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Recommended Citation
Sisson, Lisa G. and Lown, Deborah A., "Do Soup Kitchen Meals Contribute to Suboptimal Nutrient Intake & Obesity in the Homeless Population?" (2011). *Peer Reviewed Articles.* Paper 1.
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Do Soup Kitchen Meals Contribute to Suboptimal Nutrient Intake & Obesity in the Homeless Population?

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The double burden of suboptimal nutrient intake and obesity exists when available foods lack essential nutrients to promote health and provide high amounts of energy. This study evaluated the nutrition content of 41 meals served to the homeless at 3 urban soup kitchens. The mean nutrient content of all meals and of meals from each of the kitchens was compared to two-thirds of the estimated average requirement (EAR). The mean nutrient content of the meals did not provide two-thirds of the EAR for energy, vitamin C, magnesium, zinc, dietary fiber, or calcium but provided 11.8% of calories from saturated fat. On average one meal did not meet homeless individuals' estimated requirements; however, 2 meals did meet estimated requirements but provided inadequate fiber and high amounts of energy, saturated fat, and sodium. Soup kitchen meals may contribute to the high prevalence of obesity and chronic disease reported in the homeless, food insecure population.

KEYWORDS *food insecure, homeless, soup kitchen, obesity*

Aramark and Grand Valley State University provided funding support for this research. We thank Dr. Phyllis Curtiss, Director of the Statistical Consulting Center at Grand Valley State University, for her assistance with the statistical analysis and the participating soup kitchens for their cooperation and participation with this study. We also thank Suzan Couzens, MS, RN, FCN, for her encouragement, participation, and assistance, along with The Heartside Community Care and Enrichment Team for collection of the meals and insights into homelessness.

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The homeless population in the United States is estimated at 2.3 to 3.5 million individuals, or 1% of the population, during an average year.[1] Homeless people exemplify *food insecurity*, defined as the state where the availability of nutritionally adequate and safe foods or the ability to acquire acceptable foods in socially acceptable ways is limited or uncertain.[2] Studies demonstrate that though the majority of homeless individuals do not experience a shortage of accessible food, they do suffer from nutritionally inadequate food and have multiple risk factors for malnutrition, including low socioeconomic status (SES), food insecurity, high prevalence of substance abuse and smoking, and limited access to health care.[1–11] Food insecure populations consume diets of inexpensive, low-nutrient-dense foods, high in fat and added sugars and low in vegetables and fruit, resulting in overweight and obesity.[12,13] Food insecure adults have been reported to be over twice as likely to be obese compared to those who are food secure.[14]

The double burden of malnutrition exists when available foods lack essential nutrients to promote optimal health but meet or exceed energy needs through calorie-dense foods. This leads to overweight, obesity, and chronic diseases, such as diabetes, hypertension, and coronary vascular diseases.[12,15] Paradoxically, homeless people are as or more likely than other Americans to be overweight/obese.[16] In a study of homeless adults, Smith et al found that 59.4% were obese (body mass index [BMI]$\geq$30)[17] compared to an obesity rate among all Americans of 33.8%.[18] Additionally, surveys have found that 46% to 54.8% of homeless persons report chronic health conditions, such as diabetes, anemia, obesity, and hypertension.[1,19,20] Chronic diseases are more prevalent among the US homeless population than the population as a whole.[19,21] The purpose of this study was to update and further extend the literature on the nutrient quality of meals available to homeless individuals by evaluating the nutritional content of meals served at 3 urban soup kitchens.

METHODS

Sample

Grand Rapids, Michigan is a city with a population of approximately 200,000. The Heartside neighborhood of Grand Rapids is home to approximately 2,300 adults, 42.5% minority, 30% Black, where 42% live in poverty.[3] This neighborhood has been known as the "skid row" of Grand Rapids, inhabited by the poor and homeless, many living in transitional living shelters. Seventy-eight percent of households consist of one person, with 24% of the population being males between the ages of 30 to 49.[3] Many social service agencies and food distribution sites are located in the neighborhood to serve the needs of the homeless and marginalized people residing there.

