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Nutrient Intake in Heart Failure Patients

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Abstract

Background and Research Objective—Approximately 50% of heart failure (HF) patients are thought to be malnourished, and macronutrient and micronutrient deficiencies may potentially aggravate HF symptoms. Thus, concerns have been raised about the overall nutrient composition of diets in HF populations. The purpose of this study was to examine the macronutrient and micronutrient intake by caloric adequacy among community-dwelling adults with HF.

Participants and Methods—A secondary analysis of baseline data of participants in an HF lifestyle intervention study was conducted. Participants (n = 45) were predominantly male (55.6%), white, and non-Hispanic (64.4%); had a mean age of 61 years (SD, 11 years) and mean body mass index of 31.2 kg/m^2 (SD, 7.3 kg/m^2); were of New York Heart Association functional classes II and III (77.8%); and had a mean ejection fraction of 31.9% (SD,13.2%); and 69% had a college or higher level of education. The Block Food Habits Questionnaire was used to assess the intake of macronutrients and micronutrients. Analysis included descriptive statistics and Mann-Whitney *U* tests.

Results and Conclusions—Individuals reporting inadequate daily caloric intake reported a lower intake of macronutrients and micronutrients as well as other differences in dietary patterns compared with individuals reporting adequate daily caloric intake. More than half of the individuals reporting adequate caloric intake did not meet the recommended dietary allowance for magnesium and vitamin E. Interventions aimed at increasing overall intake and nutrient density are suggested. Further research is needed to better understand the relationship between dietary factors and outcomes in HF.

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Keywords

heart failure; macronutrient; micronutrient; sodium intake

Heart failure (HF) is a leading cause of death, disability, and hospital admission in the United States, and approximately half of hospitalized and community-dwelling patients with HF are thought to be malnourished.[1–3] Dietary intervention in HF care has traditionally been focused on sodium reduction alone; however, recent concerns have been raised about the overall dietary composition in HF populations. Nutrient deficiencies, which may play a role in HF progression, occur as a result of reduced overall intake, increased loss of key nutrients induced by diuretic therapy, and altered gastrointestinal absorption. In addition, HF symptoms such as fatigue may be exacerbated by poor nutrition.[4]

The purpose of this study was to examine the macronutrient and micronutrient adequacy of self-selected diets of HF patients. Baseline dietary data were collected before intervention as part of a pilot evaluation of a family partnership intervention to improve patient adherence to diet, medications, and physical activity.[5]

Background

Nutritional adequacy was investigated in 57 stable, nonobese, community-dwelling HF patients, and findings included an inadequate intake of calories and protein with reduced available energy for daily activities. [1] Among the reasons cited for inadequate intake were digestive disturbances, such as early satiety, and altered macronutrient ingestion related to eating fewer meals in a day.[1] More recently, Lennie and colleagues[6] examined appetite/hunger, emotional-social, and illness factors that influence food intake in community-dwelling HF adults. Dietary restrictions, lack of hunger, early satiety, and limited energy were identified as adversely affecting food intake. Dietary restrictions combined with age-related changes in taste and smell may contribute to a limited variety of foods consumed, thus affecting nutritional adequacy.[6] Gut edema leading to malabsorption of fat and fat-soluble vitamins and inefficient cellular absorption may also contribute to nutritional inadequacy.[7] Inadequate nutrients are not unique to persons with HF, as Gorelik and colleagues[8] found no significant differences between HF patients and a comparison group of chronically ill hospitalized patients without HF. Comorbidities of the 2 groups were similar, and they were matched for age and body mass index (BMI). All participants were deficient in magnesium, calcium, zinc, copper, manganese, riboflavin, and folic acid.[8] Reasons associated with inadequate intake may be modifiable and, if addressed, may improve the overall nutritional status of HF patients.

Other researchers assert that malnutrition in HF is due to metabolic impairment of cardiac and skeletal muscle rather than inadequate intake because muscle wasting is not reversed with high-protein and high-calorie diets.[7,9,10] Sole and Jeejeebhoy[9] cited altered cellular demands for thiamine, l-carnitine, creatine, and taurine, among other nutrient factors in HF, and questioned whether recommended dietary allowances (RDAs) of key nutrients are adequate for people with HF because RDAs are intended for healthy populations.[9] Supplementation of key nutrients using evidence-based dose-response trials to determine appropriate doses of key nutrients in the elderly has been suggested.11 Regardless of whether altered intake or metabolism is responsible, people with chronic disease and/or increased age may require more tailored nutrition than does the general population to ensure proper nutrients for cellular repair and metabolism. In HF, emphasis on low-sodium intake may be done with little consideration of other necessary nutrients.

