

Nutritional assessment of charitable meal programmes serving homeless people in Toronto

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Abstract

Objectives: To assess the potential nutritional contribution of meals provided in a sample of community programmes for homeless individuals, to determine the effect of food donations on meal quality and to develop food-based guidance for meals that would meet adults' total nutrient needs.

Setting: Toronto, Canada.

Design: An analysis of weighed meal records from eighteen programmes. The energy and nutrient contents of meals were compared to requirement estimates to assess contribution to total needs, given that homeless people have limited access to nutritious foods. Mixed linear modelling was applied to determine the relationship between the use of food donations and meal quality. The composition of meals that would meet adults' nutrient requirements was determined by constructing simulated meals, drawing on the selection of foods available to programmes.

Sample: In all, seventy meals, sampled from eighteen programmes serving homeless individuals.

Results: On average, the meals contained 2.6 servings of grain products, 1.7 servings of meat and alternatives, 4.1 servings of vegetables and fruits and 0.4 servings of milk products. The energy and nutrient contents of most meals were below adults' average daily requirements. Most meals included both purchased and donated foods; the vitamin C content of meals was positively associated with the percentage of energy from donations. Increasing portion sizes improved the nutrient contribution of meals, but the provision of more milk products and fruits and vegetables was required to meet adults' nutrient requirements.

Conclusions: The meals assessed were inadequate to meet adults' nutrient requirements. Improving the nutritional quality of meals requires additional resources.

Keywords
Homeless people
Meals
Charitable food programmes
Nutrient requirements

As the number of people who are homeless (i.e. living in public spaces or temporary accommodation because they lack safe, secure housing) swells^(1–3), communities across Canada are struggling to establish and sustain effective responses. Vulnerability to poorer physical^(4–6) and mental health^(7–10), poorer self-rated health⁽¹¹⁾ and higher rates of mortality^(8,12–14) are well-documented among homeless individuals in Canada. Furthermore, a growing body of research suggests that the food and nutrition needs of many homeless people are poorly met^(15–20). Given the inadequacy of income assistance programmes, lack of affordable housing and increasingly restrictive eligibility criteria for existing supports and services, much of the assistance available to homeless people comes from community-based initiatives to help them meet basic subsistence needs for shelter, food, personal hygiene and primary health care. Local food provisioning efforts typically include soup kitchens, street outreach programmes and meal provisions in shelters, but meals and

snacks are also now being offered on a smaller scale by an increasing number of social service agencies, drop-in centres and health centres⁽¹¹⁾. The programmes are largely *ad hoc*, voluntary initiatives, with the scope of operations varying from two to three meals per day most days of the week to a single meal per week. Many programmes rely on donated foodstuffs from food banks⁽²¹⁾ and other charitable food redistribution networks, though both the quantity and nutritional quality of foods garnered through this route are limited^(22–28). Concerns about the appropriateness and effectiveness of these efforts stem from the high levels of food deprivation documented among samples of homeless individuals^(15,17–20), and also a recent study in Toronto that found homeless youth who used charitable meal programmes to be as nutritionally vulnerable as those who did not^(11,20).

Concerns about the adequacy of nutrition supports for homeless groups are not unique to Canada. Studies in

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Europe^(29–31), Australia^(32,33) and the United States^(34–39) have also raised questions about the capacity of community food programmes to meet the food needs of homeless people. Assessments of the meals provided in soup kitchens in the USA have shown them to be of poor nutritional quality and particularly limited in fruits and vegetables^(36,37,40). An assessment of the dietary intakes of men using a shelter in Paris has also documented nutritional deficits linked to the suboptimal quality of shelter meals⁽³⁰⁾. As an initial step towards understanding the meal provisioning efforts of community programmes in Canada, the present study examines the nutritional contribution of a sample of meals offered in eighteen programmes serving homeless individuals in Toronto, investigates the effect of food donations on the nutrient contents of meals provided and develops food-based guidelines for the construction of meals to meet adults' estimated average nutrient requirements.