Self-administered questionnaires were provided and open-ended interviews were conducted by the lead author with coordinators of the soup

kitchens located in this neighborhood to obtain data on history and policies, such as who was eligible to eat at the kitchen, meals served and serving times, number of people served, sources of food, and nutrition education of food preparation and serving staff. The criterian for food distribution sites to be eligible for entry into the study was daily provision of free meals without any restrictions. Three of the neighborhood soup kitchens provided meals that met the eligibility criterian. In February and March 2009, a cross-sectional sample of a total of 41 meals was collected from these soup kitchens in the Heartside neighborhood. The meals included dinner served at Kitchens A and B and lunch and dinner served at Kitchen C. Table 1 summarizes the menu planning guides used, staff education and training, mealtime, number of meals served, and number of served meals observed at each kitchen. The staff at these soup kitchens was found to have none to basic nutritional education and the kitchens had few menu planning guidelines.

Data Collection

Trained research assistants unobtrusively documented the ingredients of prepared foods through collection of food packages and observation/recording of meal preparation methods. Meal preparation observation was recorded for 28/41 (68%) of the meals. Obstacles such as meal preparation schedules, lack of communication with soup kitchen volunteers, and service of leftovers prevented meal preparation observation of all meals included in the sample. If meal preparation was not observed, recipes, staff interviews, and food packages were used to calculate nutrient content of the meal.

Meals were served with portions controlled by volunteer servers at each kitchen. To avoid bias in portion sizes served, regular soup kitchen clients collected the meals. Because some foods, such as salads and beverages were self-serve, the soup kitchen clients were instructed to select whichever of the self-serve items they would normally choose. The sample meals were given to research staff and weighed using the Taylor TE10C digital gram scale (ARAMARK). Nutrient content was analyzed with the diet analysis software Nutritionist Pro (v 4.2.0, Axxya Systems, Stafford, Tex) utilizing the US Department of Agriculture (USDA) Nutrient Database for Standard Reference and manufacturer's databases.[22] Missing nutrient values were imputed using values from comparable foods found in the USDA Nutrient Database for Standard Reference.[22]

Data Analysis

Meals were evaluated for total energy, macronutrients, total fiber, and selected micronutrients; vitamin A, vitamin C, folate, vitamin B_6, thiamin, niacin, riboflavin, vitamin B_{12}, magnesium, iron, phosphorus, zinc, calcium, and sodium. For the vitamins and majority of minerals, the mean nutrient

TABLE 1 Description of Soup Kitchen Programs Evaluated and Meals Collected

Program	Meal type and time	Description	Menu planning guides used	Staff education and training	Average number served	
					Per meal	$N = 41$
A	Dinner 2:30–4:30 p.m.	Stand alone soup kitchen, part of a larger faith-based organization. Dinner is available to anyone.	Entrée (protein) salad, dessert. bread and butter. No formal guidelines.	No nutrition education. One staff person is ServSafe certified. Majority are volunteers and court-appointed community service workers.	310	7
B	Dinner 5:15–6:15 p.m.	A faith-based organization with multiple programs in one building, including residential substance abuse recovery, emergency shelter, food and clothing pantries, and legal aide. Soup kitchen serves dinner daily to any male not on the "banned" list (those who have caused trouble in the past).	Vegetable, starch, protein, salad, and fruit. Two times per week sweets are offered for dessert; otherwise, no desserts.	Three full-time staff have culinary degrees with minimum of one nutrition class and ServSafe certification. Volunteers serve the meals.	160	13
C	Lunch 12:30–1:00 p.m.	A faith-based organization with multiple programs in one building, including residential substance abuse recovery, emergency shelter, and food pantry. Soup kitchen serves lunch and dinner daily to anyone. Meals are preceded by chapel service. Those who do not attend chapel may join the food line after others are served.	None	Education varies, none is required. Meals are planned and prepared by recovery program clients and served by clients or community volunteers	100	9
	Dinner 6:30–7:00 p.m.				100	12

