Consumption of oral hospital diets and percent adequacy of minerals in oncology patients as an indicative for the use of oral supplements

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1. Introduction

Oncology patients are frequently victims of malnutrition, a situation which corroborates with a greater incidence of morbidity-mortality, in addition to an increase in hospital expenditure. However, although the role of the nutritional state of the patients in the prognosis of diseases has been recognized, there are still no specific nutritional recommendations for the patients. Thus the nutritional recommendations for healthy individuals have been used to plan and evaluate the diets. The adequate consumption of food and nutrients by hospital patients can be favored by adaptations to the diet, resulting in an improvement in the nutritional status of the patient, causing reductions in the time and costs of the internment. The nutritional adequacy of a patient can be evaluated from his food consumption, and subsequently an action plan established to attend the deficiencies found. The use of oral nutritional supplements stands out amongst the most adopted methods to achieve nutritional adequacy for hospital patients. However, there is a total lack of information about the ingestion of mineral nutrients and the nutritional status of hospital patients, these nutrients having been shown to be essential in the prevention and treatment of cancer. Thus considering the recommendations of the Institute of Medicine (IOM) for the ingestion of minerals, the content, consumption and percent adequacy of the
minerals (Ca, Cu, Fe, Mg, Mn, K, P, Na, Zn and Se) was evaluated amongst oncology patients who received oral diets (regular, bland and soft) isolated or associated with an oral food complement (OFC), evaluating the need and mineral composition of an oral supplement for these patients.

2. Methodology

2.1. Samples

Regular, bland and soft diets were studied isolated or associated with an oral food complement (OFC), formulated from whole bovine milk with cereals, fruits and powdered milk. The diets consisted of 6 meals: breakfast, morning snack, lunch, afternoon snack, dinner and bedtime snack, all produced by the Food and Nutrition Unit of an Oncology Hospital in Belo Horizonte, MG, Brazil (Appendix 1). After collecting the meals, each was weighed, homogenized in a food multiprocessor with a plastic helix and 50 g samples transferred to duly identified zip-lock plastic bags and frozen at −18 °C until analyzed. A total of 120 samples of the diets were taken in two non-consecutive weeks in the months of May and September, 2010 and January 2011, including all the meals of the regular, bland and soft diets as well as the OFC on the 6 investigation days.

2.1.1. Determination of the minerals (Ca, Cu, Fe, Mn, K, Na, Zn and Se)

After digesting the samples, the minerals in the diet samples were determined in duplicate according to the methodology described by Moreira et al. (2012). Following digestion and dilution of the samples, the minerals were determined using induced coupled plasma optical emission spectrometry (ICP OES). The technical suitability of ICP OES for determination of all mineral concentrations was considered appropriate for this study, given that all values exceeded the limit of detection (LOD) and the limit of quantification (LOQ).

2.1.2. Instrumentation

The mineral elements were quantified using a model Vista MPX ICP OES (VARIAN, Mulgrave, Australia) equipped with a 40 MHz radio frequency source, CCD (Charge Coupled Device) type solid state simultaneous multi-element detector, peristaltic pump and a sea spray nebulizer coupled to the nebulizer chamber. The ICP Expert software was used and 99.996% pure liquid argon (Air Liquid, SP, Brazil) as the plasma gas. The following ICP OES operating conditions were used: power of 1000 W; nebulizer rate of 0.9 L/min; liquid argon and auxiliary gas rates of 15 and 1.5 L/min; integration and reading times of 10 and 3 s; number of replicates, 3. The wavelengths used were: Ca, 317.933 nm; Cu, 324.754 nm; Fe, 259.940 nm; K, 766.491 nm; Mg, 279.553 nm; Mn, 257.610; Na, 589.592 nm; P, 213.618 nm; Zn, 206.200 nm and Se, 196.026.

2.1.3. Quality guarantee of the results

The methodologies used were validated for the parameters of precision and exactness using certified reference material (CRM) of the diet for the mineral elements studied in this work. The CRM used was the Typical Diet (1548a) obtained from the National Institute of Standards and Technology (NIST).

2.2. Casuistry

The food consumption and percent adequacy of the minerals Ca, Fe, P, Na, K, Mg, Mn, Zn, Cu and Se were examined in hospital oncology patients who received regular, bland or soft oral diets isolated or
associated with an OFC. The diet consumption was analyzed from the difference in weight between the amount offered and the leftovers.

Patients whose prescription diet was altered or suspended or who were released from hospital during the data collection days (Fig. 1) were not included in the study. The participants in the study were not communicated about the research to avoid food consumption errors. The research was evaluated and approved by the Ethics in Research Committee of the Mario Penna Foundation (CAE 00010.261238-11).

