

Nutrition in Advanced Alzheimer's Disease

Heidi K. White, MD, MHS

Nursing facilities that care for patients with advanced dementia strive to provide high-quality nutritional care. The standards set forth in federal regulations state, "Based on a resident's comprehensive assessment, the facility must ensure that a resident maintains acceptable parameters of nutritional status, such as body weight and protein levels, unless the resident's clinical condition demonstrates that this is not possible."¹ Alzheimer's disease (AD) frequently involves weight loss,²⁻⁷ which is a strong predictor of mortality.⁸ Weight loss and subsequent malnutrition may be an unavoidable part of the natural history of end-stage AD and other dementias. Whether nutritional intervention can delay functional decline and morbidity is largely untested. However, observational data from subjects with AD indicates that weight gain is associated with a reduced risk of mortality.⁸ Similar data in institutionalized subjects including those with dementia show that weight gain of even small amounts can improve morbidity and mortality.⁹ An understanding of the nutritional consequences of Alzheimer's disease, along with appropriate assessment and a thoughtful approach to intervention, may help to avoid the complications associated with malnutrition, thus preserving a better quality of life until death.

Factors Promoting Weight Loss

Taste and Smell Dysfunction

Taste and smell dysfunction occurs with normal aging and can be exacerbated by medications and disease.^{10,11} Although some changes in taste perception have been reported,¹² multiple studies in subjects with mild to moderate Alzheimer's disease have demonstrated deficits in odor identification.^{13,14} In addition,

odor threshold may become progressively more abnormal as the disease progresses.¹⁵ Olfactory dysfunction may not be specific to Alzheimer's disease; similar olfactory deficits have been noted in Parkinson's disease and vascular dementia.¹⁶

"...nutritional intervention that seeks to enhance the hedonic reward during mealtime may significantly benefit AD patients who are at risk for nutritional decline."

Inflammatory Mediators

Cytokines,* such as interleukin 6, are an integral part of anorexia-cachexia syndromes in other disease states, such as cancer and heart failure.^{17,18} Cytokines, including interleukin 1 and 6, and tumor necrosis factor alpha, play an important role in the inflammatory process that accompanies the hallmark changes of amyloid plaques and neurofibrillary tangles that occur with AD.¹⁹⁻²² In essence, these inflammatory mediators may produce important changes in the areas of the brain that control appetite.

Abnormal Eating Behavior

Abnormal eating behaviors contribute to weight loss. Typical behaviors include needing frequent verbal cues to complete the eating process, verbally refusing food, pocketing food in the cheeks without swallowing, clenching teeth, and spitting food.^{23,24} Abnormal eating behavior may be more subtle, such as a fluctuations in appetite, delusions about food (e.g., believing food is poisoned), increased distractibility at mealtime, and

* Cytokines are regulatory proteins released by cells of the immune system. These proteins act as intercellular mediators in the production of an immune response.

Heidi K. White, MD, MHS, is Assistant Professor of Medicine at the Center for the Study of Aging and Human Development and Division of Geriatrics, Department of Medicine, Duke University School of Medicine, and Geriatric Research Education and Clinical Center, Durham Veterans Affairs Medical Center. Dr. White can be reached at white031@mc.duke.edu or Box 3003, DUMC, Durham, NC 27710. Telephone 919-660-7516.

changes in food preferences.²⁵ Destruction of the hippocampus and surrounding cortical areas may explain certain behaviors. In late-stage AD, plaques and tangles have been described in the hypothalamus, the neurologic center of appetite regulation.^{26,27}

Dysphagia is a common manifestation of late-stage AD.^{28,29} Even in early stage AD, an increased duration of the oral and pharyngeal components of swallowing have been observed.³⁰

Balancing Energy Intake and Expenditure

Although inadequate oral intake is likely the primary cause of weight loss in moderate-to-severe AD, increased energy expenditure could contribute to a mismatch between energy intake and energy expenditure that leads to weight loss. While it has been suggested that resting metabolic rate may be elevated in AD, several studies now confirm that there is no evidence to support this.^{31,32} The idea that physical activity in the form of behavioral disturbances (e.g., pacing) may contribute to increased energy expenditure has not been supported either.³³ To date, there are no data on AD patients during the dynamic phase of weight loss. It is evident from our work, and that of others, that not all AD patients are losing weight all of the time.^{8,34} There can be periods of acute weight loss, a slow gradual weight loss, and variations in weight, which may include periods of substantial weight gain.

