Inadequate Nutrient Intakes Are Common and Are Associated with Low Diet Variety in Rural, Community-Dwelling Elderly

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ABSTRACT Poor dietary habits and inadequate nutrient intakes are of concern in the elderly. The nutritional characteristics of those who survive to become the oldest are not well defined. Our goal was to describe dietary habits, nutrient intakes and nutritional risk of community-dwelling, rural Iowans, 79 y of age and older. Subjects were interviewed (n = 420) using a standardized format on one occasion in their homes and instructed to complete 3-d diet records (n = 261) after the in-home interview. Standardized interviews assessed demographic information, cognitive function and dietary habits (Nutrition Screening Initiative Checklist). Adequate nutrient intake was defined as consumption of the nutrient’s estimated average requirement, 67% adequate intake or 67% recommended dietary allowance. Mean age was 85.2 y, 57% lived alone and 58% were widowed. Subjects completing 3-d diet records were younger, more cognitively intact and less likely to be at nutritional risk than subjects not completing diet records. The percentage of subjects with inadequate intakes of selected nutrients was 75% for folate, 83% for vitamin D and 63% for calcium. Eighty percent of subjects reported inadequate intakes of four or more nutrients. Diet variety was positively associated with the number of nutrients consumed at adequate intakes (r = 0.498), total energy (r = 0.522) and dietary fiber (r = 0.421). Our results suggest that rural, community-dwelling old have inadequate intakes of several nutrients. Recommendations to increase diet variety and consume a nutrient supplement may be necessary for elderly people to achieve adequate nutrient intakes. J. Nutr. 131: 2192–2196, 2001.

KEY WORDS: • elderly • diet • dietary supplements • nutrition assessment • diet variety

Dietary habits, nutrient intakes and aging processes are interrelated and are of particular importance among the elderly (1,2). Poor or marginal nutritional status is linked to increased morbidity and mortality in community-dwelling and hospitalized elderly (3–5). Low body mass indices and inadequate energy intakes are associated with functional decline and elder failure to thrive (6,7). Deficiencies of energy and individual nutrients are associated with decreased cognition with vitamin B-12 deficiency being particularly problematic in the elderly (8–10). Inadequate dietary intakes of energy, folate, vitamin D, vitamin B-6, calcium and zinc have been reported in community-dwelling elderly over 60 y old (11–14). Although effects of poor dietary habits have been and continue to be investigated, nutrition-related characteristics of those who survive to become the old (75 y and older) (15) have not been well defined.

Because nutrition can have a pronounced effect in the elderly, an indicator of diet quality is highly desirable. The Healthy Eating Index and Diet Quality Index measure diet quality based on food group consumption, intake of nutrients associated with chronic disease or diet variety (16,17). However, the appropriateness of diet restrictions in older people is questionable (18–20). The elderly remain at risk for chronic disease, but dietary limitations imposed by meeting disease-specific restrictions may compromise total nutrient intake. Measures of diet variety are based on the assumption that nutrient intake increases with diet variety and may be a more appropriate indicator of diet quality in this population. Krebs-Smith et al. (21) reported that variety among and within major food groups was associated with diet quality assessed by the mean adequacy ratio of 11 nutrients. Diet variety was greater in older adults (60–75 y) than in younger adults (20–30 y) but was not related to diet quality in a study by Drewnowski et al. (22).

The Nutrition Screening Initiative (NSI)3 was developed by interdisciplinary aging specialists with input from the American Dietetic Association to promote screening, education and care of the elderly and to identify risk factors and indicators of malnutrition in the elderly (23,24). Usefulness of the NSI Checklist has been evaluated with subjects over 60 y old; results from these studies suggest that although individual components may identify subjects at risk, the overall tool may be of limited value (25–29).

We assessed the dietary habits and nutrient intakes of an

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elderly population participating in an oral health study designed to assess dental disease and oral soft tissue lesions. The purpose of this study was to describe the nutrient intakes, dietary variety and nutritional risk of community-dwelling, rural Iowans, 79 y of age and older and subsequently explore associations between the NSI Checklist components, diet quality and diet variety.

