
Assessment of the Nutritional Status of Urban Homeless Adults

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Synopsis

Homeless people eat foods at municipal and charity run shelters, fast-food restaurants, delicatessens, and from garbage bins.

Data on the adequacy of the diets and the nutritional status of homeless persons are sparse. Therefore, nutritional indicators of 55 urban homeless subjects were assessed, and a high prevalence of risk factors was identified.

Although 93 percent of subjects reported that they obtained enough to eat, a low dietary adequacy score of 10.1 (norm=16) indicated that the quality of the diet was inadequate. Diet records showed a high intake of sodium, saturated fat, and cholesterol. Serum cholesterol levels above the desirable limit of 200 mg per dl were prevalent. Anthropometric measurements were significantly different from percentile distributions of the U.S. population ($P < .001$). Triceps skinfold measurement was above the 95th percentile in 25 percent of subjects. Upper arm muscle area, which reflects lean body mass, was below the 5th percentile in 23.3 percent of women and 44 percent of the men. These decreased levels of lean body mass and increased levels of body fat, together with the elevated serum cholesterol levels and the shortages of essential nutrients in the diet, may place the homeless at risk of developing nutrition-related disorders.

MORE AMERICANS are homeless now than at any time since the great Depression. Estimates of the size of the homeless population vary widely, from 350,000 to about 3 million (1-4). Whatever the number, it is generally agreed that this segment of the population is growing.

Homeless persons depend substantially on foods from municipal and charitable shelters, fast-food restaurants, delicatessens, and garbage bins. Information on the adequacy of these diets and on the nutritional status of homeless persons in general is sparse. Data from one study documented that men attending a soup kitchen were more malnourished than sick hospitalized patients (5).

In this study, the nutritional status of a heterogeneous group of urban homeless and marginally homeless persons was surveyed. The purposes were to assess the nutritional adequacy of their dietary

intake and to measure objective clinical parameters indicative of nutritional status.

Methods

A cross-sectional prevalence study for nutritional assessment in a marginally housed and homeless population was conducted through the single-room occupancy (SRO) and homeless program of the St. Vincent's Hospital and Medical Center of New York during 1 week in February 1987. The program provides on-site medical and social service care at shelters and SRO hotels. Two daytime drop-in centers for street persons providing three meals per day, two long-term accommodations for the previously homeless, psychiatrically ill providing two meals per weekday, and one SRO hotel where tenants must provide their own meals were

Table 1. Responses of 55 homeless persons to nutritional assessment questions

Items	Percent answering yes
1. Do you get enough to eat?.....	93
2. Do you have a good appetite?.....	73
3. How many meals are prepared for you at the center each day?	
0 meal	18
1 meal	9
2 meals	35
3 meals	38
4. Are there any cooking facilities available to you?.....	33
5. How many meals do you prepare for yourself each day?	
0 meal	53
1 meal	24
2-3 meals	23
6. Do you have money to buy food and how much, per week?	
0 dollars.....	22
Less than 20 dollars.....	18
21-50 dollars	40
Greater than 51 dollars	20
7. Have you been told by a medical doctor that you should or should not eat particular foods?	42
8. If yes, are you able to follow this diet? ...	52
9. Do you smoke cigarettes?.....	79
10. Do you drink alcohol?	29
11. Do you use any street drugs?	10
12. Do you use any vitamin supplements? ...	39
13. Has your weight changed over the last year?	56
If yes, did it go up?	61
Down?	39
14. Do you have any medical conditions?....	80
15. If yes, are you taking medications for these conditions?	98

surveyed—a total of five locations. Many of the SRO residents used hotplates to heat simple meals, often consisting of canned foods. Participants were interviewed using a questionnaire. Points of focus included housing status, dietary intake, personal habits, and nutritional assessment (table 1).

Population. Participants residing in SRO hotels were considered to be marginally housed because many have no legal right to their rooms. They live from month to month with urban gentrification and coop conversion threatening their living situation. We included them in this nutritional survey as representative of the fluid group of urban impoverished persons who fluctuate between having borderline housing and being homeless. Subjects from the dropin centers were known to be without residences, and all subjects from the long-term accommodations for the psychiatrically ill had recently been homeless. Henceforth, all will be referred to as homeless persons.

A total of 88 persons waiting to see the St. Vincent's Hospital medical team were approached for an interview either at the hospital-based SRO homeless clinic or at one of the five outreach sites. Twenty-six persons declined participation. Potential disqualifying conditions for the study were active gastrointestinal disorders, renal and liver disease, hemoglobinopathies, cancer, age older than 74 years, and recent hospitalization. Seven subjects were excluded from the study. Two were excluded because of recent gastrointestinal bleeding, one each for an age greater than 74 years, hepatic disease, renal insufficiency, partial gastrectomy and vagotomy, and recent hospitalization—factors which in themselves alter nutritional status.