It is possible that relatively subtle and, perhaps intermittent, changes in factors, such as a behavioral disturbance that influences both energy intake and energy expenditure, may tip the balance toward weight loss for patients with AD. This imbalance may be multifactorial and intermittent. Rather than one particular cause or abnormality leading to weight loss, AD may lead to a condition in which changes in energy intake and expenditure are not easily compensated. Preliminary data from institutionalized subjects with AD show that Body Mass Index (BMI)** is inversely correlated with a measure of behavioral symptoms, which indicates that lower BMI was associated with higher frequency and severity of behavioral problems.³⁵

In summary, both primary and secondary factors may contribute to weight loss in advanced AD.³⁶ Primary factors, such as those discussed thus far, are attributable to the pathophysiology of Alzheimer's disease and may or may not be amenable to intervention. Secondary factors are not attributable to the pathophysiology of AD, but are commonly encountered conditions that may contribute to weight loss and are perhaps more amenable to intervention (see Figure 1).

Evaluating Weight Loss and Malnutrition

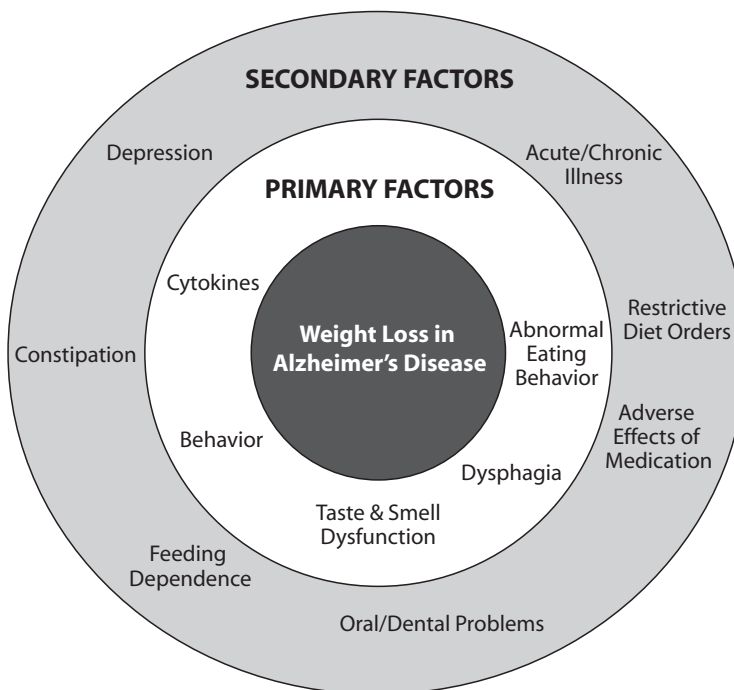
When to Evaluate

Periodic weight measurements are a primary resource for monitoring nutritional status and recognizing change. Most residents of nursing facilities are weighed monthly unless their condition would warrant weekly monitoring. According to parameters set for the Minimum Data Set, weight loss of 5% in one month or 10% in three months is considered of clinical importance and should entail further evaluation. Older adults with a BMI less than or equal to 21 are likely to be malnourished.³⁷ Conditions such as pressure ulcers that increase nutritional requirements should also prompt evaluation.

Other Illness

Common infections, such as pneumonia or urinary tract infections, will often produce anorexia. Cancer, thyroid dysfunction and other common causes of weight loss are part of the differential diagnosis. Constipation is a common condition in institutionalized individuals because of decreased fluid intake, decreased physical activity, and medication that promotes this condition. Chronic constipation can have a profound impact on appetite, yet be difficult to identify in patients with cognitive impairment. Chronic pain may also be difficult to identify, but

Figure 1.
Weight Loss in Alzheimer's Disease



Primary factors of weight loss are related to the pathophysiology of AD. Secondary factors are common occurrences that may be more amenable to interventions that promote nutritional well-being.