content of the meals was compared to the dietary reference intakes (DRI), EAR of the National Academy of Sciences, Institute of Medicine, Food and Nutrition Board.[23–28] The estimated average requirement (EAR) represents the estimated median intake to meet the requirement of half the healthy individuals in a particular life stage and gender group.[29] For dietary fiber and calcium, adequate intake (AI) was used for comparison and for sodium, and tolerable upper limit (UL) was used for comparison because these nutrients do not have an EAR.[29] Comparisons were made to two-thirds of the EER for adult males 31 to 50 years of age because the largest proportion of the population in the neighborhood where the soup kitchens are located consists of this age and gender group.[3] For energy requirements the goal was set at two-thirds of the estimated energy requirement (EER) for a 40-year-old male, 69 inches tall with a BMI of 22.5, and low active physical activity level (1694 kcal/day).[23] The goal was set at two-thirds of the EER because research indicates that most homeless people eat fewer than 3 meals a day.[7,8,11] Low physical activity level was selected becausethis is equivalent to walking 2.2 miles/day at a rate of 3 to 4 mph in addition to the activities that are part of independent living for an adult weighing 70 kg.[30] The population residing in the urban neighborhood of these soup kitchens can access all social service agencies, shelters, and soup kitchens within a few block radius, therefore requiring little physical activity. The macronutrient composition of the meals was compared to the DRI acceptable macronutrient distribution range (AMDR).[23]

Data analysis was conducted using the Statistical Package for the Social Services (v 14.0.1 for Windows, SPSS, Inc, Chicago, Ill). Comparison of mean nutrients served for each of the 4 meal times, and the mean of all 41 meals served, to two-thirds of the EAR was evaluated using one-sample *t*-test or sign tests, where the normality assumptions were violated. Due to the range of available mealtimes and the close proximity (within one block) of the soup kitchens, the energy and nutrients provided by possible 2 meal combinations was explored. Data are presented as combined kitchen and individual kitchen means $\pm$ *SD* with statistical significance set at $P < 0.05$.

RESULTS

Energy and Macronutrients

Table 2 summarizes the total mean nutrients provided by 41 meals served at the 3 soup kitchens, the mean nutrients provided at each meal by the individual soup kitchens, and the nutrient goal of two-thirds of the EAR. The soup kitchens served meals that were highly variable in nutrient content. On average the mean amount of energy provided by the 41 meals and Kitchens B and C was significantly less than the goal ($P < 0.001$), although Kitchen A dinner did achieve the goal. Due to the range of available mealtimes and close proximity (within one block) of the soup kitchens, the energy

TABLE 2 Comparison of Nutrients Provided at Soup Kitchens to Two Thirds of the EAR for Males 31 to 50 Years Old