HF Pharmacology and Nutrient Loss

Serum potassium, magnesium, and thiamine are often reduced with non–potassium-sparing diuretic use.12 Although not documented in human studies, increased sodium appetite and subsequent activation of the renin-angiotensin-aldersterone system have been related to non–potassium-sparing diuretic dose in animal studies.13,14 Angiotensin-converting enzymes (ACEs) inhibition may correct for hyponatremia and thereby decrease sodium appetite; however, it may also be associated with anorexia in HF.15–17

Magnesium is absorbed from the small intestine and excreted by the kidneys. Magnesium loss increases with loop and thiazide diuretic use. Deficiencies in magnesium, a cofactor needed for energy metabolism, may increase symptoms of fatigue.4 In addition, low magnesium has been associated with ventricular ectopy and a worse HF prognosis.18

Other Nutrients to Consider

While sodium reduction is important, other nutrients may merit more clinical attention. Thiamine, for example, is lost with the use of furosemide, a loop diuretic.19,20 As many as 30% of hospitalized HF patients are thiamine-deficient.21 Although thiamine supplementation has been shown to improve both left ventricular ejection fraction and symptoms in HF patients, few patients receive dietary assessment to determine if supplemental thiamine is needed.4,20,22 Life-threatening dysrhythmias are linked to deficits of common dietary nutrients, such as potassium, calcium, and magnesium, which are reduced by diuretic use.18,23

Elevated homocysteine levels are associated with HF severity, and this relationship is stronger in HF patients without coronary artery disease, suggesting that homocysteine has direct effects on the myocardium. 24 Folate, vitamin B_6, and vitamin B_{12} are needed for homocysteine metabolism, and deficiencies in these may result in elevated homocysteine. Homocysteine levels increase with age, which may be due in part to poor intake of folate and vitamins B_6 and B_{12}.24 The American Heart Association suggests that a healthy diet contains sufficient folic acid and vitamins B_6 and B_{12} to metabolize homocysteine until further vitamin supplementation studies are done.25 Anemia, highly prevalent in HF patients, is associated with an increased risk of death. Anemia may be multifactoral and may be explained by impaired renal function; iron, folate, and vitamin B_{12} deficiencies; dilutional anemia; or the anemia of chronic diseases.26 Few studies have examined the effects of micronutrient supplements in HF.27 However, long-term, multiple-micronutrient supplementation has been shown to improve left ventricular volume and left ventricular ejection fraction in elderly HF patients.27

Body Mass Index

The effects of obesity in HF are unclear: elevated BMI may increase the risk of developing HF28; however, some evidence suggests a protective effect of increased BMI once HF has developed.29 In studies examining obesity in HF, important variables such as severity of illness and malnutrition, as indicated by serum albumin levels less than 3.0 g/dL and/or less than 90% of the ideal body weight, or loss of skeletal muscle mass have not been considered. Low serum albumin levels are predictive of all-cause mortality and linked to increased pulmonary artery wedge pressures.30–32 Body fat reserves may remain the same because they do not provide the same metabolites as striated muscles, namely, essential amino acids for protein synthesis or energy.33 Thus, striated muscles may be preferentially metabolized in malnourished states. Preserved body fat gives the clinical appearance of being well nourished, but muscle wasting may already be in progress.

Existing evidence suggests that many HF patients may have inadequate diets; however, few studies have examined the dietary intake of a wide array of macronutrients and micronutrients in community-dwelling HF adults.1,3,8 Thus, a greater understanding of the composition of self-selected diets is required to provide direction for further research, education, and counseling.

