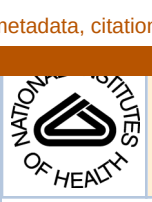

Published in final edited form as:

J Am Geriatr Soc. 2011 March ; 59(3): 463–472. doi:10.1111/j.1532-5415.2011.03320.x.

Oral Feeding Options for Patients with Dementia: A Systematic Review

Laura C. Hanson, MD, MPH[1,2], **Mary Ersek, PhD, RN**[3], **Robin Gilliam, MSW**[2], and **Timothy S. Carey, MD, MPH**[2,4]

[1]Division of Geriatric Medicine and Center for Aging and Health, University of North Carolina at Chapel Hill, Chapel Hill, NC

[2]The Cecil G. Sheps Center for Health Services Research, University of North Carolina at Chapel Hill, Chapel Hill, NC

[3]School of Nursing, University of Pennsylvania, Philadelphia, PA

[4]Division of General Internal Medicine and Clinical Epidemiology, University of North Carolina at Chapel Hill, Chapel Hill, NC

Abstract

Background—Most patients with dementia develop feeding problems, leading physicians and families to consider tube feeding or oral feeding options. Tube feeding offers limited benefit, but current decision-making includes limited information on other options.

Objectives—To review the evidence for oral feeding options in dementia.

Design—Systematic review.

Setting—PubMed/MEDLINE, EMBASE, the Cochrane Library, CINAHL and PsychINFO literature indices between January 1990 and October 2009.

Participants—Clinical trials with random or non-random control groups were included if they reported on clinical outcomes of oral feeding interventions for patients with dementia.

Measurements—Systematic literature search with review of potentially eligible studies by two independent investigators. Investigators abstracted data from included studies using a structured instrument. Studies were graded on quality and potential bias, and overall strength of evidence summarized.

Results—Thirteen controlled trials provide data on use of supplements for patients with dementia, and twelve controlled trials test assisted feeding or other interventions. Studies provide moderate strength evidence for high calorie supplements, and low strength evidence for appetite stimulants, assisted feeding and modified foods to promote weight gain in dementia. The few studies measuring function or survival showed no difference.

Conclusion—High calorie supplements and other oral feeding options can help dementia patients with feeding problems to gain weight; they are unlikely to improve other outcomes. These treatments can be offered alone or in combination as an alternative to tube feeding.

Corresponding author: Laura C. Hanson, MD, MPH, Division of Geriatric Medicine, Cecil B. Sheps Center for Health Services Research, CB 7550, University of North Carolina, Chapel Hill, NC 27599-7550, lhanson@med.unc.edu.

Conflict of Interest: The editor in chief has reviewed the conflict of interest checklist provided by the authors and has determined that the authors have no financial or any other kind of personal conflicts with this paper.

Author Contributions: Study concept, design, data analysis and interpretation, preparation of manuscript: Hanson, Ersek, Gilliam, Carey

Keywords

dementia; oral feeding

INTRODUCTION

Dementia is a syndrome of decline in cognitive domains causing functional impairment. In early dementia taste and smell dysfunction, medications or depression may reduce intake. [1] In advanced dementia apraxia and attention deficits interfere with self-feeding, and dysphagia causes choking or food avoidance.[2] Feeding problems cause important health effects such as weight loss, dehydration, poor wound healing, and pneumonia. In the CASCADE Study 86% of persons with advanced dementia developed a feeding problem, and onset was associated with 39% mortality at 6 months.[3]

Treatments include medical feeding through a feeding tube, or modifications of oral feeding including high calorie supplements, appetite stimulants, modified foods, enhanced dining environments or personal assistance. The use of feeding tubes has increased for patients with serious illness, particularly dementia and other neurologic diseases.[4,5,6,7] Controlled observational studies of persons with dementia provide evidence tube feeding does not prolong life or promote wound healing.[8,9,10,11]

Physicians and families make choices about feeding in dementia. Interview studies suggest they expect benefits from tube feeding that exceed actual outcomes.[12,13] Consent for feeding tubes usually focuses on procedural risks, with limited information on outcomes and alternatives.[14,15] If the choice is framed as opting for or against tube feeding, families may fear starvation without understanding other options.

To enhance evidence-based decision-making, we conducted a systematic review of oral feeding options in dementia. We aimed to answer two key questions for dementia care: 1) does the addition of high calorie supplements improve clinical outcomes including weight gain, function or survival; and 2) do other oral feeding interventions such as appetite stimulants, assisted feeding or modified diets improve outcomes?