**SUBJECTS AND METHODS**

Subjects. Subjects were surviving members of the Iowa 65 + Rural Health Study (IRHS), which included 84% of residents of two Iowa counties 65 y of age and older in 1982 (n = 3673) (30). IRHS subjects were recruited for the Iowa Oral Lesion Detection Study (OLDs) to investigate the prevalence of oral soft tissue lesions in this population (31). We identified 745 members of the original IRHS cohort; 269 subjects declined to participate. Interviews and oral health examinations were conducted between 1996 and 1998 with 449 cohort members. Only community-dwelling individuals (n = 420) were included in the study. Standardized interviews and questionnaires were completed by all 420 subjects and 261 subjects returned diet records. This study was approved by the Institutional Review Board at the University of Iowa.

Data collection. Using a cross-sectional design, subjects were interviewed and dental exams were completed by dental examiners in their homes. Standardized interviews assessed self-perceived oral health, dental utilization, tobacco and alcohol use, intellectual function (Short Portable Mental Status Questionnaire) (32), medication use and dietary habits. Dietary habit questions were modified from the NSI Checklist (23). In an effort to minimize response burden, NSI Checklist questions were consolidated with similar questions from other forms (e.g., medications were counted rather than using the NSI Checklist item “I take three or more different prescribed or over-the-counter drugs a day”). Current disease status was not ascertained; therefore, a proxy question for the NSI Checklist item “I have an illness or condition that made me change the kind and/or amount of food I eat” was not available. Summary scores reported herein were calculated from the other nine NSI Checklist components. Standard NSI Checklist scoring criteria were used; subjects with an illness or condition altering food choices may have been misclassified and their nutrition risk underestimated.

Dental examiners distributed and provided both written and oral guidelines for completing 3-d diet records. Subjects were requested to record all foods using household measures and brand names, the time of consumption and nutritional supplements as consumed, and were provided a written example. Subjects (n = 35) with exenuating circumstances (e.g., refusal to accept questionnaire, significant confusion, interview burden) were not provided 3-d diet records.

Diet analysis. A registered dietitian reviewed diet records for completeness. Subjects returning blank, incomplete or illegible records (n = 41) were excluded from diet analysis. Thus, diet nonresponders included subjects who did not return records and subjects whose records were not useable. Diet responders are defined as subjects who returned complete legible records. Subjects were not considered to respond if the record and assigned foods to the appropriate food item and group. The total Dietary Variety Score (DVS) was defined as the total number of food items consumed during the 3-d period. The number of food items per major food group was also determined.

Statistical analysis. Data were analyzed using SAS, Version 8 (SAS, Cary, NC) (37). Subject characteristics, NSI responses, diet quality and DVS were reported as means and SD when numerical values and percentages when categorical values. Nutrient intakes were reported as medians (25th and 75th percentiles). Differences between means were evaluated using t test or analysis of variance with Tukey’s post-hoc analysis. Differences between categorical distributions were evaluated using χ² analysis or Fisher’s exact test. A P value of <0.05 was considered statistically significant.

**RESULTS**

Subjects were Caucasian and 79 y of age or older. Diet responders were slightly younger and had higher scores of cognitive function than nonresponders. Diet responders and nonresponders did not differ by gender, living status, marital status or current weight (Table 1).

Subject responses to the modified NSI Checklist component and summary scores are shown in Table 2. Diet responders did not differ from nonresponders on individual NSI Checklist components, but the distribution of NSI Checklist summary scores differed between diet responders and nonresponders.