A total of 55 persons participated. Subjects included 30 women and 25 men; 31 were white and 24 were black. The ages ranged from 24 to 72 years with a mean of 47.3 years. Twenty-three were from dropin centers, 20 from facilities for the psychiatrically ill, and 12 from the SRO hotel.

Dietary score for assessing nutrient adequacy. A 16-point score system, developed and validated by Guthrie and Schear (6), was applied in this study. The system is based on the Basic Four Food Groups (7) and can serve as a simple and valid scoring system for the rapid evaluation of dietary adequacy. The Basic Four Food Groups are milk and milk products, meat and meat alternatives, fruit and vegetables, and bread and cereals. Points were assigned whenever a serving of a food group item appeared in the diet. A maximum of 4 points was allocated to each food group. With a dietary adequacy score of 16, the dietary intake may exceed 90 percent of the recommended dietary allowance (RDA) (8) for all 12 nutrients, except iron and vitamin B₆.

The dietary score for each of the 55 study participants was determined based on the food group content of their intake for the previous 24-hour period. Menus and recipes were obtained from the shelters, and a dietary adequacy score was calculated for the shelter meals. In addition to the dietary score, dietary intake data were collected through the 24-hour recall method for every fifth participant, a total of 11 recalls. Persons were asked to recall food and beverage consumption during the preceding 24 hours. With the help of three-dimensional food models, the size of each reported portion was recorded. Supplemental vitamin intake was not included in this analysis, although subjects were asked if they used vitamin supplements. The nutrient content of the 24-hour

Table 2. Demographic data, diet score, and anthropometric measurements for 55 homeless persons

Variables of study group	Women (N = 30)		Men (N = 25)	
	Mean \pm SD	Range	Mean \pm SD	Range
Age (years)	46.9 \pm 14.5	24.0–72.0	47.7 \pm 12.8	29.0–68.0
Time at shelter (months)	14.8 \pm 25.8	1.0–99.0	35.8 \pm 34.1	1.0–99.0
Diet score	10.2 \pm 4.5	4.0–16.0	10.0 \pm 4.6	2.0–16.0
Dollars per week for food	23.1 \pm 26.4	0.0–90.0	36.7 \pm 21.2	0.0–98.0
Body mass index	25.9 \pm 5.1	18.0–38.6	25.5 \pm 5.7	18.4–39.5
Triceps skinfold (mm)	27.0 \pm 11.5	8.0–49.0	15.8 \pm 8.8	5.0–37.0
Arm circumference (mm)	293.6 \pm 46.5	225.0–400.0	295.7 \pm 33.9	229.0–390.0
Arm muscle circumference (mm)	208.6 \pm 31.0	121.0–271.0	246.7 \pm 27.6	180.0–299.0
Arm muscle area (mm ²)	3544.3 \pm 1021.4	1159.5–5858.4	4878.9 \pm 1059.2	2565.9–7133.2
Arm fat area (mm ²)	3548.3 \pm 1700.1	849.8–6880.4	2171.6 \pm 1294.3	552.8–6140.3

recall was calculated with a dietary computing program (9), and the resultant values were compared to the RDA specific for age and sex (8).

Anthropometric measurements. Height, weight, triceps skinfold (TSF), and upper arm circumference (AC) were measured using standard techniques (10). Upper arm muscle circumference (AMC), upper arm muscle area (AMA), and upper arm fat area (AFA) were derived from measures of upper arm circumference and triceps skinfold using the procedure described by Frisancho (11). Measurements of TSF, AC, AMC, AMA and AFA were compared to percentile rankings, specific for age and sex, derived from normal population values (11).

Body mass index (BMI) is a weight to height index ($BMI = \text{weight (kg)} \div \text{height (m)}^2$) and was calculated from the weight and height measurements of each subject. The desirable BMI range for men is from 20 to 25 and for women from 19 to 24 (12). Index values were compared to percentile rankings derived from normal population values, specific for age, sex, and race (13).

Biochemical markers. Venous blood was collected from participants, who volunteered for the blood tests, for determination of complete blood count and for albumin and cholesterol levels. The values were compared to established age- and sex-specific percentile rankings derived from the normal population (14).

Statistical tests. Pearson product-moment correlation procedures, chi-square tests, and Student's *t*-tests were used to analyze the data. The significance level was set at .05 for all tests. Statistical calculations were performed with the SAS statistical program (15).

