

# Geriatric Water and Energy Nutrient Concerns

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## Abstract

The baby boomer cohort is aging, and coming along with them is a specific nutritional need -- one that is gaining recognition amongst practicing dietitians. By the year 2050, the population of senior citizens (>65 years old) in the U.S.A. will be 80 million, and the number of citizens aged 85 years and older will be 18 million; the former represents more than twice the current statistic, while the latter is a staggering four fold increase (Bobroff). Much like the new born baby and the growing adolescent, the nutritional concerns of an elder are different than those from other age groups. This branch of nutrition study is known as geriatric dietetics.

The prescription of geriatric dietetics is not always applied by the care-giver, and unfortunately, the special need of the elder for targeted nutrition often goes unrecognized. The effects go untreated, and the result is a host of confusing to diagnose quality-of-life issues, some of which can force the patient to confront mortality prematurely. The "absence of a single, reliable method" for determining cases of malnutrition helps contribute to the problem; according to Allard et al., neglect can reach extreme levels (Allard et al.) For example, basal metabolic rate (the ratio of the caloric expenditure by critical life function in the body to the total caloric intake) can often not be guaranteed to be at a satisfactory level. When the B.M.R. reaches 1:1, caloric consumption is solely devoted to basal metabolic activities. This means that the individual is simply not consuming enough energy to meet the basic daily needs of their body. Dehydration is also common, and is difficult to diagnose when it has occurred. These two elements of geriatric nutrition will be examined.

## ABBREVIATIONS

B.M.R. - Basal Metabolic Rate

B.M.I. - Body Mass Index

MJ – Mega joule(s)

EI – Energy Intake

ADH – Anti Diuretic Hormone

mL – Milliliters

RDA - Recommended Daily/Dietary Allowance

## BACKGROUND

The Body Mass Index (B.M.I.) of an elderly individual tends to vary as a function of his or her age (Klipstein-Grobusch et al.). Men typically experience a decline in B.M.I. as they grow older (Klipstein-Grobusch et al.). Conversely, women show an increase in B.M.I. over the same time-frame (Klipstein-Grobusch et al.) According to Klipstein-Grobusch et al., between the ages of 55 and 95, a male's B.M.I. declines from 25.9 kg/m<sup>2</sup> to 24.7 kg/m<sup>2</sup>, but a females B.M.I. rises from 26.3 kg/m<sup>2</sup> to 27.4 kg/m<sup>2</sup>. The decreasing B.M.I. of men may have to do with a decrease in lean body mass over the course of time; lean body mass is something

that men have generally had a greater quantity of than women throughout their lives (Bobroff).

Elders who are physically active can continue to enjoy a varied diet and an increased energy nutrient intake without the risk of weight gain, as would be expected from individuals from other age groups. The incidence of obesity is pronounced among those who live alone, and who have a low income (Klipstein-Grobusch et al.) Across Klipstein-Grobusch's study population, women were less likely to be obese.

The average basal metabolic rate was found by various studies to be 6.9 MJ/day and 5.6 MJ/day for females (Table 1) (Klipstein-Grobusch et al.) The food intake of patients from Klipstein-Grobusch et al. was satisfactory in the sense that it was able to maintain the fundamental B.M.R., as was indicated by positive energy intake to B.M.R. ratios (1.38 EI/B.M.R. for males and 1.34 EI/B.M.R. for females.) This ratio, however, is "significantly related to age" (Klipstein-Grobusch et al.). The sedentary energy expenditure was calculated to be 1.33 times the B.M.R.

**Figure 1**

Table 1: Summary of Klipstein-Grobusch Study

	BMR		BMI		EI/BMR	
	Male	Female	Male	Female	Male	Female
	6.9MJ/Day	5.6MJ/Day	25.475	26.95	1.4275	1.3775

**WATER CONCERNS**

One of the most important faucets of proper nutrition for the elderly is that of water intake. This is not coincidental considering that between 50% and 60% of the human body mass is represented by water. Robert Blackhurst, author of “Danger on the Wards”, provides the following anecdotal account that illustrates an experience he had concerning a hospitalized older man and the care staff at the institution:

“The elderly patient opposite my grandfather slept through mealtimes and did not touch any of the water in the heavy ceramic mug by his bed... We eventually told the assistant serving meals that we hadn't seen that man drink for days. ‘I'm not allowed to feed him,’ she said, ‘The managers don't let use.’ Later a consultant pronounced him dangerously dehydrated”.

