An Audit of Meal Provision in an Elderly Care Hospital

C. R. HANKEY and H. A. WYNNE
Royal Victoria Infirmary, Newcastle upon Tyne NE1 4LP, UK

Objectives: To estimate the nutritional provision to elderly patients, to compare with United Kingdom (UK) Government dietary reference values (DRV), to modify food provision to correct any major deficiencies, and to evaluate these modifications for their acceptability and consumption.

Methods: Energy, principal macro nutrients, vitamins, minerals and non-starch polysaccharide (NSP) and dietary fibre provision were measured prospectively throughout the menu cycle in a 72-bedded hospital for patients over 65 years before and after dietary supplementation with both energy-rich foods and high-fibre cakes.

Results: At baseline, mean energy provision was 1472(320) kcal, 6153(1340) kJ, representing less than the estimated average requirement (EAR) for elderly males and females. Fat provided 49% of total energy, dairy protein provision exceeded the EAR for males and females (16% energy) and provision of the micro nutrients thiamine, riboflavin, vitamins B12, C, A, calcium and iron met or exceeded these recommendations. Vitamin B6 provision was only adequate for females. Provision of niacin, folate, vitamin D, NSP and dietary fibre was also below recommendations. Supplementation allowed energy provision to reach the target EAR and fibre provision the reference nutrient intake.

Conclusions: Nutritional provision in hospital is meeting some, but not all, available Government standards for nutritional guidelines in elderly people. Increased fibre provision was poorly tolerated, but dietary supplementation with energy-rich foods was well tolerated. Copyright © 1996 Elsevier Science Ltd.

Key words: Hospital, patients, diet.

INTRODUCTION

Recent research has highlighted the problem of poor dietary intakes of elderly patients receiving continuing care in hospital [1], confirming the suspicion that undernutrition is prevalent in older adults and is associated with physical and mental disability and institutionalization [2-4]. Undernutrition increases risk of mortality and morbidity in patients admitted to both geriatric assessment wards with a range of diagnoses [5] and to hospital with specific conditions such as a fractured neck of femur [6]. Recovery from pathological conditions, such as pressure sores, is known to be inhibited by poor nutritional status [7]. However, the importance of establishing the extent to which undernutrition of the hospitalized elderly requires or responds to intervention is clear.

A range of national nutritional recommendations for the elderly exists, and has been recently reviewed [8]. This indicated few major differences between the various European and North American values, although distinction was made between the nutritional needs of independent free-living elderly and the frailer, hospitalized population. Concerns were expressed about the increased likelihood of clinical or subclinical nutritional deficiencies in the latter group.

It has been recognized that increased mortality and morbidity [9,10] are associated with undernutrition in elderly hospitalized patients, and can be reduced on supplementation [11].
Recent estimates suggest that patient food costs account for only around 1% of the costs of an overnight hospital stay [12]. Stringent economic considerations may lead to limitations in the nutritional content of hospital food. This will be cost ineffective if an impairment of patient rehabilitation and treatment response and an increased hospital stay results [12,13].

An audit of the total nutritional value of the food provision in a hospital for the elderly is essential to assess and ensure optimal food and nutritional provision [14]. Appropriate nutritional standards are the current dietary reference values [15] and the recommendations of the report on nutrition of elderly people [16].

The aim of this current audit was first to conduct an audit of food provided, second to compare the results of the audit with the recommended intakes for the elderly in the UK [15,16], third to modify the food provision to correct any major deficiencies, and fourth to evaluate these modifications for their acceptability in terms of their consumption in an elderly care hospital in northern England.

