

A B S T R A C T

Purpose: A national survey of adult Canadians (n=1,544) was recently undertaken (1997-1998) to monitor whether changes in dietary intake have occurred since the last Canadian dietary survey, conducted a generation ago (1970).

Methods: Individuals from randomly selected households from a stratified sample of 80 enumeration areas from five regions of Canada were interviewed by a dietitian at home for a 24-hour dietary recall and food frequency questionnaire.

Results: The mean dietary % energy from protein (16-18%), carbohydrate (50-56%) and fat (29-31%) was close to recommended levels in the different age-sex groups. Fat intake was reduced from previous surveys. Intakes of dairy products and fruits and vegetables are lower than recommended. Nutrient values at the 25th percentile of the nutrient distribution, were below recommended levels for calcium, folate, iron and zinc among women.

Conclusion: Despite the growing problem of obesity, Canadians are eating less fat than a generation ago but intake of certain nutrients are still suboptimal.

A B R É G É

Objectif: Une étude nationale sur des Canadiens adultes (n=1 544) fut récemment entreprise (1997-1998) pour vérifier si des changements dans la prise alimentaire étaient survenus depuis la dernière étude il y a une génération (1970).

Méthodes: Des individus furent interviewés à la maison pour répondre à un questionnaire sur le rappel nutritionnel de 24 heures et la fréquence de prise alimentaire parmi des foyers sélectionnés au hasard à partir d'un échantillon stratifié de 80 territoires énumérés venant de cinq régions du Canada.

Résultats: Le pourcentage moyen d'énergie provenant de protéines (16-18 %), des hydrates de carbone (50-56 %) et du gras (29-31 %) était près des niveaux recommandés. La prise de matières grasses avait diminué depuis les études précédentes. La prise de produits laitiers et de fruits et légumes est au-dessous de la recommandation. Les valeurs nutritives au 25e percentile de la distribution nutritionnelle, étaient au dessous des niveaux recommandés pour le calcium, l'acide folique, le fer et le zinc chez les femmes.

Conclusion: Malgré le problème croissant d'obésité, les Canadiens consomment moins de gras qu'il y a une génération mais la prise de certains nutriments est toujours sous-optimal.

Food Habits of Canadians: Reduction in Fat Intake Over a Generation

Katherine Gray-Donald, PhD, Linda Jacobs-Starkey, PhD,
Louise Johnson-Down, MSc

The role of diet in the prevention of chronic disease is well established: fruit and vegetable consumption has a strong protective effect on the development of cancer at numerous sites;¹ saturated fat intake is clearly associated with coronary heart disease;² and the total direct cost of obesity in Canada was estimated to be \$1.8 billion for 1997.³

In the U.S., the National Health and Nutrition Examination Surveys and the Continuing Survey of Food Intake of Individuals⁴ provide useful data on nutritional intake and food trends.^{4,5} These data show a downward trend in energy intake levelling off in the 1990s, but total fat consumption continuing to decline from 42% of energy intake in 1965 to 33% in 1995.² The most recent national data in Canada derive from the Nutrition Canada survey (1970-72) conducted a generation ago.^{6,7}

Four provincial surveys were completed more recently. The Ontario^{8,9} and Manitoba¹⁰ surveys used semi-quantitative food frequency questionnaires while the Nova Scotia¹¹ and Santé Québec surveys¹² used 24-hour recalls which provide quantitative measures of dietary intake. Total fat intakes have declined but remain above the recommended 30% of energy and low intakes of calcium, iron and folate were identified for specific age-sex groups.^{11,12} National data estimated from Canada's family food expenditure survey also indi-

cate declines in total fat content of foods purchased.¹³

Our survey "Food Habits of Canadians" provided data between August 1997 and July 1998 in five regions of Canada (Atlantic, Québec, Ontario, Prairies and British Columbia) on current food and nutrient intake. This report focusses on current nutrient intake and compares these data to earlier studies.