Sample and methods

In August 2004, an inventory of programmes serving meals to homeless adults in Toronto was conducted, drawing on data from a web-based community resource ('211 Toronto'), as well as data on the meal/snack programmes receiving food from the three major charitable food assistance distributors in this area and programmes participating in a winter relief programme. A brief telephone survey designed to obtain information on programme characteristics was completed with workers in 148 of the 157 programmes identified (94%) (results to be reported elsewhere). From the survey sample, eighteen programmes were selected for in-depth study, applying purposive sampling to capture programmes with different histories (considering time since inception and reasons for beginning meal service), styles of service delivery (e.g. meals offered in isolation or in conjunction with other services) and geographic locations within the city. We conducted participant observations and an open-ended interview with the coordinator in each programme (results to be reported elsewhere). In addition, over a 6–8-week period from September 2004 to April 2005, a single meal was weighed and measured on four separate occasions in sixteen programmes. Because of scheduling problems, meals were recorded on only three occasions in two programmes. In nine programmes that regularly served more than one meal, the meal of highest attendance was recorded. The meals recorded represented 'best-case scenarios', assuming ample quantities of all meal items were available for all, throughout the meal period. The origin of each meal item was also recorded, differentiating between foods that had been purchased by programmes and those that had been obtained free of charge. The latter category included foods supplied by the local food bank and a 'surplus' food redistribution

network operating in Toronto, as well as food donations solicited by programme staff from food retail or food service outlets.

The weighed meal records were entered into the Nutrition Survey System (NSS) software (a food composition database based on the 1997 Canadian Nutrient File) to estimate the energy and nutrient content of each meal. The US Department of Agriculture Food Composition Tables were used to obtain vitamin A values for foods in retinol activity equivalents (RAE) to facilitate comparison with requirements⁽⁴¹⁾. All analyses were conducted using SAS/PC Version 9.1⁽⁴²⁾.

Evaluation of meals

For each meal recorded, the number of servings from each food group defined in Canada's Food Guide (CFG)⁽⁴³⁾ (i.e. grain products, fruits and vegetables, meat and alternatives, and milk and alternatives) was calculated. The energy and nutrient contents of meals were compared to adults' average daily requirements to assess the meals' contribution towards the total needs of clients. While this might seem like an unrealistically high standard for single meals, studies of the dietary patterns and food acquisition strategies of homeless individuals in Canada suggest that it cannot be assumed that a substantial amount of nutrients come from other sources^(15,17,20,44). To assess nutrient contribution, the mean protein, vitamin A, vitamin C, folate, vitamin B₆, riboflavin, thiamin, niacin, iron, phosphorus, magnesium and zinc contents of the three or four meals recorded in each programme were compared to the estimated average requirements (EAR) for these nutrients^(45–49). The EAR represent the median requirements of different age–sex groups, and they can be understood as unbiased estimates of nutritional needs for any randomly selected person within the population⁽⁴⁹⁾. The requirement estimates for males and females, 31–50 years old, were used in the analysis because they comprise the single largest age grouping of homeless adults in Toronto⁽³⁾, and the requirement estimates of 31–50-year-olds equal or exceed those for younger or older adults for most nutrients^(45–49). To permit comparison of the protein content of meals with protein requirements expressed as grams/kilograms of body weight/day, the body weights of people consuming the meals were approximated as the weights of the population 'reference' male and female^(49,50). Total fibre and calcium were assessed by comparing programme means to the Adequate Intake levels (AI) for these nutrients⁽⁴⁹⁾. To assess the energy contribution of meals, the mean energy content of meals sampled in each programme was compared to the estimated energy requirements (EER) of the reference adult male and female, 31 years of age⁽⁵⁰⁾. The smallest BMI in the healthy range (18.5 kg/m²) was chosen for comparison to determine whether the lowest energy needs of a reference individual could be met by the average meals of

programmes, but the calculations were repeated assuming different levels of physical activity levels to generate the range of requirements for a person this size.

In nine programmes where more than one option was offered in a meal (e.g. a choice of two kinds of sandwiches), only the option with the greatest energy content was included in comparisons with requirement estimates; an analysis of other options indicated that they had lower nutritional contributions.

Development of food-based meal guidelines to meet participants' nutrient needs

Two modelling exercises were undertaken to determine the changes required for programmes to provide meals that met individuals' total nutrient needs, and thus develop food-based guidance for programme operators. Total need was represented by the EAR and AI for 31–50-year-olds because meals containing this level of nutrition could be assumed to meet the average nutrient requirements of programme participants. It was important that a single meal satisfy an individual's daily nutrient requirements because of homeless people's limited access to nutrients from other sources^(15,17,20,44). Individuals could consume more than one meal per day in a programme and thus not require a single meal to fulfil their nutrient needs, but this would likely only pertain to shelter users. Half of the programmes studied served only one meal per day (Table 1), and those serving more meals reported much lower attendance at other meals (in some cases because features of the meal service functioned to restrict attendance), suggesting that the nutritional benefit of the additional meals would be experienced only by a small proportion of clients. Individuals could conceivably eat at more than one programme each day, but distances between programmes and lack of coordination in meal schedules would make it difficult to accomplish this on a daily basis.