MATERIALS AND METHODS

This work was carried out at a 72-bedded elderly care hospital. Forty-six patients were receiving rehabilitation with a mean length of stay of eight weeks, 20 patients were receiving permanent care and 6 beds were used for patients receiving two-week periods of respite care. Functional state of the patients ranged from ambulatory and independent in activities of daily living to immobile and dependent on others for all such activities. Rehabilitation patients were receiving therapy to improve function, appropriate to their needs. Patients were not regularly exposed to direct sunlight. As is usual for National Health Service catering, contracts in the UK are awarded after detailed costing for the service has been agreed. In this unit, food provision operated as a four-week rotational menu cycle with three meals daily. Meals were plated on site in the unit kitchen using standardized portion controls. These were maintained by the use of standard cooking and serving utensils. Standard portion sizes were rechecked for the purposes of the audit by the author (CH) reweighing a selection of plated meals and comparing the weights with the standard values. Little variation was noticed [17]. For certain foods of recognized weights, standard portion sizes were used. Between-meal snacks were provided only infrequently and hence excluded from this current analysis.

Nutrient provision was estimated using the "micro diet" dietary analysis system (Salford University, UK). This computerized database includes current UK food compositional data [18]. Eighty-four meal occasions were provided for over the four-week study period. These were breakfast, lunch and evening meal and represented 168 meals, as two choices were available. Each choice was nutritionally assessed separately, which resulted in two mean nutrient totals. Any combination of meals were available to patients. However, for the purposes of this audit the two mean daily nutrient provisions for the four-week rotational menu cycle were calculated, which represented a comparison of the choice of meals available. Option A included a traditional cooked menu selection at breakfast, lunch and evening meal. The other included a breakfast of cereal and toast, a traditional "meat and two vegetable" selection only at the lunch-time meal, and a soup and sandwiches choice for the evening meal. The meals described were those served to all 72 resident patients. No ethnic food requirements existed.

Dietary adequacy was assessed with respect to the current dietary reference values (DRVs) [15] for specific macronutrients and micronutrients. Dietary recommendations for men and women over 50 years of age were used when values for those aged 65–74 years and over 75 years were unavailable. Principal reference guidelines for comparison with the food provision are the estimated average requirement (EAR), the reference nutrient intake (RNI), and the lower reference nutrient intake (LRNI), the principal reference value within the DRV. The EAR has been defined as "the estimated average requirement for a group of people for energy, protein, vitamin or mineral, about half of whom will require more than the EAR, and half less" [15]. The RNI for a protein, vitamin or mineral is "the amount of a nutrient that is enough or more than enough, for about 97% of people in a group". If the average intake of a group is at RNI, then "the risk of deficiency in the group is very small". The LNRI, the amount of a nutrient that is enough only for those who have low
TABLE 1. The average daily energy and nutrient provision during each week of the four-week menu cycle. Option A comprises the traditional cooked meals; option B includes the snack options.