METHODS

The sampling of respondents (18-65 years and adolescents 13-17 years) was done using a multi-stage random sample of adult Canadians living in five regions of Canada: Atlantic (New Brunswick, Nova Scotia, Prince Edward Island, Newfoundland), Québec, Ontario, Prairies (Manitoba, Saskatchewan, Alberta), and British Columbia. Fifteen percent of the Canadian population who lived in regions far from major population centres were not sampled. Aboriginal communities were not included. In each region, four Canada census divisions were randomly chosen with a probability proportional to the population. For each of the 20 divisions, a random sample of two subdivisions was similarly selected, and for each subdivision, two enumeration areas were selected, resulting in 80 enumeration areas across the country. Boundaries of enumeration areas were identified using Statistics Canada maps and address ranges within an enumeration area. The sampling for individual random households from within each enumeration area was done using the 1996 computerized telephone directory (Pro CD Inc., Mass.). Each household received a personalized letter to explain the study prior to telephone contact. Interviewers attempted

School of Dietetics and Human Nutrition, McGill University, Montreal, QC

Correspondence and reprint requests: Dr. Katherine Gray-Donald, Director, School of Dietetics and Human Nutrition, McGill University, Macdonald Campus, 21, #111 Lakeshore Road, Ste. Anne de Bellevue, QC, H9X 3V9, Tel: 514-398-7842, Fax: 514-398-7739, E-mail: gray-donald@macdonald.mcgill.ca

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TABLE I
Weighted Mean Nutrient Intake of Canadian Men and Women Aged 18-65

	18-34 Years		35-49 Years		50-65 Years		Recommendations*
	M (n=125)	F (n=207)	M (n=266)	F (n=459)	M (n=181)	F (n=306)	
Energy (MJ)	13.75	8.35	11.27	7.48	10.20	7.34	-
Energy (kcal)	3290	1998	2696	1789	2440	1756	-
Protein (% energy)	16.5	15.8	17.1	17.1	17.1	17.7	-
Carbohydrate (% energy)	53.1	55.9	51.6	53.0	50.1	54.0	55
Total fat (% energy)	29.1	28.8	30.2	29.7	30.6	28.9	30
Saturated fat (% energy)	10.2	9.5	9.6	9.7	9.8	9.5	10
Polyunsaturated fat (% energy)	4.5	5.0	5.1	5.2	5.3	5.0	-
Monounsaturated fat (% energy)	11.1	10.6	11.6	11.5	11.7	10.7	-
Cholesterol (mg)	395	238	340	224	343	230	<300
Total fibre (g)	21	14	18	14	16	16	-
Vitamin A (RE)	1988	1362	2014	1782	2050	1846	800-1000
Folate (µg)	375	275	311	238	308	241	180-230
B ₁₂ (µg)	5.8	5.0	8.3	5.3	7.0	5.0	1.0
Vitamin C (mg)	242	144	154	132	137	143	30-40
Calcium (mg)	1376	813	1020	764	901	777	700-900
Iron (mg)	24	14	19	13	18	14	8-13†
Zinc (mg)	18	11	15	10	14	10	9-12

* Nutrition Recommendations 1990

† For women aged 19-49, the recommendation is 13 mg.

to enrol one adult per household (the adult with the next birthday) for a total of 20 adult respondents from each enumeration area.

Appointments for interviews were made on different days of the week including weekends. Interviews were held in the respondents' homes or at other convenient locations. A repeat 24-hour recall was conducted on 30% of the adult sample within approximately one week of the initial interview in order to estimate intra-individual variability.

Each adult participant was asked whether there was a potential adolescent (13-17 years) participant living in the household. The adolescent sample was not proportional to the population and is not independent of the adult sample.

Measurements

Dietary intake was measured using the 24-hour recall, commonly used for national surveys.^{4,5,11,12} A single 24-hour recall is an appropriate method to assess the average intake of a large group of individuals provided all days of the week and seasons are covered.^{14,15} Interviews were conducted in French or English by professional dietitians who received a two-day training session in Montreal. Food portion models (graduated cup, two bowls, a plate, spoons and a ruler) were used to quantify intake.