** BMI, weight in kilograms divided by height in meters squared, is a helpful measurement of nutritional status.

can cause anorexia. Depression is another common treatable cause of weight loss in older adults. Each patient should be specifically evaluated for depression and aggressively treated when it is suspected to be present. Depression is also common occurrence in early dementia, but may also be present in more advanced disease.

Medications

Medications should be reviewed. Commonly used drugs can cause many symptoms that potentially limit caloric intake (see Table 1). Acetylcholinesterase inhibitors, which are the primary treatment for the cognitive symptoms of AD, have several potential adverse effects including nausea, vomiting, and anorexia that may contribute to weight loss.^{38,39} Additionally, galatamine, an acetylcholinesterase inhibitor, has been associated with an increased incidence of weight loss.⁴⁰ Patients with dementia may not be able to voice symptoms attributable to these drugs.

with advanced dementia suffer the consequences of aspiration without any identifiable signs. A swallowing evaluation by a speech therapist that includes visualization of the swallow either in a barium study or by fiberoptic techniques can be helpful in determining the presence and severity of swallowing dysfunction. Although this evaluation can be helpful, many patients experience the sequelae of aspiration, but do not demonstrate aspiration on such testing. On the other hand, many patients who clearly aspirate on testing do not seem to suffer obvious consequences of aspiration, such as weight loss or aspiration pneumonia. Risk factors that predispose patients with advanced dementia to aspiration pneumonia are listed in Table 2.⁴¹

Interventions for Weight Loss in AD

For the most part, getting patients with dementia to eat is a process of trial and error. It is important to make sure that food

is available not just at meal-times, but whenever the patient is inclined to eat. Many patients need supervision, constant reminders, and simple directions to complete a meal. Providing finger foods can be helpful for patients who are challenged by the use of utensils.⁴² Appetite and alertness may be better early in the day so breakfast and lunch become more substantial meals. Providing preferred foods can also increase intake.⁴³ Simplifying the environment so that there are fewer distractions during mealtime may be helpful as well.

Researchers have demonstrated that improving the ambiance during mealtime in a nursing facility by manipulating social and environmental aspects improves food consumption and nutritional status.⁴⁴ Studies that have implemented soothing dinner music for dementia patients demonstrate that this intervention can improve mealtime agitation and food intake.^{45,46} Taken together, these studies—although few in number and scope of intervention—suggest that a nutritional intervention that seeks to enhance the hedonic reward during mealtime may significantly benefit AD patients who are at risk for nutritional decline.

Feeding a patient, who can no longer feed himself/herself, can

Table 1. Medications and Induced Symptoms

| Medication Type | Medication Induced Symptom |
|--|-----------------------------|
| NSAIDs, alcohol, nicotine, cholinesterase inhibitors | Anorexia |
| Toxic levels of drugs (e.g., digoxin, theophylline), antibiotics, NSAIDs | Nausea |
| Anticholinergics, HIV drugs, antibiotics | Taste and smell dysfunction |
| Sedatives, opioids | Inattention |
| Antipsychotics | Movement disorders |
| Anticholinergics | Dry mouth |
| Bisphosphonates | Esophagitis |
| Phenothiazines, haloperidol | Dysphagia ⁶² |
| SSRI, antibiotics, laxatives | Diarrhea |
| Antipsychotics, atypical antipsychotics | Increased appetite |

Physical Examination

A thorough physical examination is an important part of the assessment of weight loss and malnutrition. The mouth is a particularly important part of the examination that should not be overlooked. Dental abnormalities such as ill fitting dentures, tooth decay, and abscess formation may contribute to weight loss. Dry mouth and antibiotic use can lead to thrush, a yeast infection that can cause discomfort and unwillingness to eat.