METHODS

Data Sources

Assisted by an experienced health services librarian, investigators searched PubMed/MEDLINE, EMBASE, the Cochrane Library, CINAHL and PsychINFO literature indices between January 1990 and October 2009. Searches used a combination of medical subheadings, keywords and text words. We used search terms for dementia and long-term care in combination with terms to identify interventions for nutrition or feeding problems. (Table 1) We added evaluation terms to ensure we did not miss smaller studies. Reference lists of selected studies were hand searched for additional clinical trials.

Eligibility and Study Selection

Investigators defined eligibility prior to searches using the PICOT framework.[16] This framework designates 1) population, 2) intervention, 3) comparison groups, 4) outcomes, and 5) time frame for outcomes. (Table 2) Eligible studies were in English. Study participants were aged 50 or older, with dementia of any stage or etiology, and evidence of a feeding problem. Initially, we planned to include only studies of dementia. Because some study populations varied in cognitive status, we accepted those that combined frail older persons with and without dementia. Participants could be in any setting – community, long-

term care or hospital. Eligible interventions included 1) prescribed use of high calorie or protein supplements, or 2) other interventions such as appetite stimulants, modified diets, assistance in feeding, or modified dining environments. Supplements without caloric value, such as vitamins, were excluded. We required a comparator group, but accepted randomized or non-randomized controls including pre-post design. Studies had to address at least one major clinical outcome, including survival, hospitalization, pneumonia, aspiration, function, quality of life, weight change, or wound healing, with follow-up of at least 1 month. Intermediate outcomes such as serum proteins or amount of intake were excluded. Two investigators (RG, LCH) reviewed all titles and abstracts, and excluded duplicates, studies that were not clinical trials, studies with ineligible interventions, and studies excluding dementia.

Data abstraction and quality assessment

Three investigators reviewed all full text articles (RG, LCH, ME). Two investigators reached consensus on abstracted data on methods, results, study quality and potential sources of bias. A third investigator settled cases of disagreement. The structured abstraction tool recorded study size, dementia diagnosis and severity, type of feeding problems, intervention and control conditions, type of controls, outcome definitions and results, time to follow-up, study setting, as well as methods indicative of study quality.

Two investigators graded each included study on: 1) the strength of evidence and 2) risk of bias using the Cochrane rating approach.[17] Strength of evidence was graded A if randomized, placebo-controlled, with concealed allocation; B if randomized without clearly defined concealment; and C if not randomized and concealment inadequate. Risk of bias was rated on type of controls, methods of double or single blinding, well-specified outcomes, well-specified inclusion criteria, >75% complete outcome assessment, risk of confounding bias, and intention to treat analysis. Studies meeting 5–7 of these criteria were judged to have low risk, those meeting 3–4 had medium risk, and those meeting 0–2 had high risk of bias. Data tables were created for summative assessment of evidence for each key question. Investigators used the PRISMA Statement to guide reporting of evidence, and AHRQ comparative effectiveness review guidelines and GRADE criteria for overall strength of evidence.[18,19,20]

RESULTS

Databases identified 1147 potential studies, and hand searches 65, representing 912 unduplicated publications. Abstract and title review excluded 802, leaving 110 articles for full-text review. Eighty-five studies failed to meet PICOT criteria (n=69) or did not test an intervention (n=16), leaving 25 studies for review. (Figure)

Studies of High Calorie Supplements for Dementia

We identified 13 original studies that examined the effect of high calorie supplements on clinical outcomes for feeding problems in dementia. [21,22,23,24,25,26,27,28,29,30,31,32,33] Studies examined a variety of outcomes meeting our criteria – change in weight or body mass index, mortality, morbidity, wound healing, physical or cognitive function. (Table 3) Follow-up varied from 1 month to 1 year. Ten studies found evidence for benefit using at least one outcome. Nine of twelve studies examining weight or body mass index found improvement. One study found improved pressure ulcer healing with supplementation.[23] Four studies measuring function, three measuring cognition, and one measuring mortality found no differences with supplementation. One study reported reduced infections at 1 year (47% vs 66%, p=0.05).[25]

Quality of Studies of High Calorie Supplements for Dementia

Between 1990 and 2009, two high quality randomized clinical trials have addressed the effectiveness of high calorie supplements for dementia patients. (Table 4) Wouters-Wessling randomized 35 nursing home residents with moderate to severe dementia and low body mass index to a micronutrient-enriched supplement compared to placebo.[31] Controls lost an average of 0.8 kg over 12 weeks, while intervention subjects gained 1.4 kg. Cereda enrolled 28 nursing home residents with Stage II–IV pressure ulcers to receive a high calorie, high protein supplement with micronutrients compared to usual diets.[23] Although this study met inclusion criteria, two-thirds of participants used tube feeding and only one-third used oral nutrition for prescribed supplements. Wound healing was more rapid in the intervention group over 12 weeks, with mean reduction of wound size of 75% vs 45% ($p<0.005$).