Dehydration is a common malady that is not all caused by any fault of the caregiver. The lack of a metric with which to measure hypo-hydration can make diagnosis difficult, especially when it occurs in the elderly (Persson et al.) There are numerous physiological contributors that occur as a result of the aging process that make dehydration more likely (Bartl, et al., Bobroff.) Most notable is that the sensation of thirst seems to subside and become less detectable as one grows older (Maughan, Bartl, et al., Bobroff.) Also, the ability of the kidney to concentrate urine declines with age. This may be the result of decrease in effectiveness of anti-diuretic hormone on the kidneys themselves. (Maughan, Bartl et al., Bobroff.) ADH is a hormone that promotes water retention in the cortical collecting duct (Wikipedia.) The end effect of reduced ADH action is water diuresis -- abnormally dilute urine that may be the cause for the frequent washroom excursions experienced during the night by elders. Both Bobroff and the Wikipedia note that caffeine and alcohol consumption interferes with the functioning of the pituitary gland and its role in ADH secretion. Bartl, et al. do not contest this effect of caffeine and alcohol, but do argue that moderate consumption of alcoholic beverages and caffeine-containing soft drinks can contribute positively to the dietary recommendation for water intake. Bartl, et al. further argue that drinks such as cola and beer are palatable and therefore enjoyable, and need not be restricted at all should other

dietary guidelines be satisfactorily met.

Mild dehydration is not conclusively known to contribute to any serious long-term medical conditions, but there may be a relationship with bladder cancer and chronic dehydration (Maughan.) Mild, acute conditions arising from dehydration include headache, fatigue and constipation (Bobroff.)

Normal and usually benign excretion of water results from urine (1400mL), feces (200mL), and expiration and perspiration (900mL) (Maughan.) These values are not adjusted to conform to the activity levels of the elderly, and they should be somewhat lower for the older age group, but may still be satisfied by the lower 1200 mL RDA for water value that was obtained by Bartl, et al. In a clinical study, Persson et al., found that realistically, the daily water intake among elderly was much higher, ranging from 1911 mL for males, and 1787 mL for females (they also note that statistical variations do not exist among different gender, age and diagnoses.) During the course of a doubly-labeled water experiment, Persson et al. discovered that among the study population, a water surplus existed; water excretion measured 1744 mL on average, compared to intakes of 1911 mL for males, and 1787 mL for females.)

It seems obvious that both the cure and the preventive measure for dehydration is to increase ones consumption of water, but for elders, the quantity of water that should be stated as the RDA is not definitively known. One reason for this, as Maughan notes, is that scientifically valid estimates are difficult to obtain. As always, the rate of consumption should coincide with and be influenced by factors such as activity level, climate, and in this case, age. A panel in the state of Florida suggests 6 to 8 glasses (around 1400 to 1900 mL) of water per day, but experimental data does not offer support for this rate of consumption. Bartl et al. suggest that five glasses (or 1200 mL) a day is sufficient due to the decreased quantity of water excreted by the elderly. Much more than five glasses of water day, they state, and a dangerously low concentration of sodium can occur in the body.

**ENERGY NUTRIENTS**

“Don't leave him alone in hospital [sic], he'll starve.”  
Blackhurst

A consistent observation made by researchers in separate studies is that participants chronically under- and over-estimate their energy intakes. Klipstein-Grobusch et al. suggest that this “may be due to the tendency of subjects to

conceal their dietary intake [either] consciously or unconsciously.” Several identifiable factors in their study influenced the nutrition data provided by the subjects. According to their results, “a significant inverse relationship between B.M.I. and reported energy intake was present for both men and women,” and that this observation remained true regardless of the age groups or cohorts represented in the study. One reason that may explain why the patients reported false information regarding food intake was a response to the need to compensate self-esteem. Patients with high B.M.I.'s may feel more comfortable stating that they consume less than they actually do, and patients with low B.M.I.'s may be relieved emotionally from the burden of socioeconomic conditions that prohibit them from eating comfortably. Observed as well was the preference some patients exhibited for certain caregivers over others and the resulting influence that the preference had on the level of cooperation attained by the researchers. This directly affected the willingness of the patients to eat as they normally would, and to truthfully acknowledge and present their food intake information to the researcher (Bartl et al.). In at least one case, results measuring water intake among participants was skewed as the result of staff overestimation and not of patient fallibility (Persson et al.) This may also be a source of error in energy nutrient measurements.