**TABLE 1**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Diet responders (n = 220)</th>
<th>Diet nonresponders (n = 200)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age,12 y</td>
<td></td>
<td></td>
</tr>
<tr>
<td>M2</td>
<td>83.8 ± 3.8</td>
<td>85.4 ± 4.0</td>
</tr>
<tr>
<td>F</td>
<td>85.1 ± 3.9</td>
<td>86.1 ± 4.0</td>
</tr>
<tr>
<td>Sex, %</td>
<td></td>
<td></td>
</tr>
<tr>
<td>M</td>
<td>33</td>
<td>32</td>
</tr>
<tr>
<td>F</td>
<td>67</td>
<td>68</td>
</tr>
<tr>
<td>Living status, %</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alone</td>
<td>54</td>
<td>62</td>
</tr>
<tr>
<td>With spouse</td>
<td>38</td>
<td>34</td>
</tr>
<tr>
<td>With other</td>
<td>8</td>
<td>5</td>
</tr>
<tr>
<td>Marital status, %</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Married</td>
<td>39</td>
<td>36</td>
</tr>
<tr>
<td>Widowed</td>
<td>58</td>
<td>57</td>
</tr>
<tr>
<td>Other3</td>
<td>4</td>
<td>6</td>
</tr>
<tr>
<td>Intellectual functioning,2 %</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intact</td>
<td>96</td>
<td>86</td>
</tr>
<tr>
<td>Mild impairment</td>
<td>2</td>
<td>8</td>
</tr>
<tr>
<td>Moderate impairment</td>
<td>2</td>
<td>8</td>
</tr>
<tr>
<td>Weight,1 kg</td>
<td></td>
<td></td>
</tr>
<tr>
<td>M</td>
<td>68.5 ± 13.6</td>
<td>68.5 ± 15.1</td>
</tr>
<tr>
<td>F</td>
<td>78.3 ± 13.9</td>
<td>78.3 ± 13.9</td>
</tr>
<tr>
<td>Diet responders are significantly different from diet nonresponders; P &lt; 0.05.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1 Data are means ± SD.
2 Diet responders are significantly different from diet nonresponders; P < 0.05.
3 Separated, divorced, never married.
sponders with a higher proportion of nonresponders identified at risk. Twenty-two of 420 total subjects reported compliance with minimal servings from the Food Guide Pyramid; diet respondents did not differ from nonresponders.

Males consumed more total energy than females [6775 (5710,8055) kJ] vs. 6140 (5075,6900) kJ; P < 0.05], but less energy per unit body weight [89 (68,106) kJ vs. 97 (78,123) kJ]; P < 0.05]. Carbohydrate intake was greater for males than for females [210 (185,252) g vs. 197 (164,240) g; P < 0.05], but intakes of protein [60 (50,70) g vs. 54 (45,66) g], fat [57 (43,76) g vs. 51 (40,65) g] and fiber [16 (13,22) g vs. 15 (12,19) g] did not differ between genders. Cholesterol intake was low [158 (114,241) mg] and alcohol intake was minimal (12,19) g] did not differ between genders. Cholesterol intake was low [158 (114,241) mg] and alcohol intake was minimal (12,19) g] did not differ between genders. Cholesterol intake was low [158 (114,241) mg] and alcohol intake was minimal (12,19) g] did not differ between genders. Cholesterol intake was low [158 (114,241) mg] and alcohol intake was minimal (12,19) g] did not differ between genders. Cholesterol intake was low [158 (114,241) mg] and alcohol intake was minimal (12,19) g] did not differ between genders. Cholesterol intake was low [158 (114,241) mg] and alcohol intake was minimal (12,19) g] did not differ between genders. Cholesterol intake was low [158 (114,241) mg] and alcohol intake was minimal (12,19) g] did not differ between genders. Cholesterol intake was low [158 (114,241) mg] and alcohol intake was minimal (12,19) g] did not differ between genders. Cholesterol intake was low [158 (114,241) mg] and alcohol intake was minimal (12,19) g] did not differ between genders. Cholesterol intake was low [158 (114,241) mg] and alcohol intake was minimal (12,19) g] did not differ between genders. Cholesterol intake was low [158 (114,241) mg] and alcohol intake was minimal (12,19) g] did not differ between genders. Cholesterol intake was low [158 (114,241) mg] and alcohol intake was minimal (12,19) g] did not differ between genders.

Twenty percent of subjects reported consumption of nutrient supplements on 3-d diet records; 11% consumed multivitamins with minerals, 2% consumed multivitamins and 7% consumed single, multiple or combination supplements (e.g., vitamin C, calcium with vitamin D, antioxidants).

Median (25th, 75th) vitamin and mineral intakes from food and percentage of subjects consuming adequate nutrient intakes from food and supplements are shown in Table 3. Median (25th, 75th) intakes from supplements were 0 (0, 0) for all nutrients. Supplement use increased the number of subjects consuming adequate intakes of folate, vitamin D and vitamin E (data not shown; P < 0.05).