The distribution and collection of the meals and OFC to the patients followed the hospital standard, including the time. After collecting the trays, the leftovers were separated and weighed individually on an electronic Pluris Top balance (Filizola S.A. Pesa
gem e Automação, São Paulo, SP, Brazil) with a capacity for 15 kg and sensitivity of 2 g. The total weight of the meals served, after deduction of the weight of the utensils and leftovers, allowed one to determine the food ingestion by the patients. These procedures were adopted on the same days as the collection of the diets submitted to chemical analysis.

The Estimated Average Requirements (EAR) or Adequate Intake (AI) values, and also the Tolerable Upper Intake Levels (UL) were used as the parameters to analyze the adequacy of mineral consumption by the patients. The mineral consumption was considered adequate when the values were situated between the EAR (or AI) and the Recommended Dietary Allowance (RDA), and inadequate when the values were situated between the EAR (or AI) and the UL.

The percent adequacy of the minerals in the regular, bland and soft diets, isolated or combined with an OFC, was calculated for elderly adults of both sexes. Adults were considered to be in-

3. Results

A total of 163 patients took part in the study, of which the majority (59.5%) were male, with mean ages of 59.1 ± 15.0 and 53.8 ± 13.6 for the male and female sexes, respectively. Less than half of the participants (47.8%) were 60 years old or older. The main reasons for their hospital admission were: surgery (50.9%), clinical intercurrence (35.6%), chemotherapy (12.9%) and radiotherapy (0.6%), the mean intertemporal time of the patients being 6.3 ± 1.2 days. The most frequent type of cancer was urological (25.2%), followed by the digestive (14.1%) and gynecological (10.4%) apparatuses. Skin cancer and Hodgkin’s lymphoma showed the smallest percentages of 3.7% and 4.9%, respectively.

Regarding the dietary prescriptions, 126 (77.3%) patients were on the regular diet, 27 (16.6%) bland diet and 10 (6.1%) soft diet. With respect to the food complement, 122 (74.8%) were not given

the OFC, but of those that did, 29 (23.0%) were on the regular diet, 8 (30.7%) on the bland diet and 4 (40.0%) on the soft diet.

The diet consumption percentages of the patients fed a diet or diet associated with OFC were 79.7% and 74.2% for the regular diet, 75.3 and 78.0% for the bland diet and 74.2 and 68.9% for the soft diet, respectively. The meals showing the greatest percentages of leftovers were lunch (regular = 65.7 and 57.7% vs. bland diet = 64.9 and 49.7% vs. soft diet = 61.2 and 30.7%) and dinner (regular = 62.8 and 60.3% vs. bland diet = 57.6 and 56.8% vs. soft diet = 39.9 and 27.4%), with the lower percentages being observed for the patients receiving the OFC, independent of the type of concomitant oral diet (Fig. 2A–C).

Amongst the patients on the regular diet with OFC, the greatest acceptance was found in the morning as compared to the afternoon (81.9% vs. 58.3%). The contrary was observed for the acceptance of the OFC for the patients on the bland and soft diets, where the highest acceptance of the OFC was found in the afternoon (bland 82.6% vs. 100% and soft = 84.7% vs. 96.8%) (Fig. 2A–C).

Table 1 shows the results for the analyses of the adequacy of mineral consumption according to the type of diet. The dietary consumption for the patients on the diets studied did not surpass the UL for the minerals investigated with the exception of Na, for which the consumption was not merely above the recommended level, but extrapolated the UL value in the regular, bland and soft diets (67.5, 77.8 and 30.0%, respectively). However, in the case of the soft diet, 5 (50.0%) of the patients showed Na ingestion below the AI. In parallel, an insufficient consumption of K was noted in relation to the recommended limit for 100% of the patients on the three diets studied.

In relation to Ca an association was observed between the type of diet and the level of consumption adequacy (p < 0.006), the consumption being below the recommended values for 96 (76.2%), 24 (88.9%) and 4 (40.0%) of the patients on the regular, bland and soft diets, respectively. An association was also found for the consumption adequacy of Fe amongst the diets (p < 0.027), all the patients on the soft diet showing adequate consumption of this mineral. Most of the patients showed insufficient consumption of Mg, and in the case of the patients on the soft diet, only 1 (10.0%) showed adequate consumption of this mineral (Table 1).