	Combined	Location and meal				2/3 EAR
Nutrient	Mean ± *SD*[a] $n = 41$	A Dinner $n = 7$	B Dinner $n = 13$	C Lunch $n = 9$	C Dinner $n = 12$	Males 31–50 years
Energy (kcal)	999.0 ± 429***	1508.0 ± 404	928.0 ± 459.8***	871.7 ± 180.6***	875.1 ± 355.3***	1694[b]
% Carbohydrate	47.1 ± 9.4	47.4 ± 4.2	49.0 ± 11.1	49.0 ± 6.6	43.3 ± 11.1	45–65[c]
% Protein	17.0 ± 7.2	13.1 ± 4.0	19.2 ± 9.0	16.0 ± 6.9	17.7 ± 6.3	10–35[c]
% Fat	36.9 ± 9.9	40.2 ± 4.9*	32.7 ± 10.1	36.2 ± 9.8	39.8 ± 11.0	20–35[c]
% Saturated fat	11.8 ± 3.5**	12.0 ± 2.8	11.2 ± 4.0	11.7 ± 3.8	12.5 ± 3.5*	<10
Vitamin A, RAE (μg)	352.3 ± 410.3	460.3 ± 431.0	458.6 ± 610.9	254.3 ± 228.6*	247.6 ± 158.6**	416.7
Vitamin C (mg)	58.8 ± 43.6*	78.9 ± 16.3	62.9 ± 61.1	48.4 ± 38.1	50.5 ± 34.7**	73.3[d]
Folate, DFE (μg)	230.1 ± 143.6	289.1 ± 73.7*	275.9 ± 210.8	154.4 ± 84.3	202.9 ± 90.4	213.3
Vitamin B_6 (mg)	0.8 ± 0.3	0.9 ± 0.4	0.9 ± 0.3	0.7 ± 0.3	0.8 ± 0.3	0.7
Thiamin (mg)	0.8 ± 0.4	1.0 ± 0.2**	0.9 ± 0.5	0.6 ± 0.3	0.6 ± 0.3	0.7
Niacin (mg)	11.3 ± 4.2***	14.1 ± 2.8**	11.5 ± 4.0**	10.4 ± 5.7	10.2 ± 3.2*	8.0
Riboflavin (mg)	0.7 ± 0.4	1.0 ± 0.2**	0.7 ± 0.4	0.5 ± 0.3*	0.8 ± 0.6	0.7
Vitamin B_{12} (μg)	1.5 ± 1.3	1.7 ± 1.2	1.4 ± 1.0	.9 ± 1.0	1.9 ± 1.7	1.3
Magnesium (mg)	108.1 ± 42.8***	128.1 ± 47.3**	112.9 ± 56.2***	96.1 ± 34.6***	100.2 ± 25.6***	233.3
Iron (mg)	6.3 ± 2.9***	8.8 ± 2.1**	6.9 ± 3.7*	4.9 ± 2.0	5.2 ± 1.5*	4.0
Phosphorus (mg)	547.6 ± 236.0***	679.2 ± 250.5*	501.8 ± 220.1	495.6 ± 161.0	559.5 ± 284.1	386.7
Zinc (mg)	4.9 ± 0.5**	6.7 ± 2.5	5.4 ± 4.0	3.5 ± 1.7**	4.5 ± 2.0*	6.3
Dietary fiber (g)	9.4 ± 5.2***	10.2 ± 3.4***	10.5 ± 7.5***	9.7 ± 4.9***	7.5 ± 2.3***	25.3[e]
Calcium (mg)	305.4 ± 218.8***	352.6 ± 153.6**	306.9 ± 250.3***	217.7 ± 138.1***	342.0 ± 264.1**	666.7[e]
Sodium (mg)	1755.7 ± 762.1	2401.7 ± 486.8**	1576.1 ± 1038.9	1653.6 ± 610.7	1650.2 ± 457.9	1533.3[f]

[a] *SD* indicates standard deviation; RAE, retinol activity equivalents; DFE, dietary folate equivalents.
[b] Two thirds estimated energy requirements for a 40-year-old male, 69 inches, BMI = 22.5, low active physical activity level.[23]
[c] Acceptable macronutrient distribution range.
[d] EAR for smokers was used for comparison because a large percentage of homeless smoke.[6,7]
[e] Adequate intakes were used for comparison of dietary fiber and calcium.
[f] Tolerable upper limit was used for comparison of sodium.
*$P < 0.05$. **$P < 0.01$. ***$P < 0.001$.

and nutrient provided by possible 2 meal combinations was explored and also compared to two-thirds of the EAR. The energy provided ranged from 1746.8 to 2436 calories for possible 2 meal combinations. Total ($n = 41$) mean macronutrient distribution for carbohydrates and protein was within the AMDR. Kitchen A served meals with 40.2% of calories from total fat, which was significantly greater than the AMDR ($P = 0.030$), and the total mean calories from saturated fat was 11.8%, again significantly more than the <10% of total calories goal ($P = 0.002$).[31]