To determine whether simply increasing the amounts of food provided would be sufficient for the meals to meet the total needs, portion sizes of foods in the originally recorded meals in all programmes except one were increased proportionally to their energy content so that the average energy content of the meals of each programme was equal to the EER of a small, sedentary reference female, 31 years of age (7574 kJ/1809 kcal)⁽⁵⁰⁾. This EER can be considered the lower bound of energy requirements for clients (assuming most individuals would be larger and more physically active), and it also can represent a viable (albeit high) energy content for a single meal. In fact, the mean energy content of meals in one programme exceeded this level, so it was proportionately reduced to obtain a mean of 7574 kJ/1809 kcal. The nutrient contents of adjusted meals were calculated and compared to the EAR and AI.

The selection and amount of foods required for meals to meet adults' total nutrient requirements were determined by an iterative process to construct meals *de novo*,

assuming no changes in the selection of foods available to programmes but ample quantities of all foods. All foods recorded in the observed meals were grouped into the food groups defined in CFG⁽⁴³⁾, with fruits and vegetables further subdivided into vitamin C-rich, vitamin A-rich, folate-rich and 'other' fruits and vegetables in order to specifically target these three nutrients. Beginning with a meal that consisted of two servings from each of the seven food categories, the minimum number of servings required from each food category was determined through a process of systematically adding or subtracting single servings from various categories. With each change, test meals were assembled from randomly selected food items within each category, and the mean nutrient contents of thirty randomly assembled test meals were compared to the EAR of men, 31–50 years old, and women's EAR for iron (i.e. the only nutrient for which women's requirements exceed men's).

Effect of food donations

Food donations were used by fourteen of the eighteen programmes, although most meals in these programmes included both purchased and donated foods. Given the widespread concern about the quality of food available for distribution through food banks in Canada^(22–28), we hypothesised that depending on food donations would pose a constraint on meal quality in these programmes. Representing the contribution of food donations by the percentage of energy from donated foods in a meal, mixed linear modelling was conducted to determine the effect of food donations on the energy and nutrient content of meals and the number of servings from each food group. Because the use of maximum likelihood estimation methods in mixed linear modelling assumes that the dependent variable is normal, the distributions of all variables were reviewed. Box–Cox transformations were applied to energy and all nutrient variables to ensure that they approximated normal distributions⁽⁵¹⁾, and mixed linear models were run using the Residual Maximum Likelihood estimation method (REML). Although the servings of vegetables and fruits in meals appeared normal without transformation, the distributions of servings from the other food groups were skewed and could not be transformed to approximate normality. The mixed linear models for all food groups were run using Minimum Variance Quadratic Unbiased Estimation (MIVQUE0), a method that, while less powerful than REML⁽⁴²⁾, can be used with non-normal data. This method was applied for servings of vegetables and fruits for consistency.

Results

The eighteen meal programmes included in the present study varied widely in terms of size and scope (Table 1). Only the three shelter programmes served three meals