Less than 20% of subjects (n = 41) consumed adequate levels of 16 or more of 19 nutrients (Table 4). Supplement use significantly increased the number of nutrients consumed at adequate levels; however, 34% of subjects (n = 76) still had inadequate intakes of 13 or more nutrients. The number of nutrients consumed at adequate levels did not differ by gender.

The distribution of component and total DVS are presented in Table 5. The total DVS was correlated with the number of nutrients consumed at adequate levels from food sources (r = 0.498; P < 0.05), total energy (r = 0.522; P < 0.05), energy per kg of body weight (r = 0.362; P < 0.05), and dietary fiber (r = 0.421; P < 0.05). Associations between total DVS and both number of nutrients consumed at adequate levels from food sources and fiber remained after adjustment for total energy (data not shown; P < 0.05). Neither the total DVS nor the number of nutrients consumed at adequate levels was associated with the NSI Checklist summary score.

### DISCUSSION

In this study, we described the nutritional risk and dietary intakes of rural, community-dwelling old. This sample is

### Table 2

<table>
<thead>
<tr>
<th>Checklist item</th>
<th>Diet respondents (n = 220)</th>
<th>Diet nonrespondents (n = 200)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;2 meals/d</td>
<td>8</td>
<td>14</td>
</tr>
<tr>
<td>Few fruits, vegetables, milk</td>
<td>67</td>
<td>73</td>
</tr>
<tr>
<td>3+ alcohol/d</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Tooth or mouth problems</td>
<td>18</td>
<td>21</td>
</tr>
<tr>
<td>Inadequate money</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Eating alone</td>
<td>4</td>
<td>32</td>
</tr>
<tr>
<td>3+ medications</td>
<td>53</td>
<td>61</td>
</tr>
<tr>
<td>Weight gain/loss per 6 mo</td>
<td>9</td>
<td>10</td>
</tr>
<tr>
<td>Barrier to shop/cook/feed</td>
<td>21</td>
<td>30</td>
</tr>
</tbody>
</table>

Score 2 (P < 0.05).

### Table 3

<table>
<thead>
<tr>
<th>Nutrient</th>
<th>Intake from foods</th>
<th>Criteria for adequate intake</th>
<th>Respondents with adequate intake, %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Protein, g</td>
<td>57 (46, 67)</td>
<td>42</td>
<td>34</td>
</tr>
<tr>
<td>Thiamin, mg</td>
<td>1.4 (1.1, 1.7)</td>
<td>1.0</td>
<td>0.9</td>
</tr>
<tr>
<td>Riboflavin, mg</td>
<td>1.5 (1.3, 2.0)</td>
<td>1.1</td>
<td>0.9</td>
</tr>
<tr>
<td>Nicin, mg NE</td>
<td>16 (14, 20)</td>
<td>12</td>
<td>11</td>
</tr>
<tr>
<td>Folate, µg DFE</td>
<td>210 (163, 275)</td>
<td>320</td>
<td>320</td>
</tr>
<tr>
<td>Pantothenic acid, mg</td>
<td>3.8 (3.1, 4.6)</td>
<td>3.4</td>
<td>3.4</td>
</tr>
<tr>
<td>Vitamin B-6, mg</td>
<td>1.5 (1.2, 2.0)</td>
<td>1.4</td>
<td>1.3</td>
</tr>
<tr>
<td>Vitamin B-12, mg</td>
<td>3.1 (2.1, 4.3)</td>
<td>2.0</td>
<td>2.0</td>
</tr>
<tr>
<td>Vitamin C, mg</td>
<td>93 (62, 134)</td>
<td>75</td>
<td>60</td>
</tr>
<tr>
<td>Vitamin A, µg RE</td>
<td>933 (649, 1492)</td>
<td>750</td>
<td>500</td>
</tr>
<tr>
<td>Vitamin D, µg</td>
<td>5 (3, 7)</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>Vitamin E, mg α-TE</td>
<td>6 (5, 8)</td>
<td>12</td>
<td>12</td>
</tr>
<tr>
<td>Calcium, mg</td>
<td>643 (448, 863)</td>
<td>804</td>
<td>804</td>
</tr>
<tr>
<td>Phosphorous, mg</td>
<td>908 (739, 1181)</td>
<td>580</td>
<td>580</td>
</tr>
<tr>
<td>Magnesium, mg</td>
<td>232 (191, 276)</td>
<td>350</td>
<td>265</td>
</tr>
<tr>
<td>Iron, mg</td>
<td>11.5 (9.3, 15.8)</td>
<td>6.0</td>
<td>5.0</td>
</tr>
<tr>
<td>Zinc, mg</td>
<td>8.4 (6.3, 10.6)</td>
<td>9.4</td>
<td>6.8</td>
</tr>
<tr>
<td>Selenium, µg</td>
<td>83 (67, 100)</td>
<td>45</td>
<td>45</td>
</tr>
<tr>
<td>Copper, µg</td>
<td>998 (795, 1207)</td>
<td>700</td>
<td>700</td>
</tr>
</tbody>
</table>