Micronutrients

The mean micronutrients provided from the 41 meals and meals at each kitchen met the micronutrient goals for folate, vitamin B_6, thiamin, niacin, riboflavin, vitamin B_{12}, iron, and phosphorus. The only exception was the significantly lower amount of riboflavin (0.5 mg) at Kitchen C lunch meals compared to the EAR goal ($P = 0.045$). The mean vitamin A content of all meals did not meet the EAR goal, but was only significantly low at Kitchen C lunch ($P = 0.039$) and dinner meals ($P = 0.004$). The combined (41 meals) mean provision of vitamin C ($P = 0.039$), magnesium ($P < 0.001$), zinc ($P = 0.001$), dietary fiber ($P < 0.001$), and calcium ($P < 0.001$) was significantly less than the EAR and AI goals. All of the individual kitchens also provided significantly lower mean amounts of magnesium, dietary fiber, and calcium compared to the EAR and AI goals. The mean sodium content of meals at Kitchen A (2401.7 mg) significantly exceeded the UL goal of 2300 mg ($P = 0.003$). The mean sodium content (1755.7 mg) of meals at all kitchens approached statistical significance for high sodium content ($P = 0.069$), with 26/41 (63%) meals providing more than two-thirds of the UL and 11/41 (27%) meals containing greater than 100% of the UL.[24] The micronutrient ranges provided by possible 2 meal combinations met the goal for all nutrients except dietary fiber (17.2–20.7 g). The sodium provided by any 2 meal combination greatly exceeded the goal of 1533.3 g, with a range of 3226.3 to 4055.3 g.

Discussion

This study found that, on average, one meal from the soup kitchens did not provide two-thirds of the EAR for energy, vitamin C, magnesium, zinc or two-thirds of the AI for dietary fiber and calcium but did exceed the recommendations for saturated fat. On average, 2 meals from the soup kitchens met the goals for all nutrients except dietary fiber. However, all possible 2 meal combinations provided excessive amounts of calories, more than twice as much sodium as desirable, and high amounts of saturated fat, thus potentially contributing to overweight/obesity and other chronic noncommunicable diseases. This finding of soup kitchens serving low-nutrient-dense meals is consistent with other studies.[7,8,32,33] Of note is that though Kitchen

A meals were the only meals that provided adequate energy, vitamin C, and zinc, the meals contained high amounts of fat and sodium. Moreover, even with the higher energy content, Kitchen A meals provided significantly less magnesium, calcium, and dietary fiber than the goals.

Serving low-nutrient-dense food to homeless people is of concern due to its role in chronic disease and the coexisting conditions commonly found in homeless men. We found that all of the soup kitchens served food low in magnesium and calcium, potentially increasing the already considerable risk for hypertension and cardiovascular disease among the men eating there.[28] The state of inadequate intake may be exacerbated by the excessive loss of magnesium in urine that can occur in cases of poorly controlled diabetes and alcohol abuse, both prevalent in the homeless population.[6,10,28,34] Low blood levels of magnesium occur in 30% to 60% of alcoholics, increasing the importance of providing adequate magnesium in foods served.[22,35] The high saturated fat and low dietary fiber served by the soup kitchens may also increase the risk for cardiovascular disease and complications of diabetes.[23] Dietary fiber, which was low at all kitchens, has also been associated with a decreased likelihood of developing obesity, Type 2 diabetes, and numerous gastrointestinal disorders such as hemorrhoids and diverticulitis.[36] The nutrients that were provided in adequate amounts (B vitamins, iron, phosphorous) were mainly those found in enriched flour products (thiamin, riboflavin, niacin, folic acid, and sometimes iron),[37] consistent with the low dietary fiber content of the meals. Data collected by the researchers showed that white bread and starches were available at most meals, whereas whole-grain products were not.

