Title: Vitamin/trace mineral supplements for the elderly

Issue: Advances in Nutrition, Vol. 3, No. 6, pp. 822-824, Nov. 2012

Author's name: Donald B. McCormick[1]

Author's affiliation: Department of Biochemistry and Program in Nutrition & Health Sciences, Emory University, Atlanta, GA, USA.

Corresponding author: D.B. McCormick, P.O. Box 81, Scaly Mt., NC 28775; Phone number 828-526-8297; E-mail: biocdbm@emory.edu

Key words: vitamins, trace elements, supplements, elderly

Abstract

The fraction of population that is elderly has been increasing, as has the consumption of vitamin/trace mineral supplements which is now a multi-billion dollar industry. Yet the rationale for such supplement intake by the majority may be questioned. Some of the current recommendations for micronutrient intake by the elderly are extrapolations from recommendations made for younger adults, whereas other recommendations are based on measurements of biochemical indices not proven to reflect a deficient level in the elderly. Suggestions that the elderly need above RDA amounts largely rest on the assumption that they should have biochemical indices similar to younger adults in spite of decreased caloric intake with decreased physical and metabolic activities of the elderly. Though some cases require supplementation because of problems with intake, absorption, or metabolism, there is little or no proof that boosting micronutrient intake above what can be achieved in well-balanced diets, some of which already contain fortified foods, will lead to a healthier outcome for most elderly individuals. There is not only the potential for unnecessary and occasionally harmful excess administered to some, but there is a cost that now runs in the billions of dollars and adds to the costs of covering multiple chronic disease

conditions. Hence, some caution should be exercised in public health promulgations concerning routine use of supplements for those within this age group (> 65 y)and of both genders until more research establishes clear connections between needs for micronutrients and nutrient-related health in the elderly.

Introduction

The population that is considered elderly (>65 years of age) is increasing in most developed countries as a result of "successful aging" and declining birth rates (1). A review of the economic analysis of nutrition interventions, such as was published in Nutrition Reviews on chronic disease prevention (2) offers some guidelines that may be brought to bear on the use of supplements for the elderly. In earlier considerations of the daily Recommended Dietary Allowances (RDAs), the oldest age category was >51 years; however, ranges of 51-70 y and also >70 y are now considered. Though the literature now provides some studies of older subjects, many of the recommendations for such elderly were and still are based on extrapolations from younger persons. Often the biochemical indices that have been adjudicated as indicating insufficient intake or utilization of a nutrient for younger adults are assumed to also indicate insufficiency in an elderly population. This is in spite of absence of any clinical signs of pathology and the possibility that there may be lowered requirements of certain micronutrients as there is for caloric intake as a result of aging. These arguments do not abrogate the possibility that some elderly may have such a degree of appetite suppression that supplementation is necessary; however, often greater concern for the gustatory quality of meals served, especially in homes for the elderly and hospitals, may alleviate some of this problem.

Present Knowledge

Clearly there are some physiologic and metabolic factors that alter physiologic and metabolic needs in the elderly (1). Accompanying reduction of activity and total energy expenditure there is a decreased need for caloric intake, though an increase in nutrient density is deemed desirable. Even though energy expenditures decline in the elderly, there is no indication that requirements for thiamin, riboflavin, and niacin are different than in other adults. Some arguments have been made for increasing the intake of B_6 where there may be some alteration in metabolism rather than absorption (3). Increased incidence of atrophic gastritis and in some cases an elevation of homocysteine in the elderly argue for some increase in vitamin B_{12} and folate. Because absorption and metabolism of vitamin C do not seem to change with aging, there is no evidence that indicates an increased need in the non-smoking elderly. There is also no evidence that either absorption or utilization of vitamin E changes with age (4). Clearly there is a decrease in skin synthesis of vitamin D and, after its metabolism in the liver to 25-hydroxycholecalciferol, the further conversion to the hormonally active 1α,25-dihydroxycholecalciferol is impaired. So too is the gut response to the hormone which leads to a specific protein-mediated uptake of calcium. Hence, an augmented need for vitamin D is expected in some elderly. For postmenopausal women, a daily intake of 800 to 1,000 IU of D has been found in 2012 by Gallager et al. (5) to support recommendations made in 2010 by The North American Menopause Society (6). In discussion of these findings, McClung concludes with the statement that "Enthusiasm among many practitioners for use of and the potential benefits of high doses of vitamin D supplements has outstripped the available evidence