### Table 4

<table>
<thead>
<tr>
<th>Intake label</th>
<th>Foods (n = 200)</th>
<th>Foods with supplements (n = 200)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>%</td>
<td></td>
</tr>
<tr>
<td>Ideal (19)</td>
<td>1</td>
<td>7</td>
</tr>
<tr>
<td>Marginal (16–18)</td>
<td>18</td>
<td>22</td>
</tr>
<tr>
<td>Limited (13–15)</td>
<td>39</td>
<td>36</td>
</tr>
<tr>
<td>Inferior (&gt;13)</td>
<td>43</td>
<td>35</td>
</tr>
</tbody>
</table>

1. Significantly different from “foods” only.
2. Number of nutrients consumed at an adequate intake level.
unique; subjects are surviving members of a 1980–1981 pop-
ulation cohort, which included all individuals aged 65 y or
older in two rural counties. Survivors may be representative of
rural Midwest, community-dwelling elderly people; however,
results may not be applicable to elderly residing in urban
communities or other geographical locations.

Diet responders were younger and more likely to be cogni-
tively intact than nonresponders. Cognitive limitations may
have impaired nonresponders’ ability to complete the 3-d diet
records. Current weights, weight gain and weight loss did not
differ between responders and nonresponders, suggesting that
nonresponders had access to sufficient quantities of food.

NSI Checklist components did not differ by responder
status; however, nonresponders were more likely to be at
nutritional risk based on the NSI Checklist summary score.
Higher cognitive impairments exhibited by nonresponders
may have interfered with their ability to respond accurately to
the NSI Checklist. However, these data are consistent with the
findings of Ortega et al. (38) who reported individuals with
lower cognitive function had lower intakes of total food,
vegetables, fruits and the nutrients folate, vitamin C, β-caro-
tene, iron and zinc than cognitively intact individuals.

Our results suggest that rural, community-dwelling old con-
sume inadequate levels of several key nutrients. Although use
of EAR or >67% AI/RDA may underestimate the number of
subjects with inadequate intakes, subjects not meeting these
criteria are likely to have inadequate intakes of clinical im-
portance. Furthermore, the EAR, RDA and AI are established
for healthy people. The health of our subjects is not known;
however, our respondents were free of acute debilitating ill-
ness. Medication use suggests the presence of chronic disease
that may increase nutrient requirements. Specifically, >60%
of subjects did not meet their estimated needs for folate,
vitamin D, vitamin E, calcium or magnesium and >25% of
subjects did not meet their estimated needs for vitamin B-6,
vitamin C or zinc. Our data are consistent with findings
reported in other studies of community-dwelling younger old
people (11–14).

Supplement use allowed a small number of subjects to have
adequate nutrient intakes. However, a substantial number of
subjects who might have benefited from supplement use did
not consume them. Other investigators have reported that
individuals with nutrient dense diets consume supplements,
while those with marginal diets may not consume or choose
appropriate supplements for their diets (39,40). Intakes of
calcium, vitamin D and folate, which are linked to bone and
cardiovascular health, were low in this sample of elderly sub-
jects, despite public health messages promoting intake of these
nutrients (41,42).