Methods

A descriptive, correlational secondary analysis was conducted on diet composition of HF patients participating in a HF family education intervention study. Data were collected at baseline before intervention. Community-dwelling HF patients (n = 45) were recruited from 3 teaching hospitals. Inclusion criteria for the original study were diagnosis of HF, *International Classification of Diseases, Ninth Revision, Clinical Modification* codes 428 inclusive; spouse or adult family member considered to be the primary caregiver willing to participate; aged 35 to 79 years; able to read, write, and speak English; on medication regimen that included ACE inhibitors and diuretic consistent with current treatment guidelines; and no contraindications to low-sodium diet, 2-L fluid restriction, or exercise as indicated by the primary care physician. Participants were excluded from the original study if they were classified as New York Heart Association (NYHA) class IV; had an acute myocardial infarction 6 months before enrollment; hemodynamically significant angina pectoris, cor pulmonale, end-stage renal failure; or HF secondary to a medical condition (eg, hyperthyroidism); planned cardiac surgery; were receiving care from a psychiatrist or home healthcare at the time of the study; did not have a telephone; and/or were undergoing cardiac transplant evaluation. From the original study (N = 62), a subset of 45 records with complete baseline Block Food Habits Questionnaire (BFHQ)34 was reviewed for this secondary analysis.

Diet Composition

The BFHQ was used to assess intake of total calories, macronutrients, vitamins, and minerals.34 The BFHQ is a 130-item detailed dietary habits instrument measuring the type and quantity of foods and supplements.34 The questionnaire has been validated through correlation with reference data consisting of multiple 4-day food records collected over 1 year from participants randomly assigned to either a usual diet or low-fat diet (n = 277).[35] These records were collected close to the time of eating and therefore were considered highly reliable. Between the 2 methods of dietary intake assessment, correlations between the BFHQ and 4-day food records generally ranged from 0.50 to 0.60 with an average correlation of 0.55 except for vitamin A (usual diet group = 0.47, and low-fat diet group = 0.37) and percent of calories from fat (usual diet group = 0.67, and low-fat diet group = 0.65).[35] The instrument, in various versions, is widely used and validated in epidemiologic research.[36,37] Limitations of the BFHQ, such as eating on a special occasion or changes in eating habits due to short-term illness, are minimized when group rather than individual data are used, which was the case with this analysis.[34]

The BFHQ was completed by participants and reviewed with a clinical dietitian at baseline assessment. The BFHQ was analyzed for total caloric intake, total fat, saturated fat, trans-fat, omega-3 fatty acids, cholesterol, carbohydrate, and protein. Micronutrients measured include thiamine (B_1); riboflavin (B_2); pyridoxine (B_6); niacin (B_3); cobalamin (B_{12}); vitamins A, C, D, and E; folate; calcium; sodium; iron; magnesium; potassium; zinc; and phosphorus.

Analysis

Dietary caloric adequacy was determined by comparing the daily caloric intake estimated by the BHFQ to the energy requirement predicted by the Harris- Benedict equation,[38] which takes sex, age, height, weight, and activity into account. The BFHQ data were compared to RDA or adequate intake (AI) standards. Recommended dietary allowances are set to meet the needs of almost all individuals, a particular life stage, or gender group. Adequate intake is used when an RDA cannot be determined, and is believed to cover the needs of almost all individuals in a group. Participants were assumed to be inactive for the calculation of the daily caloric requirement. The Mann-Whitney *U* test was used to identify significant differences between the macronutrient and micronutrient composition and dietary patterns of individuals reporting inadequate compared with adequate caloric intake.

Results

Description of the Sample

Of the 45 participants, 56% were male; the mean age was 61 years (SD, 11 years); 64.4% were white and non-Hispanic; 77.8% were categorized as NYHA classes II and III; 69% had a college education or higher; the mean BMI was 31.2 kg/m^2 (SD, 7.3 kg/m^2); and the mean ejection fraction was 31.9% (SD, 13.2%). All participants were on ACE inhibitors and diuretics, and 65% were on β-blockers. Most participants were married (76%) and had a spouse as a coparticipant. Eleven percent lived alone. Forty-four percent were diagnosed with HF within 18 months before enrolling in the study. The remaining 56% had been diagnosed more than 18 months before enrolling, with a third of these participants having been diagnosed for 4 or more years. Less than half (45%) of the sample took vitamin supplements.

Of the 45 participants, 13 (28.9%) reported a daily caloric intake equal to or greater than their estimated energy requirement. Of these, 7 women and 6 men reported a mean caloric intake of 2,358.78 kcal/d (SD, 533.13 kcal/d). There were no significant differences on demographic and clinical variables between the individuals reporting inadequate compared with adequate caloric intake (Table 1). Thirty-two individuals reported an inadequate daily caloric intake. Of these, more than one-third reported daily intake of a vitamin (Table 1).