Nine additional randomized trials provided Grade B evidence for supplement use in dementia, and six demonstrated benefit. One additional trial with concerns for inadequate randomization and one study using pre-post design provided lower quality evidence. Lower and higher quality studies had similar outcomes. Study populations varied in the severity of cognitive impairment and nutritional problems, yet weight gains were consistently 0.5–2.0 kg. Studies rarely reported potential harms from supplements. In one study, 5 of 31 (16%) subjects, particularly those with lower baseline weight, reduced their lunch intake after the supplement.[33]

Studies of Assisted Feeding and Other Interventions

We identified 12 studies of diverse nutritional and environmental interventions to improve clinical outcomes for dementia patients.[34,35,36,37,38,39,40,41,42, 43,44,45] Interventions included appetite stimulants (3); changes in environment with buffet-style dining (1) or music (1); thickened liquid or semi-solid food (2); or individualized nutritional care plans (4) including exercise (1). Ten studies used weight or body mass index as outcomes; six found positive effects. (Table 3) Follow-up ranged from 3–12 months. Function and mortality were rarely studied; two trials using these outcomes found no benefit.[35,39] Three studies tested effects of feeding interventions on behaviors, with mixed results.[36,43,45]

Three studies tested appetite stimulants for dementia patients. Volicer found dronabinol improved weight and reduced negative affect with a trend toward improving disruptive behaviors.[43, 43] Yeh randomized nursing home residents to megestrol acetate 800 mg or placebo. Analyzing subjects with complete data, 43% of the intervention vs. 18% of the placebo group gained > 1.82 kg over 12 weeks, but those with advanced dementia were less likely to respond.[44] A pilot study of megestrol demonstrated no change in weight, but secondary analyses suggested benefit when combined with optimal assisted feeding.[41]

Four non-medication interventions showed positive effects on weight, including chocolate and exercise, enhanced dietician time, lyophilized foods with modified texture, and feeding assistance.[34,37,40,42] One other study of enhanced dietician care had no effect, but enrolled less cognitively and nutritionally impaired patients.[35] Buffet style dining at one meal a day had no effect on weight.[38] A randomized trial of chin down posture compared to thickened liquids found no differential effect for aspiration; investigators commented a “usual care” control could not be used due to ethical concerns.[39]

Quality of Studies of Assisted Feeding and Other Interventions

The two high quality randomized trials in this group tested appetite stimulants and found beneficial effects on weight. (Table 4) Six additional randomized trials of non-medication interventions provided Grade B evidence with low to medium risk of bias. Four additional studies used non-random controls to test enhanced nutritional assessment, use of calming

music, and megestrol. We detected no correlation between study quality and likelihood of positive results.

Four studies explicitly collected and reported data on harms. One randomized trial comparing chin down posture to thickened liquids as interventions to prevent aspiration pneumonia found that 23% of participants experienced an adverse event. Adverse events were equal between groups, but the combined outcome of fever or urinary infection or dehydration tended to be more common for the thickened liquid group (9% vs. 5%, p=0.055).[39] In a randomized trial of lyophilized food compared to nutritional advice, nearly all deaths or hospitalizations involved patients with more advanced dementia, but rates did not differ between groups.[40] In Simmons' study of megestrol, nearly half of 17 participants reported new fatigue or loss of strength; 5 reported leg swelling but information on thrombotic disease was not provided.[41] Finally, in a placebo-controlled study of dronabinol, one patient on treatment had a seizure, and the active treatment phase was marked by increases in somnolence and euphoria.[43]

Overall Strength of Evidence for Oral Feeding Interventions in Dementia

The evidence base for oral feeding options in dementia includes an encouraging number of randomized trials with low to medium risk of bias. Examining both the quantity and quality of research, there is moderate evidence to support the use of high calorie supplements to improve weight for patients with dementia and feeding problems, and low evidence these supplements promote wound healing and reduce infection risk. For the outcome of weight gain, current research offers low evidence for appetite stimulants, assisted feeding and modified foods. Findings regarding weight gain are consistent among trials, nearly uniformly positive, and effect size for supplements can be estimated at 0.5–2.0 kg of weight gain over 1–6 months. Evidence is sparse but consistent in showing no effect of oral feeding options on function, cognition or mortality for patients with moderate to severe dementia.

DISCUSSION

This systematic review summarizes research on oral feeding in dementia. High calorie supplements are an evidence-based option to promote weight gain for patients with dementia and feeding problems. Assisted feeding, appetite stimulants, and modified foods may also improve weight, and treatments can be used individually or in combination. Based on current evidence, specialized oral feeding interventions are unlikely to change how patients with dementia function or how long they live.