Dysphagia

Patients with advanced dementia often develop serious difficulties swallowing. They may resist food being placed in the mouth, fail to manage the food bolus once it is in the mouth, or aspirate when swallowing. Caregivers should be encouraged to report changes in eating behavior and signs of dysphagia. Coughing and choking during eating are common signs of aspiration. So called “silent aspiration” occurs when patients

Table 2. Risk Factors for Aspiration Pneumonia

| Risk Factors |
|----------------------------|
| Dysphagia |
| Feeding dependence |
| Oral Care dependence |
| Number of decayed teeth |
| Tube feeding |
| Multiple medical diagnoses |
| Number of medications |

be very time consuming, and some patients may respond better to a particular caregiver. Techniques that are particularly effective in feeding a patient should be shared and mimicked by other caregivers. Research indicates that the quality of the relationship between the person being fed and the feeder is an important predictor of food intake.⁴⁷ Even severely demented patients respond best to caregivers who are personal, interested, involved, flexible, calm, cooperative, and more willing not to seek control in the relationship.

Maximize Taste and Smell

Dietary restrictions, such as low sodium and low cholesterol, that limit aroma, flavor, and calories should be avoided. Flavor enhancement has been shown to increase food intake and maintain weight in nursing home residents.⁴⁸ Facilities and caregivers should take advantage of aromatic foods, which stimulate the physiologic responses that prepare an individual for food intake and stimulate appetite. In addition to mealtimes, activities such as baking bread or popping popcorn can stimulate appetite and provide needed calories.

Nutrition Supplements

Oral liquid supplements should be given between meals to boost calorie consumption.⁴⁹ Liquid supplements should not replace food intake, as it could result in decreased calorie consumption.⁵⁰

A routine vitamin/mineral supplement should be considered for all patients with moderate to advanced AD, because inadequacies in micronutrient intake are common among eating-dependent nursing home residents.⁵¹ Like all older adults, most patients with AD will require calcium and vitamin D supplementation. Several studies indicate that even subtle deficits in nutritional status can impact cognitive performance in non-demented older adults.⁵²⁻⁵⁴ Even if nutritional supplementation does not improve cognitive symptoms, nutritional interventions may help to maintain the muscle and bone mass necessary for continued independent physical function and, in more disabled patients, prevent challenging complications, such as pressure ulcers.

Appetite Stimulants

Orexigenic agents (appetite stimulants) are often considered in the treatment of end-stage dementia with nutritional decline. None have been studied for their effectiveness in patients with advanced Alzheimer's disease. Megestrol acetate (a hormone therapy often used to treat certain cancers and other diseases with anorexia cachexia) may be a reasonable choice due to limited data with nursing home patients, but may take several months to have an effect on appetite and weight status.^{55,56} Studies of megestrol acetate in patients with cancer and AIDS have only found an increase in fat mass, but no significant increase in lean body mass. No survival advantage has been demonstrated. Side effects include adrenal suppression, fluid retention, deep vein thrombosis, confusion, and impotence. Other agents that have been used to stimulate appetite, but for which there are little or no data regarding their use in advanced dementia include cyproheptadine, dronabinol, testosterone,

growth hormone, oxandrolone, and steroids.

When considering the use of an orexigenic agent the origin and causes of the weight loss and the goals of care need to be carefully defined. If dysphagia is the primary issue hindering caloric intake then appetite stimulation may only serve to make the patients condition more uncomfortable. However, if agitation and distractibility are hindering intake, a greater sense of appetite may help the patient to focus attention on eating. The goals of care are also important to consider when making this decision since the benefits of appetite stimulants may be even fewer in advanced dementia than in other disease processes.

Antidepressants

In the situation of otherwise unexplained weight loss, even when symptoms of depression have not been clearly identified, a trial of an antidepressant may be reasonable. Although tricyclic antidepressants frequently result in weight gain for younger patients who consider this an unpleasant side effect, they may not produce this same effect in frail institutionalized patients. Side effects that include constipation, dry mouth, orthostatic hypotension, and urinary retention make these agents less desirable with the advent of selective serotonin reuptake inhibitors (SSRIs, e.g., sertraline, citalopram). Initial concern that SSRIs may produce weight loss in older adults has not been substantiated.⁵⁷ Mirtazapine, a multi-receptor agonist, has been associated with increased appetite and weight gain in younger patients in comparison to SSRIs. However, effectiveness of this agent in producing significant weight gain in frail older adults or patients with dementia is unknown.