Individuals reporting inadequate intake reported significantly lower intakes of total fat, saturated fat, protein, carbohydrates, and dietary fiber than those of individuals reporting adequate daily caloric intake. In addition, individuals reporting inadequate daily caloric intake reported significantly lower intakes of micronutrients (iron, magnesium, phosphorus, potassium, selenium, sodium, vitamins B_1, B_2, B_6, B_9, B_{12}, and vitamin E) than those of individuals reporting adequate daily caloric intake (Table 2). Individuals with inadequate daily caloric intake reported different dietary patterns from individuals with adequate daily caloric intake; for instance, they consumed fewer servings of bread, cereal, rice, and pasta, as well as fewer servings of meat, fish, poultry, beans, and eggs per day (Table 3).

Using RDA or AI standards for age and sex (Table 4), all (100%) participants reporting adequate caloric intake met the requirements for carbohydrates, protein, phosphorus, and vitamins A, B_2, and B_3, with most of these individuals meeting the requirements for iron, zinc, selenium, and vitamins B_1, B_6, B_9, and B_{12}; less than half meeting the requirements for vitamin E; a third meeting the requirements for magnesium; and only 15% meeting the calcium requirement. Of these individuals, the majority reported taking a vitamin (Table 1).

Discussion

Most participants reported inadequate caloric intake and a significantly lower caloric, macronutrient, and micronutrient intake compared with individuals reporting adequate daily caloric intake. These findings are consistent with other studies that found community-dwelling HF patients reported inadequate intake.[1,8] Inadequate intake may be due to illness-related factors including dietary restrictions, lack of hunger, early satiety, and limited energy to purchase and prepare food.[6] This was an older sample, and age-related changes in taste and smell may have contributed to a lack of hunger and limited variety of food choices.[6]

Dietary patterns also differed between the 2 groups: Those with inadequate daily caloric intake reported significantly fewer servings of foods from most major food groups. These foods represent important sources of calories, protein, and carbohydrates and identify areas for increasing consumption to rectify inadequate caloric intakes. Although individuals with inadequate daily caloric intake had sodium intake near the recommended level, overall dietary patterns were poor. One explanation may be that, in trying to adhere to the sodium-restricted diet and/or lose weight (both groups had BMIs indicative of obesity), patients may use ineffective self-management strategies.

Comprehensive assessment of the multiple factors that may contribute to inadequate caloric intake is needed to develop interventions to minimize the effect of these factors.[39] Interventions aimed at increasing the intake of protein, carbohydrates, and nutrient-dense foods are needed among individuals who may have an inadequate daily caloric intake. Economically sensitive recommendations may be required for elders with HF on a fixed income. Heart failure patients should be encouraged to discuss their dietary intake with their primary care provider who can provide individualized recommendations in the context of their medication regimens, comorbidities, and overall nutritional status. With only 37.5% of HF patients reporting inadequate intake taking a multivitamin daily, multivitamin use may be an underutilized strategy for improving micronutrient intake.

In addition to teaching HF patients about sodium restrictions, healthcare professionals need to educate patients about consuming a well-balanced diet. Recommendations for HF patients to consume an additional 3 to 7 kcal/kg of energy and at least 1 g/kg of protein per day may be of particular importance. [39] Patients, particularly those who are overweight, may benefit from referral to a dietician to help them achieve the balance between adequate caloric and nutrient intake, as weight gain is not desirable.

An interesting paradox was noted: Individuals reporting an inadequate daily intake also reported sodium intake (mean sodium intake = 2,067.1 mg [SD, 940.3]) that was more adherent with sodium restriction guidelines than that in individuals reporting an adequate daily intake (mean sodium intake = 3,067.7 mg [SD, 927.9 mg]). Although this may be partially due to underreporting all food intake and/or high-sodium foods, it indicates the need for more research on the effects that sodium-restricted diets have on overall nutrition.