<table>
<thead>
<tr>
<th>Nutrient mean (SD)</th>
<th>Week 1 (kcal)</th>
<th>Week 2 (kcal)</th>
<th>Week 3 (kcal)</th>
<th>Week 4 (kcal)</th>
<th>RNI Male</th>
<th>RNI Female</th>
<th>EAR Male</th>
<th>EAR Female</th>
</tr>
</thead>
<tbody>
<tr>
<td>kcal</td>
<td>A 1674 (210)</td>
<td>1517 (369)</td>
<td>1429 (186)</td>
<td>1502 (340)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>B 1471 (209)</td>
<td>1347 (232)</td>
<td>1372 (161)</td>
<td>1464 (213)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Protein</td>
<td>A 69 (20)</td>
<td>63 (12)</td>
<td>55 (4)</td>
<td>56 (9)</td>
<td>2250</td>
<td>1910</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>B 58 (13)</td>
<td>55 (11)</td>
<td>58 (13)</td>
<td>57 (11)</td>
<td>53.3</td>
<td>46.5</td>
<td>42.6</td>
<td>37.2</td>
</tr>
<tr>
<td>Fat g</td>
<td>A 95 (18)</td>
<td>81 (11)</td>
<td>79 (11)</td>
<td>80 (12)</td>
<td>35% food</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>B 76 (18)</td>
<td>74 (23)</td>
<td>70 (14)</td>
<td>82 (12)</td>
<td>energy</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Carbohydrate g</td>
<td>A 145 (34)</td>
<td>143 (23)</td>
<td>133 (21)</td>
<td>149 (17)</td>
<td>50% food</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>B 148 (16)</td>
<td>123 (37)</td>
<td>136 (28)</td>
<td>133 (27)</td>
<td>energy</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Thiamine mg</td>
<td>A 0.9 (0.1)</td>
<td>0.7 (0.1)</td>
<td>1.0 (0.2)</td>
<td>0.8 (0.1)</td>
<td>0.3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>B 0.8 (0.1)</td>
<td>1.0 (0.3)</td>
<td>0.9 (0.1)</td>
<td>0.9 (0.1)</td>
<td>0.9</td>
<td>0.8</td>
<td>1000 kcal</td>
<td></td>
</tr>
<tr>
<td>Riboflavin mg</td>
<td>A 1.3 (0.4)</td>
<td>1.2 (0.2)</td>
<td>1.4 (0.4)</td>
<td>1.4 (0.6)</td>
<td>1.3</td>
<td>1.1</td>
<td>1.0</td>
<td>0.9</td>
</tr>
<tr>
<td></td>
<td>B 1.4 (0.6)</td>
<td>1.3 (0.2)</td>
<td>1.2 (0.2)</td>
<td>1.3 (0.2)</td>
<td>1.4</td>
<td>1.2</td>
<td>13 µg/g</td>
<td></td>
</tr>
<tr>
<td>Niacin mg</td>
<td>A 11.7 (2.1)</td>
<td>11.6 (3.9)</td>
<td>11.1 (2.0)</td>
<td>9.9 (2.7)</td>
<td>16</td>
<td>12</td>
<td>5.5/1000 kcal</td>
<td></td>
</tr>
<tr>
<td>Riboflavin µg</td>
<td>A 11.3 (2.1)</td>
<td>12.2 (3.3)</td>
<td>9.4 (3.7)</td>
<td>9.7 (1.7)</td>
<td>200</td>
<td>200</td>
<td>150</td>
<td>150</td>
</tr>
<tr>
<td>Vitamin B6 g</td>
<td>A 1.1 (0.2)</td>
<td>1.5 (1.1)</td>
<td>1.1 (0.2)</td>
<td>0.9 (0.1)</td>
<td>0.9</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vitamin B12 µg</td>
<td>A 2.6 (0.2)</td>
<td>3.2 (1.2)</td>
<td>3.3 (2.4)</td>
<td>6.1 (9.9)</td>
<td>25</td>
<td>20</td>
<td>25</td>
<td>25</td>
</tr>
<tr>
<td>Total folate</td>
<td>A 127 (35)</td>
<td>175 (70)</td>
<td>160 (77)</td>
<td>148 (28)</td>
<td>40</td>
<td>40</td>
<td>50</td>
<td>40</td>
</tr>
<tr>
<td>Vitamin C µg</td>
<td>A 52 (24)</td>
<td>33 (11)</td>
<td>43 (17)</td>
<td>39 (9)</td>
<td>50</td>
<td>50</td>
<td>50</td>
<td>50</td>
</tr>
<tr>
<td>mg</td>
<td>A 57 (17)</td>
<td>47 (17)</td>
<td>44 (13)</td>
<td>44 (13)</td>
<td>25</td>
<td>25</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Retinol µg</td>
<td>A 371 (109)</td>
<td>235 (169)</td>
<td>2277 (699)</td>
<td>1644 (374)</td>
<td>700</td>
<td>600</td>
<td>500</td>
<td>400</td>
</tr>
<tr>
<td>Carotene (retinol equiv.) µg</td>
<td>B 1562 (397)</td>
<td>272 (195)</td>
<td>394 (196)</td>
<td>336 (206)</td>
<td>700</td>
<td>600</td>
<td>500</td>
<td>400</td>
</tr>
<tr>
<td>Vitamin D µg</td>
<td>A 1.7 (1.1)</td>
<td>1.5 (1.2)</td>
<td>1.5 (0.8)</td>
<td>1.7 (0.7)</td>
<td>10 µg after age</td>
<td>65</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vitamin E µg</td>
<td>A 4.9 (1.6)</td>
<td>3.3 (1.5)</td>
<td>4.3 (1.4)</td>
<td>3.4 (0.9)</td>
<td>1.5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>mg</td>
<td>A 3.7 (0.9)</td>
<td>3.9 (0.9)</td>
<td>3.9 (1.4)</td>
<td>4.5 (0.9)</td>
<td>12</td>
<td>12</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Calcium µg</td>
<td>A 1032 (180)</td>
<td>884 (57)</td>
<td>914 (91)</td>
<td>897 (75)</td>
<td>700</td>
<td>700</td>
<td>525</td>
<td>525</td>
</tr>
<tr>
<td>mg</td>
<td>A 822 (202)</td>
<td>672 (170)</td>
<td>642 (170)</td>
<td>709 (231)</td>
<td>700</td>
<td>700</td>
<td>525</td>
<td>525</td>
</tr>
<tr>
<td>Iron g</td>
<td>A 9.7 (2.0)</td>
<td>9.5 (1.5)</td>
<td>9.2 (2.0)</td>
<td>9.4 (0.8)</td>
<td>8.7</td>
<td>8.7</td>
<td>6.7</td>
<td>6.7</td>
</tr>
<tr>
<td>NSP g</td>
<td>B 9.3 (2.4)</td>
<td>7.3 (1.3)</td>
<td>7.8 (1.2)</td>
<td>9.2 (1.1)</td>
<td>18</td>
<td>18</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dietary fibre g</td>
<td>A 18.5 (2.1)</td>
<td>16.4 (3.2)</td>
<td>20.0 (5.0)</td>
<td>19.2 (5.3)</td>
<td>18</td>
<td>18</td>
<td></td>
<td></td>
</tr>
<tr>
<td>g</td>
<td>B 17.6 (7.8)</td>
<td>11.4 (4.3)</td>
<td>16.6 (4.0)</td>
<td>14.7 (5.7)</td>
<td>1000 kcal</td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