Minimizing Aspiration Risk

Altering food and liquid consistency can minimize the risk of aspiration. Semi-solid consistencies are generally tolerated better than liquids. Potentially helpful techniques to minimize the risk of aspiration are upright positioning of the patient during meals and for 30 minutes after meals, tucking the chin during swallowing, swallowing multiple times with each bolus, and keeping the bolus less than one teaspoon. A speech therapist should participate in developing the treatment plan and provide staff education for implementation.

Good oral hygiene reduces the bacterial load in the mouth that can be aspirated and may decrease the risk of pneumonia. A growing number of studies indicate that angiotensin converting enzyme inhibitors may elevate substance P levels and, in so doing, stimulate cough and improve oral sensation, thus decreasing the risk of aspiration and pneumonia.⁵⁸

Feeding Tubes

Even with diligent care, weight loss may continue, and malnutrition may ensue. Both physicians and patients' surrogate decision-makers tend to have high expectations for feeding tube placement to improve nutrition, functional status, and quality of life.⁵⁹ These high expectations for improved nutritional and health status are not supported by current research. There have been no randomized clinical trials comparing tube feeding with oral feeding in the severely demented. A review of existing

literature by Finucane and colleagues found no evidence to support that tube feeding prevents aspiration pneumonia.⁶⁰ In fact, tube feeding does nothing to prevent the aspiration of oral secretions nor can it prevent aspiration from regurgitated gastric contents. Furthermore, Finucane found no evidence to support that tube feeding prevents other infections, the consequences of malnutrition, or pressure ulcers. There was no evidence to support a survival benefit, improved functional status, or greater patient comfort. Adverse events associated with feeding tubes includes aspiration pneumonia, tube occlusion, leakage, and local infection. Although the mortality during percutaneous endoscopic gastrostomy tube placement is low (0-2%), perioperative mortality ranges from 6-24%.

In circumstances where careful hand feeding has not provided adequate nutrition and has resulted in pneumonia or other complications of malnutrition, the possibility of providing food and liquid as tolerated, but allowing a natural death to occur should be considered. For the patient with severe dementia, the decision of whether or not to institute a feeding tube ultimately lies with the patient's family or guardian. However, families and physicians are often aided by advance directives that allow patients with dementia to convey their wishes regarding this issue either before or during the early stages of disease. It is important for healthcare providers to initiate conversation with the patient regarding care at the end of life when cognitive abilities will still allow a meaningful discussion. In most cases, given the current evidence, the decision for careful hand feeding without the use of a feeding tube is very appropriate. Federal regulations

should not be seen as a barrier to this course of action as long as the eating problems are properly identified and assessed and reasonable efforts to hand feed are being made.⁶¹ Careful documentation by the physician and other care providers should indicate that nutritional decline is not preventable because of the patient's advanced dementia diagnosis.

Summary Recommendations

A physician should evaluate the patient with advanced AD who is losing weight, has a low BMI, or unmet nutritional needs (e.g., pressure ulcers). A thorough medical history and physical examination should be done. The physician, nutritionist, speech therapist, nurse, direct care worker, and family should contribute to the process of evaluation and the implementation of the nutrition care plan. All of these individuals must work together to ensure that weight loss and malnutrition are recognized, evaluated, and treated. The effectiveness of each intervention must be evaluated. Maintaining nutritional health will not always be possible. All involved should understand the goals of care, which may range from expected improvement in nutritional status to supportive and palliative care in the face of an advanced and terminal condition. The goals of care are likely to evolve as assessments are made and as interventions are evaluated. The nursing home medical director and primary care physicians of individual patients must provide leadership in this process, especially when alternatives to oral feeding are considered. **NCMedJ**