Results

Responses to questions about food and personal habits are displayed in table 1. Demographic information, diet scores, and anthropometric data are shown in table 2. The mean length of stay at the drop-in centers, long-term accommodations, or hotel was 14.8 months for women and 35.8 months for men. Ninety-three percent of subjects reported that they were getting enough to eat, and 78 percent had some money to purchase foods. Forty-two percent had been told to maintain a special diet, but only 52 percent of these persons felt able to comply with the prescription. Seventy-nine percent of the subjects were smokers, 29 percent reported some alcohol intake, 10 percent reported using street drugs, and 39 percent stated that they used vitamin supplements, mostly megadoses of vitamin C and E. A change in body weight of greater than 10 percent during the past year was reported by 56 percent of participants. Eighty percent reported having a chronic medical condition, and 98 percent of these persons were receiving prescription medications. Mental illness was reported by 24 subjects, and cardiac disease, chronic obstructive pulmonary disease, and diabetes mellitus each by 7 subjects; tuberculosis, alcohol abuse, and high blood pressure were reported five times each.

Dietary intake. The study subjects' mean dietary intake score was 10.1 ± 4.5 standard deviation (SD). For the shelters providing three meals per day, the dietary adequacy score of the menu was 16. For the two shelters providing morning and midday meals, the dietary scores were 7 and 8. Statistical analysis showed no difference between mean scores for women and men or black and

Table 3. Adequacy score for 12 key nutrients based on basic four food groups

Key nutrients ¹	Percent of RDA		
	Maximum score ² (16 points)	Mean score of subjects (10 points)	24-hour diet recall of 11 subjects
Protein	100	93	123
Calcium	99	73	53
Magnesium	91	51	51
Zinc	86	47	48
Iron	79	40	52
Vitamin A	96	53	121
Ascorbic acid	99	67	220
Thiamin	96	52	107
Riboflavin	99	70	98
Vitamin B ₆	82	40	57
Vitamin B ₁₂	100	87	64
Folic acid	93	58	56

¹ Meeting the RDAs for the 12 key nutrients may indicate that the RDAs are met for all nutrients.

² A score of 16 indicates a nutritionally adequate diet. This column represents the RDA score for shelters providing three meals per day.

white subjects. There were no statistically significant relationships between the dietary adequacy score of subjects and amount of spending money for food, smoking habits, and anthropometric indicators. In addition, no differences were observed between study subjects' dietary intake score and type of site (drop-in center or hotel), for length of stay at location, or for availability of cooking facilities. Although the menus at two shelters achieved a maximum total dietary score of 16 by providing three meals per day, persons who ate at these sites did not consume an adequate variety of foods. Thus their individual dietary scores were much lower.

With a mean dietary score of 10.1, the study population reached an intake of greater than 90 percent of RDA only for protein intake (table 3). If two-thirds of the RDA is used as the standard for identifying subjects at possible nutritional risk (8), the study group met the standard for only 5 of 12 nutrients.

The 24-hour dietary recalls of 11 persons were collected and compared to the RDA and the dietary adequacy score (table 3). Again the two-thirds level of the RDA was reached for only 5 of 12 nutrients analyzed. Inadequate intakes of B-vitamins, calcium, iron, magnesium, and zinc were prevalent among the subjects. The vitamin A, ascorbic acid, and thiamin levels were greater than 100 percent of RDA in two subjects because of large consumptions of avocados and vitamin-C fortified juice drink. Although the mean nutrient intake of the group as a whole may appear reasonably

adequate for some nutrients, an extreme range of intakes was observed due to the subjects' imbalanced food consumption.

Although sodium, saturated fat, and cholesterol intakes were not included in the dietary adequacy score, inspection of individual diet records showed a high intake of foods containing considerable amounts of these nutrients (for example, cold cuts, potato chips, pastry).

Anthropometric measurements. Mean \pm SD values and ranges for anthropometric measurements of the study group are presented in table 2. The anthropometric measurements of the study group were compared to reference data of the general United States population, specific for age and sex (11,13). This comparison gave the percentile level of the person for a particular indicator. A high prevalence of abnormal values was identified in the study group by these nutritional assessment techniques (table 4).

For the variables which reflected fat stores (triceps skinfold, upper arm fat area, body mass index), a statistically significant number of study participants were outside normal percentile ranges (less than 5 percent or greater than 95 percent). Depleted fat store levels (TSF, AFA) were reported in some subjects, but 30 percent of women and 20 percent of men showed TSF levels greater than the 95th percentile ($P < .001$).