Table 1 Descriptions of programmes

Programme	Description of service	Meal recorded	Clients served	
			<i>n</i>	% Regulars
A	Health centre provides a self-serve lunch in a meal room on the weekdays during the wintertime	Lunch	80	50
B	Winter meal programme serves two rounds of both breakfast and lunch, a dinner and a snack on Sundays. This programme is part of a larger organisation that provides other services	Lunch	150–300	65
C	A purpose-built shelter programme caters to youth; every day it serves three meals, a snack and a meal-to-go for users who request it	Dinner	60–80	100
D	A meal programme offers breakfast and lunch on the weekdays. Other services are available within the larger organisation	Lunch	50–150	90
E	The free meal of a programme serves brunch on the weekdays and dinner on weekdays plus Saturdays. The food programme is part of a larger organisation that provides a variety of services, including housing	Dinner	30	95
G	A mobile meal service offers breakfast to those living outdoors on Wednesday to Saturday	Breakfast	85	75
H	A meal programme that offers Wednesday dinners, Thursday breakfasts and Sunday brunches	Dinner	225	80
I	A meal programme caters to ex-psychiatric clients, serving breakfast and lunch on the weekdays and only lunch on Saturdays	Lunch	140–185	80–100
J	A drop-in programme offers breakfasts on Monday and Saturday (winter only) and dinners on Wednesday nights	Dinner	65–85	90–92
K	<i>Ad hoc</i> shelter programme receives three catered meals and a snack every day	Dinner	70	100
L	A drop-in programme offers a small snack and lunch every weekday	Lunch	45	90
M	A multi-service programme offers shelter; every day it serves a morning snack, two rounds of lunch, a take-away lunch and dinner	Lunch	50–300	75
N	A health clinic provides a self-serve lunch every weekday for clients	Lunch	30	30
O	A drop-in programme for women serves breakfast and lunch every day of the week	Lunch	50–90	80
P	Youth arts initiative serves a participant-prepared lunch on Tuesdays and Thursdays	Lunch	30	80
Q	A meal programme started by educators serve dinners on Fridays and breakfasts on Saturdays and Sundays	Breakfast	60–80	30–40
R	A purpose-built shelter programme caters to youth; every day it serves three meals, a snack and a meal-to-go for users who request it	Dinner	52	100
S	A meal programme serves dinner on Tuesday nights	Dinner	65	85

daily on all seven days of the week. The proportion of clients who ate regularly at the programmes ranged from 30% to 100%.

The mean energy content of meals ranged from 2721 kJ (650 kcal) in a dinner programme operating 6 d/week to 8750 kJ (2090 kcal) in a dinner programme operating once weekly (Table 2). The meals in most programmes would provide less than two-thirds of the EER of a small, sedentary reference male or female (9261 kJ (2212 kcal) and 7574 kJ (1809 kcal), respectively) and less than half of the EER if high levels of physical activity were assumed (12 971 kJ (3098 kcal) and 10 718 kJ (2560 kcal) for males and females, respectively).

The meals in most programmes included ≥ 1 servings of grain products, meat and alternatives, and vegetables and fruit, but ≤ 0.25 servings of milk products (Table 2). Seven programmes provided meals that, on average,

contained the recommended number of daily meat and meat alternatives servings for women in CFG, and one programme provided sufficient fruits and vegetables to meet the daily recommendation for women. For the most part, however, the average number of servings for each of the four food groups fell well below the daily recommendations for both men and women.

Wide variability was found in the nutrient content of the meals (Table 3). Both the mean and median levels fell below EAR for vitamin A, folate, magnesium and zinc, but the mean levels of other nutrients examined approximated or exceeded the EAR (Table 3). When the meals were examined by programme, the only nutrient provided in levels at or above the average requirements in almost all programmes was niacin. More than half the programmes had mean riboflavin, folate, zinc and vitamins A, B₆ and C contents below EAR for both men and women, and all

Table 2 Mean energy content and number of food servings in the meals of each programmes and the recommended number of servings from Canada's Food Guide*

Programme	Energy (kJ)		Energy (kcal)		Number of servings							
	Mean	SD	Mean	SD	Meat and alternatives		Grain products		Milk and alternatives		Vegetable and fruits	
					Mean	SD	Mean	SD	Mean	SD	Mean	SD
A	4815	1172	1150	280	1.0	0.6	3.1	1.9	1.4	1.0	4.2	2.9
B	3601	963	860	230	1.3	0.9	1.5	1.8	0.2	0.2	4.3	1.0
C	4982	1465	1190	350	2.3	1.4	1.7	2.2	0.3	0.5	7.2	3.1
D	3517	502	840	120	1.6	0.7	1.4	1.0	0.2	0.4	5.7	1.3
E	2721	670	650	160	0.2	0.2	3.2	2.2	0†		2.3	1.3
G	4731	628	1130	150	0.7	0.6	4.8	2.1	0.6	0.3	1.0	1.0
H	6992	2302	1670	550	2.4	2.0	2.0	0.7	1.7	1.1	5.7	2.2
I	5066	1214	1210	290	1.9	2.1	5.3	4.4	0.1	0.1	3.0	1.4
J	5485	1172	1310	280	2.1	1.6	4.3	2.3	0.2	0.2	2.3	0.4
K	4773	921	1140	220	2.4	0.7	2.3	2.5	0.1	0.2	2.7	2.3
L	3224	921	770	220	1.1	1.1	1.2	1.4	0.1	0.1	2.5	1.1
M	4647	963	1110	230	1.6	0.4	0.9	1.5	0.2	0.1	3.2	0.4
N	4145	1424	990	340	0.0	0.1	2.0	1.3	0.2	0.2	5.2	0.9
O	3559	963	850	230	1.7	1.4	1.7	1.2	0.0	0.0	4.3	1.5
P	4480	1758	1070	420	2.0	0.4	1.4	1.6	0.1	0.1	5.3	2.4
Q	3852	670	920	160	1.2	0.2	3.3	1.5	0.1	0.1	0.3	0.5
R	6238	3014	1490	720	2.3	2.0	2.2	3.0	1.3	0.5	5.6	0.7
S	8750	754	2090	180	2.9	1.6	4.2	0.8	0.8	0.5	5.2	2.3
All programmes	4756	1863	1136	445	1.7	1.3	2.6	2.3	0.4	0.6	4.1	2.4
Recommended servings/d†	Males				3		8		2		8	
	Females				2		6		2		7	