Among those few individuals with adequate caloric intake, most reported an intake of calcium, magnesium, and vitamin E less than the RDA/AI, which is consistent with the findings from other studies. Dietary modifications to increase calcium should focus on increasing the daily intake of low-sodium, low-fat milk products and green leafy vegetables such as spinach, turnip greens, broccoli, beet greens, and bok choy. Dietary modifications to increase magnesium should focus on increasing legumes, nuts, dark green leafy vegetables, and whole grains. Dietary modifications to increase vitamin E intake should focus on limited intake of healthy oils such as safflower and sunflower oils. Other sources of vitamin E include sweet potatoes and almonds.[40]

Limitations

Estimates of macronutrient and micronutrient intake were based on self-reported information about dietary patterns, and participants may have overestimated or underestimated their actual intake. In addition, these analyses are limited to dietary intake and do not include vitamin supplements. Vitamin supplements may be useful, and additional studies are needed to better understand the associations among supplement use, dietary intake, and health outcomes.[41] Secondary analyses are limited to information available in the database, thus limiting the generalizability of study findings. For example, incorporation of physical activity measures would provide a more comprehensive nutritional assessment. The small sample in this study limits the generalizability. The participants in this study were well-educated older HF adults, and the findings can be generalized only to older HF adults with similar educational levels. Additional studies are warranted in more diverse age and socioeconomic groups.

Implications for Clinical Practice

These data suggest that routine dietary assessment in HF patients is important to provide individualized diet teaching and counseling. Healthcare providers need to consider the mixed messages about diet that patients may receive and to conduct appropriate clinical laboratory assessments to accurately determine nutritional status.

Because HF patients have a higher energy expenditure, individuals at risk for caloric inadequacy may need to increase their protein and caloric intake, which should be considered in the context of the individual's age, sex, activity level, and BMI. For example, a 150-lb adult with HF may need 68 g of protein per day and additional 210 to 490 kcal/d. Sources of protein include lean cuts of beef, fish, and poultry as well as vegetable sources including beans, nuts, and whole grains.40 By encouraging fruit and vegetable consumption, nurses can help patients make choices that will improve the nutrient density of their patients' diet. Nutritional counseling may be appropriate for HF patients with comorbidities or those who may have difficulty adhering to a low-sodium diet.

Conclusions

Individuals with HF may have overall poor dietary intake. Individual dietary assessment of caloric and nutrient intake adequacy in addition to dietary sodium compliance is warranted. Interventions aimed at increasing nutrient density in the context of adequate calories are suggested. Most HF dietary education focuses on sodium reduction; however, the need for more comprehensive nutrition counseling should be explored. Further research is needed to better understand the relationship between dietary factors and outcomes in HF.

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Table 1

Demographic Variables by Inadequate and Adequate Daily Caloric Intake

	Adequate Intake n = 13	**Inadequate Intake n = 32**	***P***
Sex, %			.419
Male	46.2	59.4	
Female	53.8	40.6	
Age, mean (SD), y	59.2 (9.1)	62.2 (12.3)	.259
College degree or higher, %	23.1	46.9	.696
Race, %			.344
White, non-Hispanic	53.8	68.8	
Black, non-Hispanic	46.2	31.3	
NYHA class, %			.443
I	15.4	25.0	
II	61.5	40.6	
III	23.1	34.4	
BMI, mean (SD), kg/m^2	32.8 (8.2)	30.7 (7.2)	.582
Ejection fraction, mean (SD), %	29.0 (13.4)	33.07 (13.12)	.276
Took multivitamin, %	61.5	37.5	.332

Abbreviations: BMI, body mass index; NYHA, New York Heart Association.

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Table 2

Differences in Nutrient Intake by Adequate Compared With Inadequate Caloric Intake