The intake was higher for nearly all micro- and macro-nutrients among men than for women, with the exception of calcium, where the groups were similar, and for vitamin C, which women consumed more of (Klipstein-Grobusch et al.) Across the board, Klipstein-Grobusch et al. reported a linear trend of decreasing energy intake among men as they grew older. The constituency of the energy intake changed, however, as less protein and more carbohydrate and fat was consumed. For chronically ill patients, however, protein should represent the bulk of the meal (Bobroff.) While similar guidelines can be applied to aging women, the trend was less consistent and the consumption of some independent nutrients either increased or remained stable when compared to the results of males (Klipstein-Grobusch et al.)

Among active cigarette smokers, macro nutrient consumption was much higher and micro nutrient intake was significantly lower when compared to non- and previous smokers (Klipstein-Grobusch, et al.) The level of education attained (e.g. high school, college, etc.) also reflected nutrient intake; those having less formal education were most likely also in taking smaller quantities of macro and

micro nutrients. Understandably, disability often leads to lower food intake. Disorders such as dysphagia can make mealtime painful and the reduced sense of taste and smell as result of both aging and drug/body interaction can further distance elders from the joy of eating (Allard et al.). Memory often declines with age, and as a result, subjects in studies may not be able to accurately recall what they had eaten. Poor eyesight and aprosexia may affect the person's ability to participate in a study, and may promote a low participation rate (Klipstein-Grobusch et al.) Furthermore, co morbid dehydration can heighten the impairment of any pre-existing cognitive disability, and may even cause instances of acute confusion (Maughan.) Maughan states that when elderly in a confused state are admitted to a hospital, they are often “in a state of fluid deficit.”

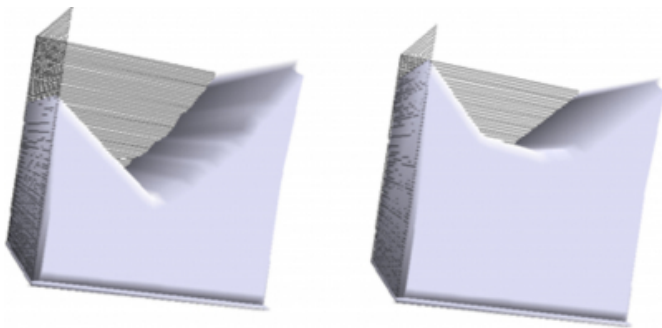
Additional strains are place upon elders and their care-givers to maintain proper nutrition in relation to the maintenance of a healthy immune response. It is known that aging has a detrimental effect on cell mediated immunity (Bartl et al.), and when combined with poor nutrition, especially protein energy malnutrition, the results can be devastating. Immunity-providing cells are constantly undergoing regeneration, and the required protein prerequisites are simply not available. In one study, 84% of the patients did not meet the required energy intake to satisfy the calculated estimate of daily energy expenditure ( $1.33 \times \text{B.M.R.}$ ), while 30% would not satisfy fundamental B.M.R. (Elmståhl et al., Persson et al.)