*Recommendations for men and women, 31–50 years old⁽⁴³⁾.

†There were no milk product servings in any of the meals.

Table 3 Mean and median nutrient contents of the 70 meals sampled in eighteen programmes and the average requirements of 31–50-year-old males and females

Variable	Mean	SD	Median	Min.–Max.*	EAR	
					Males	Females
Protein (g)	48.0	25.0	43.0	10–122	46.0	38.0
Vitamin A, RAE (µg)	411.0	283.0	394.0	17–1221	625.0	500.0
Vitamin C (mg)	99.0	77.0	77.0	1–298	110.0†	95.0†
Folate, DFE (µg)	226.0	125.0	199.0	40–720	320.0	320.0
Vitamin B ₆ (mg)	1.1	0.7	1.0	0.1–4.5	1.1	1.1
Thiamin (mg)	1.0	0.5	0.9	0.3–3.0	1.0	0.9
Niacin (mg)	22.0	12.0	20.0	5–75	12.0	11.0
Riboflavin (mg)	1.0	0.6	0.9	0.3–3.1	1.1	0.9
Vitamin B ₁₂ (mg)	2.7	6.5	1.6	0.1–53.7	2.0	2.0
Magnesium (mg)	158.0	83.0	130.0	30–420	350.0	265.0
Iron (mg)	8.1	3.4	7.5	2.8–17.4	6.0	8.1
Phosphorus (mg)	667.0	330.0	595.0	130–1640	580.0	580.0
Zinc (mg)	6.5	4.4	5.6	1.2–26.0	9.4	6.8
Total fibre (g)	10.0	6.0	9.0	1–31	38.0‡	25.0‡
Calcium (mg)	360.0	247.0	278.0	50–1258	1000.0‡	1000.0‡

RAE, retinol activity equivalents; DFE, dietary folate equivalents.

*Minimum and maximum values among all programmes.

†The estimated average requirements (EAR) are presented for smokers because a high proportion of homeless individuals smoke⁽²⁰⁾. The EAR for non-smokers would be 35 mg/d less.

‡The Adequate Intakes were used in comparison with total fibre and calcium contents.

programmes failed to meet the EAR for magnesium. Half of the programmes had mean protein contents below the EAR for men and half had mean iron contents below the EAR of women. The average calcium and total fibre contents of meals in all programmes were well below the AIs for these nutrients (data not shown).

When portion sizes of all foods served in the meals were increased to achieve an average energy content equivalent

to the EER for a small, sedentary woman, all or almost all programmes met the EARs for iron, phosphorus, protein, niacin, riboflavin, thiamin and vitamin B₆. However, the average levels of folate, zinc, magnesium and vitamins A, B₁₂ and C in the meals in several programmes were still below median requirements. Additionally, the calcium and fibre content of meals in almost all programmes were below the AIs for these nutrients (data not shown).