The overall mean daily energy and nutrient provision in the hospital rotational menu are presented in Table 1, together with the reference nutrient intakes, where available, for adults over 50 years of age. No such values are available for adults over 75 years of age apart from energy requirements.

**Macro nutrients**

Mean energy provision was 1472 kcal (range 1347–1674 kcal). The total fat content of the monthly menu cycle accounted for 49% total energy (range 45–51%). Carbohydrate provided
a mean of 35% (range 32–38%) food energy. The dietary reference values suggest the population as a whole should aim at in excess of 50% dietary energy from carbohydrate, and less than 35% energy from fat, with no specific reference value for the older age group, although the Department of Health (DoH) report on nutrition of elderly people [16] suggests these values are appropriate. The overall daily protein provision was 59 g (range 55–69 g). This provision exceeded the EAR for males and females over 50 years of age by 38 and 58%, respectively, and the RNI, by 10 and 26%. Protein provided an overall mean of 16% total food energy (range 15–17%).

Vitamins and minerals

The mean daily provision of thiamine, riboflavin, niacin, folate, vitamin C, vitamin A (represented as the sum of retinol including carotene equivalents), vitamin D (cholecalciferol), vitamin E, calcium and iron, NSP and dietary fibre is shown in Table 1. Provision of thiamine, riboflavin, vitamin B\textsubscript{12}, vitamin C, vitamin A and iron met or exceeded these recommendations. The range of carotene and retinol provision was considerable due almost entirely to the presence or absence of liver on the menu and achieved all targets. Mean daily calcium provision exceeded the RNI and EAR by 15%, and extra provision occurred in milk-containing drinks.

Niacin provision was above the requirements of the RNI at 7.2 mg per 1000 kcal. Vitamin B\textsubscript{6} provision was at the RNI for females, but failed to achieve this for males by 13%. Folate provision was 21% under the RNI, but 6% above the EAR. Vitamin D provision was well below the recommendation of 10 \textmu g daily for those over 65 years of age and not receiving a minimum of 2 h sunlight daily. No current reference value exists for vitamin E. NSP provision was 24% below the general RNI of 18 g NSP, 44% below the general dietary fibre daily recommendation of 30 g for the adult population [19].