An association (p < 0.004) was found for Mn between the type of diet and the level of consumption adequacy, with only 2 (20.0%) of patients on the soft diet showing adequate consumption, whereas 95 (75.4%) and 17 (63.0%) of patients on the regular and bland diets, respectively, showed adequate consumption. The consumption of P and Se showed high percentages of adequacy for all the diets studied, although in the second case there were more patients on the regular and bland diets with consumption below the recommended limits (Table 1).

There was an association (p < 0.001) between the type of diet and the consumption adequacy of Zn, the majority of patients on the regular diet showing consumption below the recommended limit (87 patients – 69.0%), to the contrary of those on the soft diet, where 8 (80.0%) showed nutritionally adequate consumption of this mineral (Table 1).

An analysis of the consumption of minerals by patients on diets supplemented with OFC, represented by 41 (25.2%) of the patients taking part in the study, showed that the combination with OFC made no difference to the adequacy of consumption in the majority of cases, only making a difference in the case of Ca (p < 0.001), as can be seen in Table 2.

An estimate for the mineral composition of an oral supplement aimed at attending the mineral recommendations (RDA or AI) and respecting the respective UL value, was calculated from the data for the dietary ingestion by the patients studied who did not receive the OFC. The results showed the need for two complements with
distinct compositions, considering the differences between the profiles of the diets and also the respective nutritional support received by these patients (Table 3).

In the case of patients on the soft diet, although some showed consumption below the recommended levels, it was also shown that another part consumed Na at levels above the UL. Considering that the recommended value for Na is based on the AI, the mineral supplement proposed for patients on the soft diet did not include this mineral.

The prescription of an oral mineral supplement with the suggested chemical composition (Table 3) would make it possible for hospital patients to receive the minerals in safe amounts, compatible with the nutritional recommendations, supplanting the use of the current OFC and reducing the negative effect of food consumption by these patients.

4. Discussion

The mean internment time for the patients in this study (6.3 ± 1.2 days) was close to that found in a Spanish study with hematological patients of (7.0 ± 3.6 days). A study carried out in Brazil involving 25 hospitals, also showed that the mean internment time was higher amongst malnourished patients. On the other hand, Stanga et al. (2003) found a negative correlation between internment time and satisfaction of the patients with the diet offered.

Hospital patient acceptance of the diet is fundamental to attend the nutritional needs of the patient and contribute to his recovery. Nevertheless, studies on food wastage in hospitals in Switzerland and Australia indicated that 25–30% of the food offered to patients was not consumed, values surpassing the wastage reported for other types of catering service. The deficit in food ingestion by the patients in the present study resulted in a reduced amount of nutrients being consumed, including that of the minerals, with the exception of Na (Table 1).

The reasons for the low consumption of oral hospital diets include the clinical condition of the patient, the flavor, variety, presentation mode, odor, texture, portioning, meal times, interruptions and even the atmosphere of the ward. In addition, the inadequacy of the dietary prescriptions is also amongst the motives for the low consumption, since the diets aim to adapt the food to the physical and pathological conditions of the patients, including alterations in the consistency and preparation of the foods.

Dupertuis et al. (2003) analyzed the energetic and protein adequacies of hospital meals, and found that, despite the adequate offer of these items in the diets, the nutritional requirements of 57% of hospital patients were not attended, consuming a maximum of 75% of the energy carried by the diets, the lowest consumption being found for the patients on an oral diet with modified consistency.

A study carried out in Brazil reported a reduction in food ingestion in 50% of the patients, of which 25% had been prescribed oral diets with modified consistency. The percentage cited was similar to that found in the present study, where 23% of the prescriptions were for oral diets with modified consistency (soft diet), resulting in lower food ingestion by the patients who received them (Fig. 2A–C).

Researchers have reported that the oral diets with modified consistency, including soft diets, prescribed for dysphagic patients, carried Fe and Ca contents below the recommended values, to the
A survey carried out with a Tribal Nation in the northwest of the Pacific reported that the majority of the natives ingested mineral contents below the recommended values, but that a significant part of these individuals consumed Na at a level above the UL. In the present study, the elevated Na content of the diets at a level that also extrapolated the UL resulted in an excessive ingestion of this element.

The Na content of the diets can be reduced by using seasonings based on herbs, reducing the use of industrialized products and substituting the sodium chloride by potassium chloride. Considering that large amounts of K can be found in fresh fruits and vegetables, the menu, associated with the low food ingestion by participants, a percentage higher than that reported in hospitals in the patients, was involved in the ingestion of this mineral below the recommended value (Table 1).