supporting that usefulness. Our recommendations to our patients must be based on solid evidence, not on hopes or hypotheses" (7). Even more broadly as concerns older women, it has been reported that the use of dietary supplements of commonly used vitamins and minerals is not associated with reduced mortality, but rather many supplements were associated with increased risk for total mortality compared with corresponding nonuse (8). As for the essential trace minerals, cessation of the menstrual period in women leads to some decrease in the iron requirement; however, there is still need for some iron that functions in essential non-heme roles as well as for zinc and other nutrients that may help offset the decrease in immunocompetence with aging. Evidence is insufficient to support an age effect on copper requirements (9). Dietary intakes of chromium are often less than estimated for the Adequate Intake (AI) suggested for all adults; however, there is insufficient evidence to suggest a patho-physiologic consequence of decreases in levels of the mineral in serum, hair, and sweat with aging (10). Serum selenium levels in some elderly have been found lower than normal, but no pathologic conditions related to selenium insufficiency have been reported in the US (11,12).

Toxicity becomes an observed danger with excess of some micronutrients such as some of the fat-soluble vitamins and most trace elements. The tolerable upper intake levels are not well established for many of the micronutrients. Cost is a significant consideration. Each year there is increasing cost for age-related multiple chronic disease conditions such as diabetes, heart disease, chronic respiratory conditions, and cancer (13,14). With regard to heart disease, the dubious use of vitamin-mineral

supplements has already been addressed (15). Micronutrient supplementation for cancer patients is also not recommended at present, as it has been reported that though benefit may accrue to those with low nutrient intake, cancer is actually promoted in those with higher nutrient status given supplements or to achieve pharmacologic exposures (16).

Conclusion

From all of the above, it is apparent that changes in requirements for the elderly do not suggest massive supplement use covering most micronutrients. Rather generally minor dietary shifts can accommodate most needs, with supplements included only where there is evidence for serious limitation of intake. Given that a large proportion, perhaps half or more of the elderly in the US use vitamin/trace element supplements (17), and that such use now totals in the billions of dollars (18), it seems reasonable to ask if the cost-benefit ratio is a worthy public health investment. In one review in the medical literature (19), it was suggested that all adults should take a multivitamin and mineral supplement, and the elderly should take two. It has recently been stated by employees of a nutritional products business that adequate intake of vitamins in the elderly is still a concern and that where dietary manipulation is difficult, fortified foods and dietary supplements can be a pragmatic solution (20). However, there are arguments that may temper any large and all-encompassing suggestions (18). There is little or no proof that boosting micronutrient intake above what can be achieved in a well-balanced diet will lead to a healthier life that can be extended beyond the genetic set point we inherit. It appears that the exuberance of some should be tempered by such evidence-based findings as are presently available. As stated in a recent report, (16), “The hypothesis that groups with low nutrient status may benefit from

supplementation has yet to be formally tested." These are clinically certifiable problems that must be addressed. This can be contrasted with the practice of taking vitamin/trace element supplements without proven need.

Recommendations

It would be helpful for all health professionals who communicate their views on micronutrient needs for any age group to be familiar with such knowledge as detailed in books on vitamins (21), minerals (22), and the interactions of these micronutrients as regards human nutrition (23,24). Additionally, further research focused on the nutrient needs of the elderly, a growing fraction of our population, should be continued to add depth and certainty to our knowledge. Well-informed professionals might then offer advice to a public that can be reinforced with the certainty that more is not always better.

References

1. Bales CW, Ritchie CS. The elderly. In: Shils ME, Shike M, Ross AC, Caballero B, Cousins RJ, eds. *Modern Nutrition in Health and Disease.* 10th ed. Baltimore, MD and Philadelphia, PA: Lippincott Williams & Wilkins; 2006: 843-858.

2. Wong JB, Coates PM, Russell RM, Dwyer JT, Schuttinga JA, Bowman BA, Peterson SA. Economic analysis of nutrition interventions for chronic disease prevention: methods, research, and policy. Nutrition Reviews. 2011; 69: 533-549.