A sociodemographic questionnaire was used, including data on country of origin,

TABLE II
Mean Nutrient Intake of Canadian Adolescents Aged 13-17 Compared to Recommended Levels (RNI*)

Nutrients	Males n = 84	Recommendations	Females n = 94	Recommendations
Energy (MJ)	13.4	11.7-13.4	9.2	8.78-9.20
Energy (kcal)	3206	2800-3200	2201	2100-2200
Protein (% energy)	14.6	-	14.4	-
Carbohydrate (% energy)	55.9	55	60.3	55
Fat (% energy)	30.8	30	27.2	30
Saturated fat (% energy)	10.2	10	9.1	10
Monounsaturated fat (% energy)	11.9	-	9.9	-
Polyunsaturated fat (% energy)	5.2	-	4.6	-
Cholesterol (mg)	303	-	196	-
Total fiber (g)	17.9	-	14.5	-
Vitamin A (RE)	1888	900-1000	1434	800
Folate (µg)	299	175-220	274	170-190
B ₁₂ (µg)	6.1	1.0	5.0	1.0
Vitamin C (mg)	173	30-40	214	30
Calcium (mg)	1407	900-1100	1004	700-1000
Iron (mg)	22.2	10	15.1	12-13
Zinc (mg)	15.8	12	9.8	9

* Nutrition Recommendations, 1990.

language of interview, civil status, birth date, educational level, smoking status, number of adults and children in the household and perceived health status as well as reported height and weight. Average income per enumeration area was obtained from the 1991 census.¹⁶

Double verification of all 24-hour recalls was done and data were entered into the nutrient analysis program Candat (Godin London Inc., London, Ontario, 1991). The most recent Canadian Nutrient File (Health Canada, Ontario, 1997) was used and a total of 267 food items were added to the data set using nutrient information obtained from food manufacturers' data

when possible or from the American data base.¹⁷ Food portion sizes from the four food groups of Canada's Food Guide to Healthy Eating were calculated based on categories of foods and standard weights assigned to those categories.¹⁸

ANALYSIS

In order to eliminate potential bias resulting from the sampling strategy, individual results were multiplied by weights calculated using 1991 Canadian census data of the total population and the number of households in each region. The weighting process involved three compo-

TABLE III
Distribution of Intakes for Selected Nutrients for Adults 18-65 Years in the Food Habits of Canadians Survey

	Males						Females										
	18-34 (n=125)		35-49 (n=266)		50-65 (n=181)		18-34 (n=206)		35-49 (n=459)		50-65 (n=306)						
	25th	50th	75th	25th	50th	75th	25th	50th	75th	25th	50th	75th					
Energy (MJ)	9.72	11.50	14.44	8.34	10.37	12.83	7.44	9.27	11.03	6.08	7.34	8.69	5.98	7.20	8.53	5.91	7.87
Energy (kcal)	2325	2751	3455	1995	2481	3069	1780	2218	2639	1455	1756	2079	1431	1722	2041	1414	1883
Protein (g)	84.6	105	137	78.4	97.9	126	71.6	90.7	113	55.2	65.2	81.6	54.4	66.2	82.1	52.7	64.7
Carbohydrate (g)	285	365	496	211	326	458	173	246	357	189	244	300	178	224	272	179	217
Fat (g)	63.3	86.7	117	61.4	79.5	106	54.6	74.1	95.1	42.2	54.0	66.6	42.1	54.0	66.9	39.1	49.9
% Energy Fat	25.0	29.3	34.5	25.9	30.1	34.3	26.3	30.1	34.6	24.7	29.0	33.0	25.2	29.7	33.7	24.6	28.6
Saturated Fat (g)	20.7	30.4	40.2	17.6	24.7	34.8	15.1	23.2	31.3	12.5	17.5	23.0	12.7	17.2	21.6	12.0	15.9
% Energy Sat. Fat	9.42	9.80	10.2	9.46	9.75	10.1	9.41	9.75	10.1	9.22	9.56	9.90	9.26	9.54	9.83	9.21	9.53
Cholesterol (mg)	189	292	417	163	250	347	151	224	347	113	154	216	115	167	226	115	160
Calcium (g)	739	1018	1490	621	821	1208	570	803	1070	473	664	980	477	679	934	492	679
Folate (µg)	213	274	382	197	276	365	195	246	327	154	200	271	156	201	268	163	213
Iron (mg)	14.7	19.0	23.5	13.2	17.1	21.3	12.8	16.0	20.1	9.3	12.2	15.9	10.0	12.2	14.4	10.1	12.2
Zinc (mg)	11.2	14.0	18.0	10.0	12.9	16.8	9.0	11.4	15.3	6.8	8.7	11.2	7.0	8.8	11.2	7.0	8.6

Data are adjusted for within-subject variability by the National Research Council Method.²⁰

nents: a ratio of populations estimating how many people each respondent represented within their region; the number of households in a given region because we sampled by household not individuals; and the number of adults in each household responding to the survey.