Table 4 Meal planning guide developed for meals to meet adults' nutrient requirements

Food categories*	Serving sizes†	Number of servings
Grains group		
Breads	1 slice	2
Pasta, rice, noodles	$\frac{1}{2}$ cup	
Cereals	30 g ($\frac{1}{2}$ cup)	
Bagel, pita, bun	$\frac{1}{2}$ of one	
Meat and alternatives		
Beef, poultry, pork, fish	100 g	2
Beans, lentils, chickpeas	1 cup	
Vitamin A-rich vegetables/fruit		
Carrots	$\frac{1}{2}$ cup	1
Mixed vegetables (frozen)		
Peas (frozen)		
Butternut squash		
Vitamin B-rich (folate) vegetables/fruit		
Beans, lentils, chickpeas	$\frac{1}{2}$ cup	1
Dark greens, e.g. broccoli, Spinach, Romaine lettuce		
Vitamin C-rich vegetables/fruit		
Oranges/citrus fruits	1	2
Orange juice (from concentrate)	$\frac{1}{2}$ cup	
Grapefruit juice (from concentrate)		
Sweet peppers		
Apple juice with vitamin C added		
Broccoli		
Other vegetables/fruit		
Tomatoes (fresh, canned)	$\frac{1}{2}$ cup	2
Potatoes, including dried potato products		
Cauliflower		
Corn (canned)		
Vegetable juice		
Melons		
Apple juice		
Milk products		
Fluid milk	1 cup	2
Milk powder	50 g ($\frac{1}{2}$ cup)	
Processed cheese slices	2 slices	
Yoghurt	$\frac{3}{4}$ cup	
Solid cheeses	50 g (3" × 1" × 1")	

*The examples of foods in each food category were drawn from the list of foods found in the meals recorded.

†Based on standard serving sizes found in Canada's Food Guide⁽⁴³⁾.

A guide for planning more nutritionally adequate meals was developed, working with foods included in the meals recorded at these programmes (Table 4). On average, the meals constructed following this guide exceeded the EARs for all nutrients, except for magnesium, and approximated the AI for calcium (Table 5). The mean fibre content of the meals was still below the AI, but it was more than double the content of observed meals (Table 3). The mean energy content of the meals was only 838 kJ (200 kcal) higher than that of the observed meals (Table 2).

The mean per cent contribution of donated foods to the total energy content of meals ranged from 0% to 94%; even within programmes using donations, there was wide variation in the per cent contribution of food donations from one meal to the next (Table 6). The percentage of energy from donations in a meal was positively associated with vitamin C content, and marginally significant positive relationships were observed for folate and thiamin (Table 7). The use of Box–Cox transformed

nutrient variables in these analyses prohibits direct inferences about the magnitude of the effect, but some indication comes from the back-transformation of predicted values for vitamin C. As the percentage of energy from food donations increased from 0% to 100% of the meal, vitamin C content increased from 40 to 100 mg/meal. No associations were observed between the percentage of energy from donations and the total energy content, other nutrients or food group servings in meals (Table 7).

Discussion

Our results indicate that the meals served in most of the eighteen food programmes studied were insufficient to meet adults' daily energy and nutrient requirements. The low nutritional contribution of meals implies that homeless individuals cannot rely on these programmes to meet their needs, let alone replenish micronutrient stores depleted from frequent experiences of food deprivation

Table 5 Energy and nutrient content of meals (*n* 30) randomly generated following the meal planning guide

Variable	Minimum	Maximum	Mean	SD	Requirement*
Energy (kJ)	3810	8336	5614	1097	n/a
Energy (kcal)	910.0	1991.0	1341.0	262.0	n/a
Protein (g)	63.0	107.0	80.0	12.0	46.0†
Vitamin A, RAE (µg)	443.0	1660.0	1065.0	241.0	625.0
Vitamin C (mg)	86.0	234.0	142.0	35.0	110.0
Folate, DFE (µg)	219.0	852.0	484.0	176.0	320.0
Vitamin B ₆ (mg)	1.1	3.1	1.9	0.6	1.1
Thiamin (mg)	0.7	2.1	1.3	0.3	1.0
Niacin (mg)	21.0	32.0	25.0	3.0	12.0
Riboflavin (mg)	1.4	2.9	2.0	0.4	1.1
Vitamin B ₁₂ (mg)	0.9	5.7	3.5	1.2	2.0
Magnesium (mg)	167.0	414.0	283.0	68.0	350.0
Iron (mg)	6.8	20.7	13.0	4.0	8.1‡
Phosphorus (mg)	951.0	1932.0	1399.0	242.0	580.0
Zinc (mg)	7.5	14.7	11.0	1.9	9.4
Total fibre (g)	10.0	36.0	22.0	8.0	38.0§
Calcium (mg)	778.0	1468.0	1046.0	163.0	1000.0§

RAE, retinol activity equivalents; DFE, dietary folate equivalents; n/a, not applicable.

*Requirement estimates are estimated average requirements (EAR) for males, 31–50 years old, unless otherwise noted.