The relationship between BMI and excess morbidity and mortality has been divided into risk levels. As body weight increases, the relative risk of complication increases (16). Thirty percent of women subjects (BMI 19-24) and 48 percent of men subjects (BMI 20-25) were in the range of normal body weight. Below the normal range were 6.7 percent of women and 8 percent of men. Above the normal range were 63.3 percent of women and 44 percent of men.

The variables which reflect lean body mass were significantly depleted in women and men. The upper arm muscle circumference was below the 5th percentile in 13 percent of women and in 36 percent of men. Upper arm muscle area was below the 5th percentile in 23.3 percent of women and 44 percent of men ($P < .001$).

Laboratory assessment. Seventeen participants (31 percent) agreed to give blood samples. Serum albumin levels were all within normal limits (mean \pm SD, 4.39 \pm .32 grams per deciliter). Ninety-two percent of subjects had cholesterol levels above the desirable limit of 200 mg per dl (17) (mean \pm SD,

Table 4. Percentage distribution of study group compared with distribution of the U.S. population in NHANES I for anthropometric measurements

Measure	Percent distribution of 55 subjects among 5 categories				
	Less than 5 percent	5-25 percent	Greater than 25 to 75 percent	Greater than 75 to 95 percent	Greater than 95 percent
U.S. population ¹	5	20	50	20	5
<i>Study subjects</i>					
Tricep skinfold:					
Women.....	3.3	26.7	20	20	30
Men.....	8	12	36	24	20
Arm circumference:					
Women.....	10	26.7	26.7	33.3	3.3
Men.....	16	44	36	0	4
Arm muscle circumference:					
Women.....	13.3	33.3	33.3	13.4	6.7
Men.....	36	36	28	0	0
Arm muscle area:					
Women.....	23.3	20	40	10	6.7
Men.....	44	28	24	0	4
Arm fat area:					
Women.....	6.7	20	23.3	33.3	16.7
Men.....	8	16	44	16	16
Body mass index:					
Women.....	0	23.3	53.3	16.7	6.7
Men.....	8	20	52	12	8

¹ Numbers indicate the percent of U.S. population in a specific category.
NOTE: All values were significantly different from percentile distributions of the

U.S. population NHANES-1 (references 11, 13) ($P < .001$ by chi-square test), except BMI for men ($P = NS$).

233.85 ± 50.44, range 178-332 mg per dl). Although only two subjects had abnormal hemoglobin (Hb) and mean corpuscular volume (MCV) values, a trend towards higher MCV levels was observed in subjects with self-reported alcohol consumption (table 5).

Discussion

A high prevalence of nutritional risk factors was identified by dietary and anthropometric assessment techniques in this study population of homeless adults. Although 93 percent of subjects reported that they obtained enough to eat, the low dietary adequacy score of 10.1 points, or 63 percent of a maximum score of 16, suggests that the quality of the diet is inadequate. Low intakes, less than two-thirds of the RDA, were observed for B-vitamins, calcium, iron, magnesium, and zinc. RDAs are levels of intakes considered adequate to meet the known nutritional needs of healthy persons. The risk of ingesting inadequate diets increases as intakes fall below recommended levels (8). Dietary intakes modestly below the RDA have been reported in nationwide food consumption surveys (18,19). However, intake of homeless persons in this study population deviated substantially from requirements of the RDA, placing them at increased risk for nutritional deficiencies.

The serum cholesterol level was greater than 200 mg per dl in 92 percent of subjects who cooperated with laboratory evaluations. Hypercholesterolemia is a major risk factor for coronary heart disease. Increased blood cholesterol levels correlate with increased prevalence and severity of the disease. Recent evidence has firmly established that lowering the blood cholesterol concentration in hypercholesterolemic persons reduces their risk of developing symptomatic cardiovascular disease (17). The majority of the study subjects had very high intakes of saturated fat and cholesterol.

Bray (16) describes a curvilinear relationship between body mass index (BMI) and the presence of certain chronic diseases such as hypertension and diabetes mellitus. As BMI increases, the relative risk of certain illnesses increases. In this study population a large proportion of participants had a BMI above the normal range. Triceps skinfold measurement, a valid measure for body fatness (13), was above the 95th percentile in 25 percent of subjects.