In order to provide the 25th and 75th percentiles of the distributions of nutrients, repeat measures were used to calculate the ratio of within-person to between-person variability for each nutrient for men and women separately. Log and square root transformations were used to normalize the data. The nutrient distribution for *usual* intake of these nutrients was modelled using the method described by the National Research Council.¹⁹ The basal metabolic rate (BMR) for each subject was calculated.²⁰

RESULTS

The study sample consisted of 1,544 adults and 178 adolescents from 80 enumeration areas across Canada. These ranged from a fishing village in Newfoundland to a suburb of Victoria, British Columbia. The response rate (interviewed/interviewed and refusals) was calculated for each enumeration area. The average rate was 30%. In three enumeration areas in inner city Montreal and Vancouver, we were unable to obtain more than 10 subjects because of the very low response rate. More women than men accepted to be interviewed (972 vs. 572 respectively). Our sample was similar to the Canadian population (1991 Census) in number of people born in Canada (86% vs. 84%), number of subjects with less than high school education (22% vs. 26%), and single marital status was 26% vs. 32% respectively. The percentage of adults reporting a BMI of >27 was 32% in our survey

and 30.5% in the National Population Health Survey.²¹

Nutrient intake data for the country, weighted for the sampling strategy, are presented separately for males and females in three age groups (Table I).²² A comparison of reported energy intake compared to basal metabolic requirements yielded ratios of 1.3 to 1.7 for men and 1.2 to 1.4 for women indicating some under-reporting for women.^{22,23} The mean values for all nutrients listed for men and women are above the recommended intakes for Canadians²² with the exception of calcium in some age/sex groups. The mean intake of calcium for most groups, however, is below the new Dietary Reference Intake (a new common standard for Canadians and Americans).²⁴ The percent of energy from fat (29-31%) was close to the recommended value of 30% and saturated fat represented approximately 10% of energy intake. Mean intakes of adolescents (Table II) indicated higher energy intakes than for adults as expected, however, fat intakes as a percent of energy were similar to those of adult participants. Mean micronutrient levels met intake recommendations except for vitamin A in adolescent girls.

Table III provides the 25th, 50th and 75th percentiles of intake for each adult age-sex group adjusted for within-person variability. (The sample size for the adolescent population was not sufficiently large to do this adjustment.) The median intake for the percentage of energy from total fat was 29-30% in all age-sex groups while the 75th percentile was 33-35%. Calcium intake among women at the 25th percentile of intake was under 500 mg for all age groups indicating very low intakes in many women. Similarly iron intakes in women of reproductive age were low in a substantial portion of the population.

A comparison with the Nutrition Canada Survey indicates major changes in the intake of a number of nutrients over a generation (Table IV). Mean nutrient intakes, using the two age groups originally reported on in the Nutrition Canada Survey of 1970,^{6,7} are compared to our data (1997-1998). Mean energy intakes were lower in our survey in most age-sex groups. Total fat intake, however, declined far more over the last 27 years, as did the

intake of saturated fats. Micronutrient density, however, has improved. Absolute intakes of most vitamins and minerals have increased.

The mean number of servings of the four food groups – grain products, vegetables and fruit, milk products, and meat and alternatives – for adults are shown in Table V. The consumption of vegetables and fruits were low, particularly among women and among men aged 50+ years. Similarly the consumption of dairy products is below the suggested intake of two servings a day among women and men 35 years and older. Foods considered as extras and not part of the four food groups of the Food Guide¹⁸ provided 26-29% of energy and 24-34% of fat intake in the different age-sex groups, but only very small amounts of protein and micronutrients.