“Weight changes, particularly weight loss, are not a normal or automatic consequence of aging” (Bartl et al.) The most important consideration of weight for the elderly is that it remains stable. Unstable is defined as  $\pm 4\%$  change in mass in 4 months, or  $\pm 2\%$  in 2 months. The healthy B.M.I. of a young adult is between  $19 \text{ kg/m}^2$  and  $25 \text{ kg/m}^2$ . For this cohort, a graph measuring B.M.I. range imposed upon the statistical risk of cardiovascular disease shows a distinct “U” curve. B.M.I. values of less than  $19 \text{ kg/m}^2$  and higher than  $24 \text{ kg/m}^2$  steeply ascend with the corresponding increase in risk of cardiovascular disease. (Figure 1). This is only true for the younger cohorts however. With seniors, the U curve flattens out. Interestingly, it has been shown that slightly elevated B.M.I. values are of less importance than general wellbeing, and that for those aged 74 years and older; a decrease in mortality from any cause is correlated with having a higher B.M.I. (Bartl, et al.) This is corroborated by Allard et al., who state that “the best survival was for those who were overweight,” (having a B.M.I.  $>26 \text{ kg/m}^2$ ).

Therefore, the B.M.I. value recommendation is gradually increasing to 24-29 kg/m<sup>2</sup> which may help to combat the effect that decreasing caloric intake has on aging seniors (assuming they had higher B.M.I. to begin with). (Bobroff indicates that a 10 kCal and 7kCal increase in kCal intake is occurring per year for men and women, respectively. The decrease in caloric intake is the result of decreasing basal demand by diminishing lean body mass.) Put precisely, a low optimal B.M.I. does not appear to exist for seniors. Rather, there appears to be a higher optimal B.M.I. (Bartl, et al.).

### Figure 2

Figure 1: Example of “U” curve formation when plotting B.M.I. against risk for cardiovascular disease (Younger adults vs. geriatric adults)



Many seniors experience malnourishment even when in the hands of professional care-givers. Blackhurst indicates that 60% of the elderly patients in United Kingdom hospitals are malnourished, and that two-thirds lose weight during their stay. He furthermore cites “that more than 10 per cent of meals go uneaten” by elders in the hospital. While his figures represent research done in the United Kingdom, there is no clear reason to argue that the situation in Canada or the USA is any better. For example, a study by Allard, et al. indicates that the rate of malnutrition ranges from 12% to 85% among long term care facilities around Toronto, Ontario, Canada. Two software packages have been developed in Canada to help diagnose susceptibility for nutrition related problems (Alibhai et al): ENS ([http://www.dieticians.ca/seniors/content/other/csle\\_overview.asp](http://www.dieticians.ca/seniors/content/other/csle_overview.asp)) and SCREEN (<http://www.dieticians.ca/seniors/index.asp>).

Compositionally, meals could be provided that are more appetizing, such as finger foods, with fortified courses constituting main meals. Easily accessible, energy-condensed (but still nutrient-dense) snacks should be made available during other non-mealtimes such as social gatherings, a time when many people enjoy eating food the

most (Bartl et al., Bobroff.) Even though fat is the most energy dense macro nutrient, and is useful when trying to increase a subjects energy intake, too much is not beneficial. Also, the food and drink preferences of the individual patient should be considered. For example, seniors with oral maladies require specially prepared meals. When employed, these suggestions have been shown to halt and even reverse any weight-loss experienced during a patients stay in a hospital. Various pharmaceutical methods of weight loss control have been studied, but they have neither shown a considerable benefit, nor earned any scientific merit. Malnutrition and food anhedonia should, of course, be treated organically whenever possible.

In many cases there is no identifiable cause for weight loss, and it may be indicative of the presence of a more serious underlying disease (Alibhai et al.) Causes can be classified within one of three groups, which are collectively entitled the “anorexia of aging”: psychological, organic, and non-medical (Alibhai et al.) Psychological causes such as dementia affect mealtime, whereas organic causes, such as neurochemical deficiencies, can cause conflicting recognition and inadequate response to feelings of satiety and satiation (Alibhai et al.). Whatever the cause, however, at least four separate studies support the claim that weight loss can lead to mortality, often within 1 to 2.5 years after the onset of weight loss (Alibhai et al.)