REFERENCES

- Omnibus Budget Reconciliation Act of 1987. Medicare and Medicaid requirements for long-term care facilities. 42 CFT. Part 483.
- White H, Pieper C, Schmader K, Fillenbaum G. Weight change in Alzheimer's disease. *J Am Geriatr Soc* 1996;44:265-272.
- Cronin-Stubbs D, Beckett L, Scherr P, Field T, et al. Weight loss in people with Alzheimer's disease: A prospective population based analysis. *Br Med J* 1997;314:178-179.
- Du W, DiLuca C, Growdon JH. Weight loss in Alzheimer's disease. *J Geriatr Psychiatry Neurol* 1993;6:34-38.
- Wolf-Klein GP, Silerstone FA, Levy AP. Nutritional patterns and weight change in Alzheimer patients. *Int Psychogeriatr* 1992;4:103-111.
- Burns A, Marsh A, Bender DA. Dietary intake and clinical, anthropometric and biochemical indices of malnutrition in elderly demented patients and nondemented subjects. *Psychol Med* 1989;19:383-391.
- White H, Pieper C, Schmader K, Fillenbaum G. A longitudinal analysis of weight change in Alzheimer's Disease. *J Am Geriatr Soc* 1997;45(40):531-532.
- White H, Pieper C, Schmader K. The association of weight change in Alzheimer's disease with severity of disease and mortality: A longitudinal analysis. *J Am Geriatr Soc* 1998;46:1223-1227.
- Keller HH. Weight gain impacts morbidity and mortality in institutionalized older persons. *J Am Geriatr Soc* 1995;43:165-169.
- Schiffman SS, Pasternak M. Decreased discrimination of food odors in the elderly. *J Gerontol* 1979;34:73-79.
- Schiffman SS. Taste and smell losses in normal aging and disease. *JAMA* 1997;278:1357-1362.
- Schiffman SS, Clark C, Warwick Z. Gustatory and olfactory dysfunction in dementia: Not specific to Alzheimer's disease. *Neurobiol Aging* 1990;11(6):597-600.
- Serby M, Larson P, Kalkstein D. The nature and course of olfactory deficits in Alzheimer's disease. *Am J Psychiatry* 1991;148(3):357-360.
- Koss E, Weiffenbach J, Haxby J, Friedland R. Olfactory detection and identification performance are dissociated in early Alzheimer's disease. *Neurology* 1988;38(8):1228-1232.
- Murphy C, Gilmore MM, Seery CS, Salmon DP, Lasker BR. Olfactory thresholds are associated with degree of dementia in Alzheimer's disease. *Neurobiol Aging* 1990;11:465-469.
- Meshulam R, Moberg P, Mahr R, Doty R. Olfaction in neurodegenerative disease: a meta-analysis of olfactory function in Alzheimer's disease and Parkinson's disease. *Arch Neurol* 1998;55(1):84-90.
- Inui A. Cancer anorexia-cachexia syndrome: Are neuropeptides the key? *Cancer Res* 1999;59:4493-4510.
- Berry C, Clark AL. Catabolism in chronic heart failure. *Eur Heart J*. 2000;21(7):521-532.
- Griffin WS, Sheng JG, Roberts GW, Mrak RE. Interleukin-1 expression in different plaque types in Alzheimer's disease: Significance in plaque evolution. *J Neuropathol Exp Neurol* 1995;54:276-281.
- Griffin WS, Sheng JG, Royston MC, Gentleman SM, McKenzie JE, Graham DI, Roberts GW, Mrak RE. Glial-neuronal interactions in Alzheimer's disease: The potential role of a 'cytokine cycle' in disease progression. *Brain Pathol* 1998;8:65-72.
- Ringheim GE, Szczepanik AM, Petko W, Burgher KL, Zhu SZ, Chao CC. Enhancement of beta-amyloid precursor protein transcription and expression by the soluble interleukin-6

