9	10	0.5	12.6	--	--
WILD RASPBERRY	13 (9.0)	1 (.00)	0.4 (.32)	30.7	0.6	61.8
WILD STRAWBERRY	6	26	<.3	23.8	--	--

[A] Standard deviation is reported when two or more independently harvested samples were analyzed.
[B] Not analyzed.
Note. Values following < indicate not detectable below this level.

0.72 mg/100 gfw, ascorbate at 3.3 to 413.8 mg/100 gfw, carotene as RE at 0.2 to 31.4 RE/100 gfw, and total folate 2.8 to 68.3 µg/100 gfw.

Vitamin A and vitamin C are the vitamins routinely reported for berries in the literature; however, interpreting the data is again complicated by lack of information of exact species (i.e., "blueberries") or analytical method used. Particularly problematical are vitamin A values reported prior to use of HPLC techniques. Other problems related to storage of plant tissue also affects the unstable vitamins.

Mann *et al.* (1962) reported Alaska salmonberries at 0.02 mg thiamine, 0.06 mg riboflavin, 0.38 mg niacin, and 85.4 mg C/100 gfw, whereas Keely *et al.* (1982) reported ascorbate in Washington salmonberries at 27.5 mg/100 gfw. Hooper's values (1984) for Alaska salmonberries were 0.04 mg thiamine, 0.07 mg riboflavin, 0.1 mg niacin, 1550 (RE/IU) vitamin A and 2.4 mg ascorbate per 100 gfw. Hoffman *et al.* (1967) reported Arctic crowberry (*Empetrum nigrum*) with an average of 30 mg/100 gfw ascorbate, and 112 µg/100 gfw β-carotene (equivalent to 18.6 RE). Tuba *et al.* (1945) reported Alberta rosehips (various species) to be 1300–3500 mg ascorbate and 2500 IU (750 RE) vitamin A 100 gfw. The difference in ascorbate values may be due to the fact that the Nuxalk rosehips were analyzed after the seeds were removed from the fruits. Mazza (1982) reported carotene at 29.7 ppm (2.9 mg/100 g) dry weight with moisture at 80%. *Vaccinium vitis-idaea* (noted as lingenberry) from Alaska was reported by the Alaska dietary survey in 1956–1961 to contain 0.02 mg thiamine,

0.08 mg riboflavin, 0.4 mg niacin, and 21 mg ascorbate (U.S. Department Health, Education and Welfare, 1961). Although we do not have values for these nutrients to report for lowbush cranberries, the values compare well for thiamine, niacin, and ascorbate (but not riboflavin) for other berries in this report.

CONCLUSION

Wild berries are an important food resource for native people following traditional lifestyles. Their scientific notation and nutritional values have been largely ignored in the literature bases of nutrition, food science and public health. This report documents the use and nutrient content of 23 berries used by native Indian people of the west coast of British Columbia.

This is the first report of any nutrient data on wild blue current (*Ribes laxiflorum*), soapberry (*Shepherdia canadensis*), bunchberry (*Cornus canadensis*), mountain bilberry (*Vaccinium membranaceum*), stink currant (*Ribes bracteosum*), and watery blueberry (*Vaccinium alaskense*). It is also the first report of Sr, total folate, and neutral detergent fiber in these berries. Furthermore, this is a more comprehensive listing of nutrient values for any of these 23 species which has been reported to date.

These data can be used in the evaluation of dietary data of native Indian people, and other west coast residents, who consume these foods.

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REFERENCES

AOAC (1980). *Official Methods of Analysis.* 13th ed. Association of Official Analytical Chemists, Washington, DC.

Barberie, M. A. (1946). *Edible Wild Plants of New Brunswick as a Source of Riboflavin.* M. Sc. thesis, University of New Brunswick.

Drucker, P. (1965). *Cultures of the North Pacific Coast.* Chandler, San Francisco, CA.

Erkama, J., Saimnen, A., and Sinkkonen, I. (1953). Uber denspurenelementgengehalt einiger gewahnlichsten finnischen beerenfruchte. *Suom. Kemistil. Acta* **26**, 20–22.

Fukomoto, H. E., and Chang, G. W. (1982). Manual salicylate–hypochlorite procedure for determination of ammonia in Kjeldahl digests. *J. Assoc. Off. Anal. Chem.* **65**, 1076–1079.

Goering, H. K., and Van Soest, P. J. (1970). *Forage Fibre Analysis.* Handbook No. 379, U.S. Dept. of Agriculture, Washington, DC.

Health Services and Promotion Branch (1987). *Nutrient Value of Some Common Foods.* Minister of Supply and Services Canada, Ottawa.