†The protein requirement is obtained from the reference adult male.

‡The EAR of iron for females, 31–50 years old, is shown because it is the highest requirement within this age group.

§Requirements for total fibre and calcium are presented as Adequate Intakes.

Table 6 Percentage of energy from donations in the average meals at the eighteen community food programmes

Programme	<i>n</i> *	% of energy from donations			
		Minimum	Maximum	Mean	SD
A	3	91	100	94	5
B	4	0	35	15	18
C	4	0	0	0	
D	4	90	100	97	5
E	4	34	84	64	22
G	3	16	73	44	28
H	4	0	0	0	
I	4	22	100	49	35
J	4	45	69	58	10
K	4	0	0	0	
L	4	68	100	88	15
M	4	0	22	10	12
N	4	0	61	37	26
O	4	0	66	32	34
P	4	0	0	0	
Q	4	0	30	8	15
R	4	0	12	4	6
S	4	45	96	81	24

*Number of meals sampled per programme.

and dietary compromise⁽²⁰⁾. While the generalisability of our results is clearly limited by the use of a small, non-random sample of programmes, our findings are consistent with programme users' reports of the low quality, limited selection and insufficient amount of foods served in meal programmes^(11,17,20,44,52,53). The results also help to explain how an analysis of the dietary intakes of homeless youth in Toronto could find little impact of programme use on youths' total energy and nutrient intakes⁽²⁰⁾.

We have likely overestimated the true contribution of the meal programmes studied to individuals' total needs

Table 7 Linear relationship between the energy, nutrient and food group content of meals and the percentage of energy from donated foods*

Variable	Slopet	SD†	F _{1/52}	P value
Energy (kcal)	0.00003	0.0009	0.00	0.97
Protein (g)	0.01	0.007	0.03	0.87
Vitamin A, RAE (µg)	-0.01	0.02	0.21	0.65
Vitamin C (mg)	0.06	0.02	9.23	0.0037
Folate, DFE (µg)	0.0008	0.0004	3.75	0.058
Vitamin B ₆ (mg)	0.002	0.002	0.68	0.41
Thiamin (mg)	0.003	0.002	3.42	0.070
Niacin (mg)	0.001	0.002	0.23	0.64
Riboflavin (mg)	0.0006	0.002	0.10	0.75
Vitamin B ₁₂ (mg)	-0.004	0.005	0.58	0.45
Magnesium (mg)	0.0003	0.002	0.05	0.82
Iron (mg)	0.002	0.002	1.19	0.28
Phosphorus (mg)	0.01	0.02	0.31	0.58
Zinc (mg)	-0.002	0.003	0.39	0.54
Total fibre (g)	0.004	0.005	0.91	0.35
Calcium (mg)	0.002	0.003	0.42	0.52
Meat and alternative servings	-0.002‡	0.005‡	0.12	0.7293
Grain product servings	0.002‡	0.009‡	0.04	0.8366
Vegetable and fruit servings	0.009‡	0.007‡	1.62	0.2083
Milk product servings	0.0006‡	0.002‡	0.09	0.7598

RAE, retinol activity equivalents; DFE, dietary folate equivalents.

**n* 54 meals (excluding meals recorded in four programmes that did not use food donations).

†Parameter estimate from mixed linear model, based on transformed intake variables.

‡Food group servings were not transformed, but rather the mixed linear model was conducted using a method of estimation that did not assume normality in the dependent variable.

because the meal records analysed represent 'best-case scenarios.' Portion sizes are often reduced and meals are altered during the course of meal service as supplies are depleted and other foods are substituted. Data on the dietary intakes of meal participants are needed to truly assess the meals' contributions to their total nutrient

needs. In addition, data on height, weight, age, sex and usual physical activity levels of meal participants are required to obtain more accurate energy and nutrient requirement estimates.

The true nutrient needs of many homeless adults are likely higher than the requirement estimates applied here. Not only do the EAR represent medians of the requirement distribution for any one age–sex grouping, but these estimates are also designed to apply to healthy people. Given the high levels of poor health^(4–14) and nutrient inadequacies⁽²⁰⁾ documented among samples of homeless groups in Canada, it is likely that some of their nutrient requirements exceed the estimates used. Furthermore, at any given time, some proportion of homeless women are pregnant⁽⁵⁴⁾, elevating their nutrient requirements. If the true nutrient needs of individuals were known, meals would likely appear even more inadequate.