- receptor/interleukin-6 complex. *Mol Brain Res* 1998;55:35-44.
- 22 Hull M, Berger M, Volk B, Bauer J. Occurrence of interleukin-6 in cortical plaques of Alzheimer's disease patients may precede transformation of diffuse into neuritic plaques. *Ann NY Acad Sci* 1996;777:205-212.
 - 23 Volicer L, Seltzer B, Rheume Y, et al. Eating difficulties in patients with probable dementia of the Alzheimer type. *J Geriatr Psych Neurol* 1989;2:188-195.
 - 24 Blandford G, Watkins LB, Mulvihill M, Taylor B. Correlations of aversive feeding behaviors in dementia patients. *J Am Geriatr Soc* 1995;43:SA10, P4.
 - 25 Morris CH, Hope RA, Fairburn CG. Eating habits in dementia. *Br J Psych* 1989;154:801-806.
 - 26 van de Nes JAP, Kamphorst W, Ravid R, Swaab DF. The distribution of Alz-50 immunoreactivity in the hypothalamus and adjoining areas of Alzheimer's disease patients. *Brain* 1993;116:103-115.
 - 27 Swaab DF, Grundke-Iqbal I, Iqbal K, Kremer HPH, Ravid R, van de Nes JAP. Tau and ubiquitin in the human hypothalamus in aging and Alzheimer's disease. *Brain Res* 1992;590:239-49.
 - 28 Horner J, Alberts MJ, Dawson DV, Cook GM. Swallowing in Alzheimer's disease. *Alzheimer's Dis & Assoc Disorders* 1994;8(3):177-189.
 - 29 Chouinard J, Lavigne E, Villeneuve C. Weight loss, dysphagia, and outcome in advanced dementia. *Dysphagia* 1998;13(3):151-155.
 - 30 Priefer BA, Robbins J. Eating changes in mild-stage Alzheimer's disease: a pilot study. *Dysphagia* 1997;12(4):212-221.
 - 31 Donaldson KE, Carpenter WH, Toth MJ, Goran MI, Newhouse P, Poehlman ET. No evidence for a higher resting metabolic rate in non-institutionalized Alzheimer's patients. *J Am Geriatr Soc* 1996;44:1232-1234.
 - 32 Niskanen L, Piirainen M, Koljonen M, Uusitupa M. Resting energy expenditure in relation to energy intake in patients with Alzheimer's disease, multiinfarct dementia and in control women. *Age Ageing* 1993;22:132-137.
 - 33 Poehlman ET, Toth MJ, Goran MI, Carpenter WH, Newhouse P, Rosen CJ. Daily energy expenditure in free-living non-institutionalized Alzheimer's patients: A doubly labeled water study. *Neurology* 1997;48:997-1002.
 - 34 Gillete-Guyonnet S, Nourhashemi F, Andrieu S, deGlisezinski I, Ousset PJ, Riviere D, et al. Weight Loss in Alzheimer's disease. *Am J Clin Nutr* 2000;71(suppl):637S-42S.
 - 35 White HK, McConnell ES, Bales CW, Kuchibhahtia M. A 6-month observational study of the relationship between weight loss and behavioral symptoms in institutionalized AD subjects. *J Am Med Dir Assoc*, in press.
 - 36 White, HK. Dementia. In: Bales, CW, Ritchie, SC (eds.) *Handbook of Clinical Nutrition and Aging*. Humana Press, Totowa, New Jersey, 2004, pp. 349-365.
 - 37 Council for Nutrition: *Clinical Strategies in Long Term Care: Clinical Guide to Prevent and Manage Malnutrition in Long-Term Care*. Programs in Medicine, Philadelphia, PA, 2000.
 - 38 Rogers SL, Farlow MR, Doody RS, Mohs R et al. A 24-week, double-blind, placebo-controlled trial of donepezil in patients with Alzheimer's disease. *Neurology* 1998;50:136-145.
 - 39 Rosler M, Anand R, Cicin-Sain A, Gauthier S, et al. Efficacy and safety of rivastigmine in patients with Alzheimer's disease: international randomized controlled trial. *Br Med J* 1999;318(7184):633-640.
 - 40 Rasking MA, Peskind ER, Wessel T, Yuan W, et al. Galantamine in AD: A 6-month randomized, placebo-controlled trial with a 6-month extension. *Neurology* 2000;54(12):2261-2268.
 - 41 Langmore SE, Terpenning MS, Schork A, Chen Y, et al. Predictors of aspiration pneumonia: How important is dysphagia? *Dysphagia* 1998;13:69-81.