The positive association between adequate nutrient intakes
and greater diet variety in this study agrees with studies of
younger adults (21,43). The Dietary Guidelines for Americans
2000 emphasize the need to select a diet varied in whole
grains, fruits and vegetables to improve fiber intake, limit fat
intake and obtain nutrients concentrated in different fruits
and vegetables (44). Of potential concern, consuming a
greater variety of energy dense foods has been associated with
increased energy intake at meals in both rats and humans and
with increased body fat in humans, which may contribute to
obesity and related chronic diseases (45–47). As expected,
intake of a greater variety of vegetables was inversely associ-
ated with body fat (47). An association between dietary vari-
ety and excessive energy intake in elderly people is unlikely,
because many of them have limited energy intakes (6,7,11,13).

Our results suggest that the current Dietary Guidelines for
Americans 2000 (44), the Food Guide Pyramid (48) and other
programs that promote a varied diet are appropriate guidance
for the elderly to achieve adequate nutrient intakes.

One objective of the NSI is to identify individuals whose
nutritional status is at risk. In this study, nutritional risk
defined by the NSI Checklist was not associated with nutrient
adequacy or variety of foods consumed. Our categorization of
risk is made without the NSI Checklist component diet-
associated disease, which may result in misclassification of
individuals from a higher risk to a lower risk category. Also,
the NSI is designed to identify risks due to a variety of medical,
psychosocial or environmental factors, which may not affect
current food intake. Previous studies support the hypothesis
that the NSI Checklist is more appropriate for education and
awareness than for identification of at-risk elderly people (25–
28).

Limitations of this study include the cross-sectional nature
of data collection, difficulties inherent in dietary data collec-
tion and the unique nature of the sample studied. Cross-
sectional studies allow for associations to be identified, but not
for identification of causal relationships. Furthermore, our
subjects are the survivors; we do not have dietary data on
IRHS participants who did not survive or chose not to par-
ticipate. Genetic and environmental factors may have allowed
these individuals to survive in a relatively healthy condition;
diet may or may not be related to their survival. Although
current diet may be consistent with early diet, we cannot make
assumptions regarding diet and longevity from this study. Our
assessment of diet simply reflects our best measure of what
rural, community-dwelling older people are currently eating.
A subset of original IRHS cohort members who chose not to
participate in the OLDS study did not differ from OLDS
participants in either age or gender distribution (49). How-
ever, it is conceivable that nonparticipating original IRHS
cohort members had poorer cognitive and nutritional statuses
than OLDS participants, which would both underestimate the
true risk of this group and limit the generalizability of our data.

All data were self-reported. Diet respondents may have
changed dietary habits in response to the process of recording
their diet. In addition, actual intakes may differ from recorded
intakes due to declines in eating, memory deficits, subtle
cognitive deficits or fine motor difficulties compromising the
recording process.

Although results of our study may not be directly applicable
to the old living in urban, coastal or southern regions, they are
consistent with results described by others in younger old
people. In summary, our population of older Iowans consumed
inadequate intakes of several nutrients. Recommendations to

### Table 5: Diet variety scores of diet responders

<table>
<thead>
<tr>
<th>Food group description</th>
<th>Score1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beverages (14)2</td>
<td>2.6 ± 1.1 (0–6)</td>
</tr>
<tr>
<td>Breakfast foods (12)</td>
<td>2.6 ± 1.3 (0–6)</td>
</tr>
<tr>
<td>Fruits (10)</td>
<td>3.0 ± 1.3 (0–6)</td>
</tr>
<tr>
<td>Vegetables (22)</td>
<td>4.7 ± 1.8 (0–10)</td>
</tr>
<tr>
<td>Meats, soup, pasta (23)</td>
<td>3.4 ± 1.3 (0–8)</td>
</tr>
<tr>
<td>Breads, snacks, spreads (12)</td>
<td>3.0 ± 1.2 (0–6)</td>
</tr>
<tr>
<td>Sweets (7)</td>
<td>2.5 ± 1.1 (0–5)</td>
</tr>
<tr>
<td>Restaurant foods (6)</td>
<td>0.0 ± 0.1 (0–1)</td>
</tr>
<tr>
<td>Total diet variety score (106)</td>
<td>21.8 ± 4.3 (10–32)</td>
</tr>
</tbody>
</table>

1 Data are means ± SD (ranges).
2 Number of food types within food group.
consume a variety of foods from all food groups are appropriate to improve or maintain nutrient intakes from foods. Multivitamin/mineral supplementation with additional calcium may be necessary for the old to achieve adequate nutrient intakes.

LITERATURE CITED