As previously stated, only Kitchen A was found to serve statistically high amounts of sodium in meals, although the mean sodium provided by all kitchens approached significance ($P = 0.069$). Two meals from the kitchens provided as much as 4055.3 g sodium, or 2.6 times the recommended amount. High sodium intake is of importance because it may increase blood pressure, particularly among African Americans and persons with hypertension, and diabetes, all found in disproportionally high numbers among the homeless.[1,19,24]

The variance in mean energy and nutrient content of the meals from one kitchen to another may be accounted for by the diverse characteristics of the soup kitchens. Kitchen A served only one mid-afternoon dinner meal daily and provided no other services. Kitchens B and C were housed in larger facilities providing a broad range of services, including 3 meals a day to those enrolled in their rehabilitation programs. In these 2 soup kitchens, the meals available to the general community were planned in a manner similar to meals provided to program participants.

There were a number of strengths and weaknesses inherent in this study. The meals collected were from a small convenience sample, with some kitchens having more meals collected than others. Fewer meals were

collected from Kitchen A than Kitchens B or C due to barriers to researcher access, including timing of meal preparation and limited cooperation from kitchen staff. A higher proportion of meals collected from Kitchen A may have provided more accurate mean results of the food available from the neighborhood soup kitchens. However, for descriptive purposes the convenience sample collected can be considered representative because meals were obtained from all kitchens, during all days of the week and weeks of the month. Additionally, results may not accurately reflect the nutrient content of food available at the soup kitchens due to the meal collection method that used homeless individuals to collect the meals. At a few meals, a limited number of items were self-selected by the homeless individual, thus affecting the results of both the energy and nutrients evaluated. A dietary recall questionnaire that collects data on when and where meals are eaten, sources of food consumed other than soup kitchens, and the average length of time individuals depend on soup kitchens for meals would improve the results of this study. Unfortunately, the ability to obtain reliable information from this population is limited by the prevalence of substance abuse, suspiciousness of outsiders, and the inconsistency of their day-to-day eating patterns.[2,7] Michigan, located in the upper Midwest, has a short growing season, with the soup kitchens receiving few donations of fresh fruits and vegetables in the winter. This may result in a significant difference in the nutrient content of the meals during summer months compared to winter months. A comparison of the nutrient content of meals served in the summer months could strengthen the results of this study. An important strength of the study was the observation and recording of meal preparation methods and ingredients used. Similar prior studies relied on menus, recipes, or cooks' recollections to analyze food served, whereas this study identified specific ingredients and amounts used in the food served and accounted for the preparation method in the nutrient analysis.[8,33,38] This method was chosen for increased accuracy, because the soup kitchen directors acknowledged that menus and recipes were often not available, or followed, due to lack of planning and irregular food donations.

CONCLUSIONS

This study's findings of low-nutrient-dense meals served by soup kitchens are important because the food insecure homeless population depends on soup kitchens to meet their nutritional needs without contributing to their risk for chronic diseases, overweight/obesity, and future hospitalizations. Consequently, the kitchens and donors may need to rethink the old adage that any food is better than none and embrace the new paradigm of the double burden of malnutrition that exists when the food provided does not promote optimal health but potentially contributes to overweight, chronic

diseases, and increased health care costs. A model of provision of nutrient-dense foods to improve health and nutrition in food insecure people already exists in food banks in the Grand Rapids area. These food banks/pantries are providing more frequent access to fruits/vegetables and lower-sodium canned goods to those food insecure individuals with chronic disease in hopes of decreasing hospitalizations that result in increased health costs. Cooking classes by dietitians are also provided to assist these individuals to prepare healthy meals with the provided food. The future plans for the information from this study are to present results to community donors and businesses so they might reevaluate their donations with the goal of improving community health and decreasing hospital costs in the community. We also plan to share this information with soup kitchen staff so they will understand the importance of changing their food preparation and service practices to maximize the health of their clients and prevent future hospitalizations. We recognize that costs and feasibility constraints make change difficult for soup kitchens. Despite these challenges, we believe that this study will result in new discussions with those serving the homeless community.

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