DISCUSSION

This first national dietary survey since 1970 indicates important reductions in dietary fat intake and substantially higher intakes of a number of important micronutrients. Significant numbers of Canadians, particularly women, still consume inadequate intakes of calcium, folate and iron during the reproductive years. This same trend was seen in a comparison of the diet of Quebecers between 1971 and 1990 where the authors conclude, “Les Québécoises et les Québécois mangent donc mieux, mais pas encore bien...” (Quebecers eat better but still not well).¹² Although there are a number of indicators of an improvement in diet quality, it is very evident from statistics on body weight and height for the population that there is a serious problem of obesity in Canada,³ and increasing rates of obesity are reported in Europe²⁵ and the United States.²⁶ The total energy that we observed was less than that reported in 1971, most particularly among young men. This trend is similar to that observed in Quebec,¹² where Nutrition Canada Data for Quebec alone were compared to Santé Québec data of 1990. Energy expenditure is widely believed to have decreased substantially in the last three decades and is blamed for the increase in obesity.²⁵

TABLE IV
Comparison of Food Habits Data 1997-98 to Nutrition Canada 1970

Year	20-39 Years				40-64 Years			
	Males		Females		Males		Females	
	1970	1997-98	1970	1997-98	1970	1997-98	1970	1997-98
Sample Size	999	203	1347	343	1222	348	1500	608
Energy (MJ)	14.12	12.21	8.37	7.82	11.18	10.31	7.22	7.32
Energy (kcal)	3378	2921	2002	1871	2675	2467	1727	1751
Protein (g)	119	123	72	75	94	104	63	75
Fat (g)	154	98	89	63	118	84	75	58
% energy from fat	41.0	29.4	40.0	29.2	39.7	30.3	39.1	29.3
Calcium (mg)	1081	1177	709	781	883	896	613	745
Iron (mg)	18	21	12	14	16	17	11	13
Thiamin (mg)	1.57	2.57	1.02	1.58	1.32	2.23	0.90	1.70
Riboflavin (mg)	2.59	2.70	1.70	1.68	2.09	2.27	1.49	1.67
Niacin (NE)	48	52	28	33	37	46	25	32
Vitamin C (mg)	118	204	89	143	101	134	106	132
Folate (µg)	221	322	146	239	183	301	148	241
Vitamin A (RE)	1551	2018	1292	1462	1332	1854	1031	1832

TABLE V
Average Number of Servings for Each Food Group According to “Canada’s Food Guide to Healthy Eating” by Gender and Age on the Day of their Recall

Food Group	Recommended Portions	Males				Females			
		18-34	35-49	50-65	Mean	18-34	35-49	50-65	Mean
Grain Products	5-12	8.0	6.8	6.4	6.9	5.2	5.0	4.5	4.9
Vegetables & Fruit	5-10	5.8	5.3	4.6	5.2	4.1	4.5	5.0	4.6
Milk Products	2-4	2.5	1.7	1.5	1.8	1.6	1.5	1.3	1.4
Meat & Alternatives	2-3	3.9	3.3	3.0	3.4	2.0	2.1	2.0	2.0

In terms of dietary changes for disease prevention, the decreases in saturated fat intake may explain a part of the observed decreases in coronary heart disease in Canada. The decline in fat intake, however, is not related to the decreases in obesity. In fact, Willett suggests that dietary fat is not a major determinant of body fat.²⁷ The vegetable and fruit consumption is difficult to compare to Nutrition Canada because of changing definitions of portion sizes over time, but the intake of nutrients that are usually found in fruits and vegetables – such as vitamin C and folate – has increased.

As with any dietary survey, there are important limitations in terms of the accuracy of the reporting of dietary data and the response rate. The accuracy of the reported intake cannot be ascertained in a survey, but 24-hour recall was observed to compare closely the energy expenditure in young women.²⁸ There is the concern for underreporting – particularly in dietary survey – and the trend for underreporting may be increasing.²⁹ Our data, however, indicate the expected higher intake in males and the expected age gradient. The data for energy intakes of men appear to

be accurate according to physiological needs for age, height and weight, but intakes of women indicate some underreporting.²³ The response rate was low, in part due to out-of-date telephone listings in areas of high mobility and the need to compete with telephone soliciting. The Nutrition Canada Survey had a response rate of 46%, the U.S. Continuing Food Survey 1987, 35%. The particular difficulty of recruiting participants in very low income housing settings, means that the poorest Canadians in large cities may not be well represented in this survey. In addition, high-risk groups with well-known nutritional problems – such as children living in poverty^{30,31} and frail elderly³² – were not included in the sample.

In summary, the diets of Canadians appear to be improving in general, with important decreases in fat intake and higher intakes of some micronutrients. Given the very important role of diet in the prevention of cardiovascular disease, cancer and diabetes, it is important to encourage further improvements and to monitor the changes in the diet of Canadians on a regular basis.

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