Upper arm muscle measurements, indicators of lean body mass, were significantly depleted in the study subjects. The dietary protein intake was greater than 90 percent of the recommended intake. Albumin levels, which reflect dietary protein intake, were within normal limits. Therefore, these

Table 5. Data on laboratory values, smoking habits, alcohol consumption, and anticonvulsants by age of 17 study subjects

Age (years)	Hb (g per dl)	MCV (cu microns)	Smoking	Alcohol	Phenytoin
Women:					
54	14.3	¹ 91	+	+	+
60	² 12.7	¹ 99	+	+	-
64	13.6	86	-	-	+
72	² 12.8	87	-	-	-
62	15.7	¹ 99	+	+	+
27	³ 11.4	³ 72	+	+	-
48	² 12.6	¹ 92	+	-	-
45	³ 7.0	³ 63	+	-	+
Men:					
57	15.5	89	+	-	+
29	14.8	¹ 94	+	-	-
61	² 13.8	81	+	-	-
47	² 15.1	¹ 97	+	-	+
50	² 14.0	81	+	-	+
63	15.7	¹ 90	+	-	+
62	² 13.9	¹ 99	+	+	-
32	16.1	86	-	-	-
47	² 13.6	86	+	-	+

¹ Greater than median values, specific for age and sex of the U.S. population (14).

² Less than median values, specific for age and sex.

³ Less than 95 percent range, specific for age and sex.

NOTE: Hb = hemoglobin; MCV = mean corpuscular volume; cu microns = cubic microns; + = positive history for smoking, alcohol intake, and phenytoin; - = negative history for smoking, alcohol intake, and phenytoin.

decreased muscle measurements were not due to protein malnutrition. Deficits of lean body mass have also been reported in another study. That one described a group of men (mean age 33 years) who were attending a soup kitchen. The mean AMC value of 26.6 cm was at the 25th percentile (5).

These results may reflect an acceleration of the changes in body composition that occur in adult life. Forbes (20) has shown that lean body mass declines progressively during adult life, the loss tending to accelerate in later years and to be greater for men. The loss is compensated by an increase in body fat, leading to a slight rise in body weight. Forbes (20) has documented that the maintenance of a normal body composition is dependent upon physical exercise, gravity, and muscular innervation. Increasing physical activity can delay the decrease in lean body mass that comes with normal aging. Homeless persons living in the streets and crowded shelters may have limited opportunities and motivation to change their physical activities to prevent the accelerated decline of muscle mass. Although persons living in the street may move about periodically, the lifestyle is sedentary as reflected by the prevalence of peripheral vascular disease secondary to chronic dependency of the lower extremities.

In sum, when compared with normal population

values, the homeless persons in our study had decreased levels of lean body mass and increased levels of body fat. The abnormalities may be a reflection of sedentary lifestyle and dietary excesses. Furthermore, shortages of essential nutrients in the diet were prevalent. These factors may place these persons in a state of subclinical malnutrition and contribute to the development or aggravation of chronic disorders (17,21). There is growing clinical and laboratory evidence to suggest that malnutrition is associated with increased susceptibility to infection and certain chronic medical conditions (22-24).

The population in this study was skewed heavily towards persons with chronic diseases because it was drawn from people seeking medical outreach services. However, there is a large reservoir of disease among the homeless population (4) and this sample is not necessarily unrepresentative. Many homeless persons require special diet prescriptions which are not being addressed by the facilities sampled. The sample was also skewed toward homeless persons with high functional statuses, as all involved were able to make contact with the medical team. Thus it would be expected that those sampled might be among the most capable and motivated to maintain good nutrition.

Most nutrient intake deficiencies could be met by incorporating fresh fruit and vegetables into the diet. A more economical approach would be to provide a multivitamin and mineral preparation with the RDA for each nutrient. It is of interest that 39 percent of the study participants used vitamin supplements, but mostly extraneous megadoses of vitamin C and E.

The key lies in educating persons to select healthful foods, for even those eating at sites providing three balanced meals daily had poor individual dietary intake scores. A cooperative approach among the patient, the health care system, and the services in shelters can create dietary modifications so that essential nutrients are supplied, and salt, cholesterol, and saturated fat intake is limited.

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The Reporting of Race and Ethnicity in the National Notifiable Diseases Surveillance System

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Synopsis

The authors used 1987 data from the Epidemiologic Surveillance Project (ESP) of the Centers for Disease Control to examine the completeness of race-ethnicity reporting in the National Notifiable Diseases Surveillance System. And, to the extent possible, they used ESP to assess racial and ethnic disparities in the occurrence of selected notifiable infectious diseases. For the 30 reporting areas (29 States and the District of Columbia) that provided data to ESP for all of calendar year 1987, approximately 60 percent of case reports were accompanied by specified race-ethnicity for affected persons. This percentage varied widely by disease and State.

In general, non-Hispanic whites had morbidity rates (cases per 100,000 population per year) that were among the lowest compared with rates for other groups, and Native Americans commonly had rates that were among the highest. The ranking of morbidity rates among blacks, Hispanics, and Asians and Pacific Islanders varied by disease,