Nutrient	Adequate Intake Mean (SD) n = 13	Inadequate Intake Mean (SD) n = 32	Mann-Whitney *U*	*z* Score	*p*
Total calories, kcal	2,358.8 (533.1)	1,442.9 (504.4)	43.0	−4.132	.000
Total fat, g	90.3 (34.1)	55.9 (26.9)	84.0	−3.105	.002
Saturated fat, g	23.1 (8.5)	15.7 (7.8)	97.5	−2.767	.006
Protein, g	83.4 (25.1)	54.3(22.8)	80.0	−3.205	.001
Carbohydrate, g	314.6 (64.5)	186.3 (66.4)	36.0	−4.307	.000
Cholesterol, mg	237.0 (99.5)	191.7 (133.7)	146.0	−1.553	.121
Total fiber, g	22.9 (8.7)	16.0 (9.2)	102.0	−2.655	.008
Calcium, mg	828.9 (379.9)	618.9 (293.8)	140.0	−1.703	.089
Iron, mg	17.5 (7.5)	11.5 (4.9)	96.5	−2.793	.005
Magnesium, mg	363.8 (98.4)	243.5 (95.5)	73.0	−3.381	.001
Phosphorus, mg	1,417.4 (438.8)	940.6 (382.1)	89.0	−2.980	.003
Potassium, mg	3,670.7 (781.7)	2,455.4 (881.1)	59.5	−3.719	.000
Selenium, µg	113.1 (36.2)	77.8 (39.7)	102.0	−2.654	.008
Sodium, mg	3,067.7 (927.9)	2,067.1 (940.3)	91.0	−2.930	.003
Zinc, mg	14.7 (9.2)	9.9 (6.2)	136.5	−1.791	.073
Vitamin A, IU	10,057.7 (4,830.8)	11,002.4 (7,703.1)	200.0	−0.20	.841
Thiamine, mg	1.88 (0.69)	1.16 (0.44)	64.5	−3.606	.000
Riboflavin, mg	1.99 (0.81)	1.43 (0.59)	119.5	−2.224	.026
Niacin, mg	26.4 (9.3)	15.3 (6.5)	61.5	−3.669	.000
Vitamin B_6, mg	2.3 (0.9)	1.5 (0.6)	74.0	−3.364	.001
Folate, µg	491.3 (224.9)	330.1 (117.3)	111.0	−2.429	.015
Vitamin B_{12}, µg	5.1 (3.2)	3.4 (1.9)	141.5	−1.665	.096
Vitamin C, mg	160.8 (87.1)	126.0 (69.6)	157.0	−1.277	.202
Vitamin D, IU	158.1 (118.1)	131.4 (89.3)	179.0	−0.726	.468
Vitamin E, aTE	14.0 (7.3)	8.7 (3.5)	118.5	−2.242	.025

Abbreviations: aTE, alpha-tocopherol equivalents; IU, international units.

Actual means and SDs are provided to facilitate interpretation.

Table 3

Meal Patterns by Adequate and Inadequate Caloric Intake

Meal Patterns (No. of Servings)	Adequate Intake Mean (SD) n = 13	Inadequate Intake Mean (SD) n = 32	Mann Whitney *U*	*z* Score	*P*
Vegetables	4.2 (1.6)	3.3 (2.1)	144.5	−1.591	.112
Bread, cereal, rice, and pasta	6.4 (2.9)	3.8 (1.8)	95.5	−2.819	.005
Milk, protein, yogurt, and cheese	1.1 (0.9)	1.0 (0.8)	207.5	−0.013	.990
Meat, fish, beans, and eggs	2.6 (1.1)	1.7 (1.1)	111.5	−2.419	.016
Fruits and fruit juices	1.9 (1.1)	1.6 (1.2)	167.5	−1.016	.310
Fat, oil, and sweet intake	3.7 (2.3)	2.7 (1.3)	158.0	−1.253	.210

Actual means and SDs are provided to facilitate interpretation.

Table 4

Individuals With Adequate Caloric Intake by Recommended Dietary Allowance (RDA/AI)

Nutrient	Met RDA/AI n (%)	Did Not Meet RDA/AI n (%)
Carbohydrates, g	13 (100.0)	0 (0)
Protein, g	13 (100.0)	0 (0)
Calcium, mg	2 (15.4)	11 (84.6)
Iron, mg	11 (84.6)	2 (15.4)
Magnesium, mg	5 (38.5)	8 (61.5)
Phosphorus, mg	13 (100.0)	0 (0.0)
Selenium, μg	12 (92.3)	1 (7.7)
Zinc, mg	10 (76.9)	3 (23.1)
Vitamin A, IU	13 (100.0)	0 (0.0)
Thiamine, mg	12 (92.3)	1 (7.7)
Riboflavin, mg	13 (100.0)	0 (0.0)
Niacin, mg	13 (100.0)	0 (0.0)
Vitamin B_6, mg	11 (84.6)	2 (15.4)
Vitamin B_9, μg	8 (61.5)	5 (38.5)
Vitamin B_{12}, μg	11 (84.6)	2 (15.4)
Vitamin C, mg	11 (84.6)	2 (15.4)
Vitamin E, aTE	6 (46.2)	7 (53.8)

Abbreviations: aTE, alpha-tocopherol equivalents; IU, international units.