An important tool for the elderly whom are physically incapable of eating is the feeding tube. Intended to be used as a last effort to deal nutrients, the tube should be use only after a medical examination has either exhausted plausible diagnoses or options for the possible treatment of the causes for the dietetic distress. Tubes range in type from easily insertable and temporary nasogentic tubes, through to permanent, long-stay gastrostomy and jejunostomy tubes; the last is used when the patient lacks a stomach. The intention is always the same, however: to deliver a composition of nutrients in an effort to maintain body mass. There are a variety of commercially available formulas that offer varying compositions of the three energy nutrients (protein, carbohydrate, and fat) and the various essential vitamins and minerals. Typically, 1mL of formula is equal to 1 kilo-calorie and is 75-80% water by volume (Dharmarajan, et al.) Although they provide the necessities of nutrition, tube use is controversial because of the less than favorable results obtained through their use. Dharmarajan et al. provide an example of a form that can be used to assess a patient's suitability for tube feeding and to minimize

incorrect or unethical uses. Pope John Paul II was sustained by tube during the last portion of his life.

**FOOD INSECURITY**

“Food insecurity refers to problems with the availability, accessibility and utilization of food... Food insecurity exists whenever the availability of nutritionally adequate and safe foods or the ability to acquire acceptable foods in socially acceptable ways is limited or uncertain.” Frongillo et al.

In economically stable countries like Canada and the U.S.A., food deprivation among the elderly is usually caused by reasons other than monetary ones. The fact that many seniors are earning pensions or receiving other guaranteed incomes precludes them from this (financial) facet of food insecurity. However, Bobroff notes that between 5.5% and 16% of American seniors have difficulties financially and more than 10% were below the poverty line -- still a considerable portion. Poor health, limited mobility, and inadequate social means of support can all contribute to food insecurity. Depression is a concern among some of this population as a result.

Elders, while not more prone to food insecurity than those of other age groups, offer a unique set of circumstances for the nutritionist to analyze and interpret. As a group, older citizens avoid asking for help because they perceive such help as being equivalent to a claim of welfare. Supporting this notion is the feeling that they have of having “weathered the tough times before” in scenarios such as, for example, the Great Depression. Believing in this, they assume an attitude of self dependence.

Elements that can force such perceptions on the elderly are divided by Frongillo, et al. into several groups: a qualitative component that may force the consumption of unfavorable food items, a social component that represents possible engrained or ethnic food practices, and a psychological component reflecting the compounding uncertainty of food insecurity itself. An interesting manifestation of food insecurity is illustrated by Frongillo, et al.: elders prefer private assistance programs in comparison to services such as the food stamp program in the U.S.A. Frongillo et al. attribute this to the perceived negative stigma attached to such welfare programs. As food insecurity is a direct contributor to malnutrition, it is in the best interest of the patient to prevent its occurrence entirely whenever possible.

**Figure 3**

Table 2: Changes and Corresponding Risks Associated with Aging.

Type	Change	Risks	Possible Alleviator(s)
Physiological	Lean body mass decreases	Decreased caloric requirements	Exercise and careful diet planning
		Reduction in physical strength	
		Less tissue buffering leading to increased risk of bone breakage	
	Increase in body fat in proportion to muscle	Diabetes mellitus	
	Decreased total volume of body water	Dehydration	Proactive water intake; treatment of diaphoria, vomiting, etc.
		Acute headache, fatigue and constipation (Bobroff)	
		Possible long-term increase in risk of bladder cancer (Maughan)	
	Gradual desensitization of senses	Eyesight	Corrective lenses, etc.
		Sense of taste	Awareness of condition and proactive water and energy consumption
		Mental disorders	Depression, dementia
Socioeconomic	Deteriorating immune function	Infection, complications	
	Socially isolated as a result of, for example, the death of a loved one	Malnutrition, Dehydration	
	Economic ability to purchase food		Education campaigns stressing the use of public food initiatives
	Limited physical mobility and difficulty in obtaining food		

**CONCLUSION**

The population of senior aged individuals will soon skyrocket because of aging baby-boomers. This cohort represents a subunit of dietetics that is sometimes neglected, or otherwise not fully understood by health care professionals. B.M.I., when use as a general indicator of wellbeing, is a function of age during the later years and men generally drop in B.M.I., whereas women see a rise. Water intake is often compromised because of physiological changes that occur within the elderly individual. Energy nutrient intake can host problems as well, and is associated with components identified collectively as the “anorexia of aging,” and also includes aspects of food insecurity such as socioeconomic wellbeing.

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