 - 42 Soltesz KS, Dayton JH. Finger foods help those with Alzheimer's maintain weight. *J Am Diet Assoc* 1993;93:1106-1108.
 - 43 Winograd CH, Brown EM. Aggressive oral refeeding in hospitalized patients. *Am J Clin Nutr* 1990;52:967-968.
 - 44 Mathey MAM, Vanneste VGG, de Graaf C, de Groot LCPGM, et al. Health effects of improved meal ambiance in a Dutch nursing home: a 1-year intervention study. *Preventive Med* 2001;32:416-423.
 - 45 Ragneskog H, Brane G, Karlsson I, et al. Influence of dinner music on food intake and symptoms common in dementia. *Scand J Caring Sci* 1996;10:11-17.
 - 46 Denny A. Quiet music: An intervention for mealtime agitation? *J Gerontol Nurs* 1997;23:16-23.
 - 47 Amella EJ. Factors influencing the proportion of food consumed by nursing home residents with dementia. *J Am Geriatr Soc* 1999;47:879-885.
 - 48 Mathey MAM, Sieblink E, de Graaf C, Van Staveren WA. Flavor enhancement of food improves dietary intake and nutritional status of elderly nursing home residents. *J Gerontology: Med Sci* 2001;56A(4):M200-205.
 - 49 Lauque S, Arnaud-Battandier F, Mansourian R, Guigoz Y, et al. Protein-energy oral supplementation in malnourished nursing-home residents. A controlled trial. *Age Ageing* 2000;29:51-56.
 - 50 Fiatarone Singh MA, Bernstein MA, Ryan AD, et al. The effect of oral nutritional supplements on habitual dietary quality and quantity in frail elders. *J Nutr Health & Aging* 2000;4(1):5-12.
 - 51 Rudman D, Abbasi AA, Isaacson K, Karpiuk E. Observations on the nutrient intakes of eating-dependent nursing home residents: Underutilization of micronutrient supplements. *J Am Coll Nutr* 1995;14(6):604-613.
 - 52 LaRue A, Koehler KM, Wayne SJ, Chiulli SJ, Haaland KY, Garry PJ. Nutritional status and cognitive functioning in normally aging sample: A 6-year reassessment. *Am J Clin Nutr* 1997;65:20-29.
 - 53 Perrig WJ, Perrig P, Stehelin B. The relation between antioxidants and memory performance in the old and very old. *J Am Geriatr Soc* 1997;45:718-724.
 - 54 Goodwin JS, Goodwin JM, Garry PJ. Association between nutritional status and cognitive functioning in a healthy elderly population. *JAMA* 1983;249:2917-2921.
 - 55 Yeh SS, Wu SY, Lee TP, Olson JS, et al. Improvement in quality-of-life measures and stimulation of weight gain after treatment with megestrol acetate oral suspension in geriatric cachexia: Results of a double-blind, placebo-controlled study. *J Amer Geriatr Soc*. 2000;48(5):485-492.
 - 56 Yeh SS, Wu SY, Levine DM, Parker TS, et al. The correlation of cytokine levels with body weight after megestrol acetate treatment in geriatric patients. *Journals of Gerontology Series A-Biological Sciences & Medical Sciences*. 2001;56(1):M48-54.
 - 57 Rigler SK, Webb MJ, Redford L, Brown EF, et al. Weight outcomes among antidepressant users in nursing facilities. *J Am Geriatr Soc* 2001;49:49-55.
 - 58 Marik PE, Kaplan D. Aspiration pneumonia and dysphagia in the elderly. *Chest* 2003;124:328-336.
 - 59 Cox CE, Lewis CL, Carey TS, Garrett JM, et al. Expectations and outcomes of feeding tube placement from the perspective of patients' surrogates and physicians. *JGIM* 2002;17(S1):187.
 - 60 Finucane TE, Christmas C, Travis K. Tube feeding in patients with advanced dementia: a review of the evidence. *JAMA* 1999;282(14):1365-1370.
 - 61 Gillick MR. Rethinking the role of tube feeding in patients with advanced dementia. *N Eng J Med* 2000;342(3):206-210.
 - 62 Sokoloff LG, Pavlakovic R. Neuroleptic induced dysphagia. *Dysphagia* 1997;12:177-179.