Supplementation

A variety of supplements, which would increase dietary energy provision to the EAR, were offered, and individual patient preference assessed. Maxijul, a glucose polymer (Scientific Hospital Supplies Ltd., Liverpool, UK) was mixed with patients’ food, to a maximum of 120 g or 500 kcal per patient per day. Where this was not tolerated Build Up (Nestle) a dry, flavoured powder mixed with milk, containing 325 kcal per serving, was offered twice per day. The majority of patients tolerated Build Up. Those who did not were offered alternative milk- or water-based supplemental drinks until a preference was found. Acceptability of these supplements was assessed by measuring consumption over the supplementation period.

Supplementation allowed energy provision to reach the target EAR, though in practice energy consumption was 200 kcal per patient per day below the EAR [20].

Dietary fibre/NSP provision was increased by the addition of 7 g fibre per day, 6 g NSP being routinely provided in cakes. These cakes were produced according to recipes from the Kellogg’s company, and included their breakfast cereals. The texture was soft, and some were spread with butter in an attempt to increase palatability. An earlier audit showed that only one quarter of this provision was actually consumed [21].

DISCUSSION

The recommended daily amounts of food energy and nutrients for the United Kingdom [22,16], and the dietary reference values [15] are statistical concepts relating to physiological requirements for health and well-being among population groups [23]. They are designed as guidelines and are appropriate for use by health professionals and food planners. They are intended to offer the hospitalized elderly a nutritional provision that allows maximum rehabilitation and treatment response [12]. In addition, the DoH report on nutrition in the elderly [16] provides some other specific recommendations. These include the encouragement of a variety of energy-dense foods and an adequate intake of vitamin C, especially for the institutionalized, and the routine assessment of nutritional status on admission of an elderly person to hospital.

Catering standards within the National Health Service have been established for a
considerable time, with particular attention being given to nutrients of which the elderly are at risk of deficiency, including iron and vitamins C and D [24]. The nutritional values calculated in our study are dependent on available estimates of nutrient composition published in current food tables [18], and subject to sampling differences [25]. Nutrient content is also affected by both cooking method and food-holding practice. In particular, the time that the food is held between cooking and serving can result in considerable nutrient losses [26]. Elements of catering practice such as warm holding of foods, plate waste, inappropriate eating utensils, unfamiliar or disliked foods and insufficient time for meals are thought to affect the nutritional quality of food provision [27]. The effects of these factors on lowering heat-labile nutrients and reducing dietary intake are well recognized, with the effect of lowering intakes of some nutrients. Our estimates do, however, represent the most accurate analysis available for use within this type of investigation, and the issues discussed by Fenton et al. [27] had been raised with hospital staff in terms of catering and nursing practice.

This study suggests that energy provision is inadequate when dietary reference values designed for a fit elderly group are used. Many of the elderly patients in hospital situations are less active [16], and requirements will differ, although exact standards are unavailable. It is likely that immobile patients will have a greater provision than required, though actual nutritional intakes may be lower than by fitter patients. As provision does not equate with intake, sub-nutrition may occur even when dietary provision is adequate. Banerjee et al. [28], found that patients offered supplemental drinks reduced their intake of fat and carbohydrate from food. In our study supplements were generally well tolerated, but though they increased energy provision to the EAR, intake remained below this value [20]. Energy intake in an institutionalized elderly population has been reported to average only 6.2 MJ (1500 kcal) daily [3]. This, and our study showed adequate protein consumption compatible with the trend described for the United Kingdom of an increase in those aged 50–64 [29]. Some studies suggest that this may be beneficial in continuing-care elderly, particularly those with pressure ulcers [30]. The DoH report [16] suggests that the elderly who consume inadequate total energy are at risk of body protein loss when requirement is increased by illness, including sepsis.

The menu content of vitamins of the B group—thiamine, riboflavin, niacin and B<sub>6</sub>—achieve recommendations, and therefore individuals consuming food produced according to these menus would be unlikely to be at risk [15]. However, thiamine intakes are known to be closely related to energy intakes [28], and thus continuing-care elderly, who are at risk of low-energy intakes, may be susceptible to thiamine deficiency [1]. Riboflavin content of our menus was adequate, in contrast to a previous report [31]. Vitamin B<sub>12</sub> provision met recommendations. As Vitamin B<sub>12</sub> is stored copiously in the liver, impaired absorption requires some years to develop a clinically significant deficiency.