On the other hand the formulation of the OFC included the use of fresh fruits, and the artisanal beverage was offered to 25.2% of the participants, a percentage higher than that reported in hospitals in the patients.

c) The Na content of the diets can be reduced by using seasonings based on herbs, reducing the use of industrialized products and substituting the sodium chloride by potassium chloride. Considering that large amounts of K can be found in fresh fruits and vegetables, the menu, associated with the low food ingestion by the patients, was involved in the ingestion of this mineral below the recommended value (Table 1).
the United Kingdom, where 14% of hospital patients receive the nutritional complement together with the prescribed diet, which is formulated considering the lack of appetite, bad food ingestion and weight loss of the patients.24

In the present study, the OFC, which is distinguished from the nutritional supplement by containing no added nutrient or specific dietetic substance, or any herbs or other botanical substance,25 was only prescribed for patients considered to have greater nutritional requirements. This scheme has been reported to improve acceptance by the patients.26

The patients who consumed the OFC showed an improvement in the Ca ingestion adequacy (Table 2), since the formulation contained cow’s milk. Moreover, in September (2010) and January (2011), Ca enriched protein modules were included in the OFC (Appendix 1). The use of the OFC did not significantly alter the adequacy of the other minerals, indicating that the formulation was below the nutritionally desirable amount. A Brazilian study compared the use of artisanal and industrialized oral supplements in the recovery of the nutritional status of oncology patients, and reported that the artisanal supplement presented about 25% less K, Cu, Mg and Fe than the industrialized supplement.27

In the present study the consumption was lower for lunch and dinner amongst the patients that received the OFC than amongst those who did not (Fig. 2A–C). The OFC being offered before the meals. Although the studies have not indicated a reduction in food ingestion due to the concomitant use of a nutritional supplement,28 it has been reported that nutritional supplements with a smaller volume and higher energy density were better accepted.29 Nevertheless, since the nutrients are minerals, the use of capsules could be a valid alternative, collaborating to avoid an error in the dietetic consumption of the patients.

There is disagreement with respect to the parameter to be used for the recommended amounts of nutrients for hospitalized patients.30–32 The use of the values recommended for healthy individuals can be interpreted as promoting health, contrary to the idea of specific recommendations for the sick based on distinct nutritional demands resulting from the pathology and nutritional status of the patient.29 However, considering there are no specific recommendations for oncology patients, the present study aimed for adequacy using the recommendations for healthy populations as the parameter.

A study evaluating the habitual dietary intake among patients with severe short bowel syndrome shows that multiple micronutrients the intakes in a large percentage of patients were below the Recommended Dietary Allowances (RDA): vitamin A (47%), vitamin D (79%), vitamin E (79%), vitamin K (63%), thiamine (42%), vitamin B6 (68%), vitamin B12 (11%), vitamin C (58%), folate (37%), iron (37%), calcium (63%), magnesium (79%) and zinc (68%).31 Even when considering the limitations intrinsic to a hospital unit, and to the number of days and patients involved, and also the severity of the disease among the patients studied, the results of this research indicated the need to pay more attention to the menus of the oral hospital diets, the composition of the OFS or nutritional supplement prescribed, and to accompany the dietetic consumption of the patients. A comparison of the results obtained also presents limitations due to the scarcity of studies evaluating the consumption of minerals by the sick. The majority of dietetic consumption surveys are restricted to energy and protein analyses,14 a lacuna still exists with respect to micronutrients consumption, including minerals and vitamins, supporting the need for more approaches such as the one presented in the present study.

Studies concerning the consumption of minerals by hospital oncology patients are necessary, to establish a relationship between intake values and organic levels, including the checking of the specific nutritional requirements, dealing not only with those on enteral and parenteral diets, but also those on oral hospital diets, who represent the great majority of hospital patients.

5. Conclusions

The percent consumption of regular and soft oral diets was influenced by the joint offer of an OFC. For the three diets, lunch and dinner resulted in the greatest percentages of leftovers and the highest acceptance scores were awarded by the patients who receive an OFC, independent of the type of oral diet. The consumption of an OFC only resulted in an improvement in the ingestion adequacy of Ca. The consumption of oral hospital diets, isolated or associated with an OFC, was shown to be inadequate, indicating the need to exclude the OFC currently in use and include a daily oral mineral supplement not containing P or Na, with the objective of making ingestion by the patients adequate with respect to the nutritional recommendations.

Statement of authors contributions

All authors participated in data collection and analysis; DCFM, KDQ, MAM participated in data interpretation and manuscript writing. All authors read and approved the final manuscript.

Conflict of interest statement

The authors declare that they have no conflict of interest.

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Appendix A. Supplementary data

Supplementary data related to this article can be found at http://dx.doi.org/10.1016/j.clnu.2013.09.005.

References