3. Russell RM. Factors in aging that effect the bioavailability of nutrients. J Nutr 2001; 131 [Suppl]: 1359S-1361S.

4. Food and Nutrition Board, Institute of Medicine. *Dietary Reference Intakes for Vitamin C, Vitamin E, Selenium, and Carotenoids*. Washington, DC: National Academy Press, 2000.

5. Gallagher JC, Sai A, Templin T, Smith L. Dose response to vitamin D supplementation in postmenopausal women: a randomized trial. Ann Intern Med 2012; 156: 425-437.

6. The North American Menopause Society. Management of osteoporosis in postmenopausal women: 2010 position statement of The North American Menopause Society. Menopause 2010; 17: 25-54.

7. McClung MR. Postmenopausal women & vitamin D supplementation. Available at http://www.medscape.com/viewarticle/764910_print. Accessed on 6/13/2012.

8. Mursu J, Robien K., Harnack LJ, Park K, Jacobs Jr DR. Dietary supplements and mortality rate in older women. Arch Intern Med 2011; 171: 1625-1633.

9. Food and Nutrition Board, Institute of Medicine. *Dietary Reference Intakes for Vitamin A, Vitamin K, Arsenic, Boron, Chromium, Copper, Iodine, Iron, Manganese, Molybdenum, Nickel, Silicon, Vanadium, and Zinc*. Washington, DC: National Academy Press, 2001.

10. Davies S, McLaren Howard J, Hunnisett A , Howard M. Age-related decreases in chromium levels in 51,665 hair, sweat, and serum samples from 40,872 patients—implications for the prevention of cardiovascular disease and type II diabetes mellitus. Metabolism 1997; 46: 469-473.

11. McClain CJ, McClain M, Barve S, Boosalis MG. Trace metals and the elderly. Clin Geriatr Med 2002; 18: 801-818.

12. Savarino L, Granchi D, Ciapetti G, Cenni E, Ravagia G, Forti P, Maioli F, Mattoli R. Serum concentrations of zinc and selenium in elderly people: results in healthy nonagenarians/centenarians. Exp Gerontol 2001; 36: 327-339.

13. Schneider KM, O'Donnell BE, Dean D. Prevalence of multiple chronic conditions in the United States' Medicare population. Health and Quality of Life Outcomes 2009; 7:82-93.

14. U.S. Department of Health and Human Services Email Updates. HHS Initiative on Multiple Chronic Conditions. Available at: http://www.hhs.gov/ash/initiatives/mcc/. Accessed on 6/5/2012.

15. McCormick DB. The dubious use of vitamin-mineral supplements in relation to cardiovascular disease. Am J Clin Nutr 2006; 84:680-681.

16. Mayne ST, Ferrucci LM, Cartmel B. Lessons learned from randomized clinical trials of micronutrient supplementation for cancer prevention. Ann Rev Nutr 2012; 32: 369-390.

17. Ervin R, Wright J, Kennedy-Stephenson J. Use of dietary supplements in the United States, 1988-1994. J Vital Health Stat 1999; 11: 1-14.

18. McCormick DB. Vitamin/mineral supplements: of questionable benefit for the general population. Nutr Rev 2010; 68(4): 207-213.

19. Fletcher RH, Fairfield KM. Vitamins for chronic disease prevention in adults: clinical applications. JAMA 2002; 287: 3127-3129.

20. Troesch B, Eggersdorfer M, Weber P. 100 Years of vitamins: adequate intake in the elderly is still a matter of concern. J Nutr 2012; 142 (6): 979-980.

21. Zempleni J, Rucker RB, McCormick DB, Suttie J, eds. *Handbook of Vitamins*, 4th ed. Boca Raton, FL: CRC Press; 2007.

22. Bogden JD, Klevay LM, eds, *Clinical Nutrition of the Essential Trace Elements and Minerals. The Guide for Health Professionals.* Totowa, NJ: Humana Press; 2000.

23. Bowman BA, Russell RM, eds. *Present Knowledge in Nutrition*, 8th ed. ILSI Press, Washington, DC: 2006.

24. Shills ME, Shike M, Ross AC, Caballero B, Cousins RJ, eds. *Modern Nutrition in Health and Disease*, 10th ed. Philadelphia, PA: Lippincott Williams & Wilkins; 2006.