Total folate provided within the menus was adequate, exceeding the EAR. However folate is of limited stability and easily destroyed on cooking and during holding periods before food service [26,27]. Low erythrocyte folate levels have been reported in hospitalized elderly [1,32,33], due both to poor variety in the diet and overcooking of food [16]. Within the current menu provision it is feasible to increase total folate provision by a range of options. Apart from orange juice, rich sources of folate include most commercially produced cereals. The regular use of meat or yeast extract in meat or stew preparations is also of value. Re-evaluating the type of protein foods offered within the menu provision offers a more complicated method of increasing total folate provision [34].

Vitamin C is well known to be lost on cooking and storing of cooked food. Thus, although menu provision appeared adequate, this may not reflect the meals' content of vitamin C. Food holding has been shown to lower the vitamin C content of cooked meals delivered to community-dwelling elderly people, which may retain only 10% of their original vitamin C on serving [22]. In turn those dependent on institutional catering are also at risk, with effects on iron absorption and status [1]. The value of supplementing institutionalized elderly with vitamin C to improve their rate of wound and pressure sore healing has been reported [35]. The use of fresh orange juice, in individual sealed containers, or fresh fruit, would resolve the vitamin C provi-
sion deficiencies, although cost, practicality and acceptability have yet to be evaluated. Adequate vitamin A provision, as retinol equivalents, is in accordance with the results of the dietary and nutritional survey of British adults [29].

The low provision of vitamin D, recognized to be a problem in institutional catering [1], is reflected in this study. The risks of deficiency in hospitalized elderly, are well known [1,36,37]. Increased provision of foods rich in vitamin D, such as vitamin D-enriched margarine, oily fish, cheese and liver would achieve requirements [34]. Optimal quantity and suitability of these foods within the unit menus requires assessing for patient acceptability as important health and cost benefits of vitamin D supplementation have been reported [38]. Davies [39] reports the practicality of manufacturers enriching custard powder with vitamin D, the vitamin showing acceptable stability within a food-holding situation. Vitamin E recommendations are without a specific dietary reference value [40]. Multivitamin preparations can be beneficial [41], but were not used here as the majority of required vitamins and nutrients were provided with the Build Up supplement. Reduced gastric availability of iron may be problematic in this population with poor iron provision and intake [16]. The DoH [15] suggests a dietary intake of calcium of more than 500 mg daily in elderly people, although much recent work suggests that intakes of over 1 g are required to reduce loss of bone mass [42] and prevent hip and other fractures [38]. The DoH figure was well exceeded in the provision, both for the individual weeks and for the overall mean in these hospital menus. The limiting factor for effective calcium utilization may, however, be in the low provision of sunlight and of dietary vitamin D with its direct influence on calcium uptake [43]. NSP and dietary fibre provision was inadequate, a deficit that is known to contribute to the high prevalence of constipation in this population [44,45]. Although we were able to increase the fibre provision to approach the EAR, actual intake changed only marginally, highlighting the importance of both provision and intake in determining ultimate nutrition of this elderly population.

The provision of two menu choices is valuable. The option B comprising snacks differed little from option A in terms of nutritional value. However, the snack foods were more bulky, and less energy dense. Although snack meals extend choice, the more traditional meal with the greater energy density may be of more benefit in safeguarding nutritional status of the institutionalized elderly patient.

The audit process has suggested that these menus achieve the majority of current dietary guidelines. Lipski et al. [1], using the same patient group, conclude that "elderly long stay patients were grossly undernourished, and their dietary intake did not satisfy basal metabolic demands based on available recommendations." Our studies highlight the potential difference between provision and intake, demonstrating that adequate nutritional intake is less easy to achieve than adequate provision in this population. Any specific menu changes to provide the Government recommendations must therefore be assessed for patient and staff acceptability to ensure that such changes result in improved nutritional intake.

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