Hoffman, L., Nowosad, F. S., and Cody, W. J. (1967). Ascorbic acid and carotene values of native Eastern Arctic plants. *Canad. J. Bot.* **45**, 1859–1862.

Hooper, H. M. (1984). Nutrient analysis of twenty Southeast Alaska native foods. *Alaska Native News*, September 24–28.

Hoppner, K., Lampi, B., and Perrin, D. E. (1972). The free and total folate activity in foods available on the Canadian market. *Canad. Inst. Food Sci. Technol. J.* **5**, 60–66.

KEELY, P., MARTINSEN, C. S., HUNN, E. S., AND NORTON, H. H. (1982). Composition of Northwest native fruits. *J. Amer. Diet. Assoc.* **81**, 568–572.

KUHNLEIN, H. V. (in press). Change in the use of traditional foods by the Nuxalk native people of British Columbia. In *Perspectives on Dietary Change: Studies in Nutrition and Society*. (G. R. Pelto and L. A. Vargas, Eds.). International Nutrition Foundation for Developing Countries, Cambridge, MA.

KUHNLEIN, H. V. (1984). Traditional and contemporary Nuxalk foods. *Nutr. Res.* **4**, 789–809.

KUHNLEIN, H. V., CHAN, A. V., THOMPSON, J. N., AND NAKAI, S. (1982a). Ooligan grease: A nutritious fat used by native people of coastal British Columbia. *J. Ethnobiol.* **2**, 154–161.

KUHNLEIN, H. V., TURNER, N. J., AND P. D. KLUCKNER (1982b). Nutritional significance of two important "root" foods used by native people on the coast of British Columbia. *Ecol. Food Nutr.* **12**, 89–95.

MANN, G. V., SCOTT, E. M., HURSH, L. M., HELLER, C. A., YOUMANS, J. B., CONSOLAZIO, C. F., *et al.* (1962). The health and nutritional status of Alaskan Eskimos. *Amer. J. Clin. Nutr.* **11**, 31–76.

MAZZA, G. (1982). Chemical composition of saskatoon berries (*Amalanchier alnifolia* Nutt.). *J. Food Sci.* **47**, 1730–1731.

MCQUAKER, N. R., BROWN, D. F., AND KLUCKNER, P. D. (1979). Digestion of environmental materials for analysis by inductively coupled plasma-atomic emission spectrometry. *Anal. Chem.* **51**, 1082–1084.

MCILWRAITH, T. F. (1948). *The Bella Coola Indians*, Vols. I, II. University of Toronto Press, Toronto.

MEDICAL SERVICES BRANCH (1985). *Native Foods and Nutrition. An Illustrated Reference Resource.* Minister of Supply and Services Canada, Ottawa.

MOSS, R. (1968). Food selection and nutrition in ptarmigan (*Lagopus mutus*). *Symp. Zool. Soc. London* **21**, 207–216.

NUXALK FOOD AND NUTRITION PROGRAM STAFF (1984). *Nuxalk Food and Nutrition Handbook*. Malibou Press, Richmond, B.C.

PELLETIER, O., AND BRASSARD, R. (1977). Determination of vitamin C (L-ascorbic acid and dehydroascorbic acid) in food by manual and automated photometric methods. *J. Food Sci.* **42**, 1471–1477.

PENNINGTON, J. A. T., AND CHURCH, H. N. (1980). *Bowes and Church's Food Values of Portions Commonly Used*, 13th ed. Harper & Row, New York.

SMITH, H. E. (1928). *Materia Medica of the Bella Coola and Neighbouring Tribes of British Columbia*. Nat. Mus. Can. Bull. No. 56. King's Printers, Ottawa.

THOMPSON, J. N., DUVAL, S., AND VERDIER, P. (1985). Investigation of carotenoids in human blood using HPLC. *J. Micronutrient Anal.* **1**, 81–92.

TUBA, J., HUNTER, G., AND KASTELIC, J. (1945). Approximate nutrient composition of dried rosehips. *Canad. J. Res.* **23**, 5–7.

TURNER, N. J. (1978). *Food Plants of British Columbia Indians. Part II. Interior Peoples*. B.C. Provincial Museum. Handbook No. 36, Victoria.

TURNER, N. J. (1975). *Food Plants of British Columbia Indians. Part I. Coastal Peoples*. B.C. Provincial Museum. Handbook No. 34, Victoria.

TURNER, N. J. (1973). The ethnobotany of the Bella Coola Indians of British Columbia. *Syesis* **6**, 193–220.