For simplicity in comparing meals to requirement estimates, we considered the meals' contribution only in relation to the days when they were provided. However, most programmes studied did not provide meals 7 d/week; thus, their true contribution must be less than what our analyses indicate because on some days, they contributed nothing. Conversely, we have underestimated the contributions of programmes that served more than one meal/d by considering only one meal. This underestimation was greatest in the three shelter programmes that served three meals and a snack daily. Whether examining all foods served would indicate that the programmes were meeting adults' daily nutrient requirements, however, is debatable. A recent study of shelter users in Toronto raised concerns about the quality of food provided⁽⁵³⁾; moreover, studies of shelter users elsewhere have revealed serious problems of dietary inadequacy^(30,34). A more comprehensive examination of shelter meals is required to assess their nutrient adequacy.

Setting appropriate nutrient standards for charitable meal programmes hinges on understanding the role of these meals in relation to the total food intakes of those who use them. Studies of homeless individuals in Canada and elsewhere routinely document their difficulties obtaining enough to eat^(17,37,44). In the Canadian context, this struggle is revealed in the assortment of desperate strategies homeless individuals employ to acquire food, including panhandling, theft, retrieval of food discarded by others or receipt of free food from people who exploit them^(11,15,17,18,20,55,56). The inadequacy and insecurity of such food acquisition strategies imply that substantial nutrient intakes are unlikely to be achieved on a daily basis from foods consumed outside charitable meal programmes. Homeless individuals may obtain food or beverages that provide additional energy during the course of a day, but they are unlikely to meet their micronutrient needs through other routes⁽²⁰⁾. Thus we would argue that meal programmes providing one meal/day or less to this extraordinarily vulnerable group should

strive to supply meals that meet adults' daily requirements, particularly for protein and micronutrients. Our results indicate that these nutrient goals can be achieved through the provision of more nutrient-dense foods, such as milk products and micronutrient-rich vegetables and fruits, with minimal change in the energy content of the meals. However, changes in food selection are required. Simply increasing portion sizes will have little impact on the micronutrient levels of meals in most programmes because they include very little milk products, fruits and vegetables currently. Improving the nutritional quality of meals offered thus requires additional resources.

Most programmes in the present study relied, in part, on food donations collected through large, well-established, food redistribution networks. Contrary to expectations, given the extensive literature critiquing the quality of food donations distributed by food banks in Canada^(22–28), meal quality was positively related to the use of donated foods in these programmes. This must to some extent reflect the limited funding available for food purchases in many programmes. Unfortunately, there is probably little scope for programmes to increase their supplies of donated foodstuffs. Despite the constant quest for more donations, food banks continue to report that demands for their services exceed supplies⁽²¹⁾. In distributing the donations they collect, food banks must weigh the needs of meal programmes for homeless adults against the needs of their extensive network of emergency food hamper programmes for domiciled families, as well as children's programmes, prenatal programmes and other valued community programmes that they supply. Thus, programmes for homeless individuals probably cannot make significant improvements in their meals without additional funds for food purchasing. Yet this also appears unlikely. Since 1999, the federal government has made some financial assistance available to communities to help them deal with local problems of homelessness, but funding has declined in recent years, and none of this funding is specifically dedicated to food programmes^(57–60).

While the present study has highlighted the low nutritional contribution of meals provided by community programmes, other problems have also been identified. Homeless individuals report difficulty obtaining meals because of the infrequent, short meal service hours in many programmes and the distances required to access different programmes at various times of the day or week^(11,17). Moreover, programme users complain about having to stand in long line-ups for food, eat in what are often crowded, unpleasant settings and participate in prayer services or other activities as a prerequisite to obtaining food in some programmes^(11,17,52). Thus even if resources can be found to improve the nutritional adequacy of meals provided, the appropriateness of such fragmented, *ad hoc* food provisioning as a long-term response to meeting the food needs of homeless people should be challenged.

Conclusion

The *ad hoc*, voluntary nature of charitable food provisioning efforts in Canada speaks of the high levels of concern in communities for the plight of homeless individuals. However, our examination of the nutritional contribution of meals served in a sample of programmes in Toronto suggests that these initiatives may have limited potential to meet the food and nutrition needs of this group. While any meal is obviously 'better than nothing', a reliance on programmes providing meals of low nutritional quality will further compromise the nutritional health of homeless individuals. More resources are required to remedy this situation, highlighting the need for more systemic, policy responses to the needs of homeless individuals in Canada.

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