Our results are consistent with a meta-analysis which found protein energy supplementation improved nutrition and reduced morbidity and mortality for undernourished older hospitalized patients.[46] Another systematic review found moderate evidence to support use of supplements for healing of pressure ulcers.[47] The single study in this review demonstrating wound healing included patients who were both tube fed and orally fed, limiting clear conclusions about oral supplements and pressure ulcer healing. To be effective, prescribed supplements must be ingested. Incomplete administration of supplements occurs in practice, and is associated with weight loss among nursing home residents with dementia.[48]

This systematic review combines studies that are heterogeneous in the dementia status and feeding problems of enrolled participants, interventions, and outcome measures, precluding meta-analysis. Variation in baseline dementia severity and nutritional status of study subjects raises questions about optimal timing for nutritional interventions in the progression of dementia. Many studies target moderate to severe dementia, but are too small to stratify findings by stage. Some studies enrolled patients at risk for nutritional decline, while others

enrolled patients with clear indications of nutritional insufficiency. Findings from individual studies suggest that interventions may be ineffective when initiated before nutrition is a major issue, or for very advanced dementia or very low body mass index, when interventions may be too late. This review focused on dementia, and results may not extend to other populations with nutritional problems.

Our review did identify several areas for improvement in this body of research. Future studies will be strengthened by careful definition of dementia stage and feeding problems of the enrolled subjects. Study of more complex, programmatic interventions make double blinding difficult; single-blinding of outcome assessment and concealment of randomization allocation can avoid important sources of bias. Several studies that demonstrated positive results were supported by manufacturers of nutritional supplements; it is unclear whether or not reporting bias (i.e., failure to publish studies with negative findings) affected the available published literature. Current evidence relies on numerous single-site small studies (average sample size n=73). Future interventions, and combinations of promising interventions in comprehensive nutritional programs, could be tested in multi-site randomized trials. Investigators should be encouraged to design trials that view intake and weight gain as intermediate outcomes, so as to provide stronger evidence about the effects on function, behavior, infection risk and wound healing. Ethical concerns about withholding feeding treatments may limit the range of possible control conditions, including a randomized comparison of oral assisted feeding to tube feeding.

Feeding treatments choices may cause great legal, ethical and clinical controversy, and remain emotionally difficult for family caregivers.[49] State laws reflect this controversy, and many set stricter legal requirements, such as health status or explicit evidence of patient wishes, in order to withhold or withdraw medical forms of nutrition and hydration. Patients, and families of patients with dementia, may rely heavily on medical advice to understand other treatment options. No randomized trials of tube feeding compared to oral feeding exist, but observational studies of dementia patients indicate tube feeding is not superior for promoting survival, function or wound healing. In these observational studies, patients without tube feeding served as controls and many may have received oral feeding treatments included in this review.

Nearly all patients with advanced dementia develop feeding problems. Health care providers may confidently advise families that high calorie supplements, perhaps in combination with assisted feeding, foods modified in taste or texture, and appetite stimulants can promote weight gain for several months. Given the progressive nature of dementia, families should be counseled not to expect improvements in function or survival with any available form of feeding. In end-stage dementia, oral feeding may no longer be possible, and tastes and sips of food combined with mouth care may be used to promote comfort.[50] Families and health care providers may improve the quality of informed decision-making using current evidence for oral feeding options in dementia.

Acknowledgments

This research was funded by the National Institute for Nursing Research, R01 NR009826

Sponsor's Role: The sponsor had no role in the design, methods, subject recruitment, data collection, analysis or writing of this manuscript.

References

1. Morris J, Volicer L. Nutritional management of individuals with Alzheimer's disease and other progressive dementias. Nutr Clin Care. 2001; 4:148–155.

2. Volicer L, Seltzer B, Rheaume Y, et al. Eating difficulties in patients with probable dementia of the Alzheimer type. J Geriatr Psych Neurol. 1989; 2:188–195.
3. Mitchell SL, Teno JM, Kiely DK, et al. The clinical course of advanced dementia. N Engl J Med. 2009; 361:1529–1538. [PubMed: 19828530]
4. Lewis CL, Cox CE, Garrett JM, et al. Trends in the use of feeding tubes in North Carolina Hospitals: 1989 to 2000. J Gen Intern Med. 2004; 19:1034–1038. [PubMed: 15482556]
5. Rabeneck L, Wray NP, Petersen NJ. Long-term outcomes of patients receiving percutaneous endoscopic gastrostomy tubes. J Gen Intern Med. 1996; 11:287–293. [PubMed: 8725977]
6. Callahan CM, Haag KM, Weinberger M, et al. Outcomes of percutaneous endoscopic gastrostomy among older adults in a community setting. J Am Geriatr Soc. 2000; 48:1048–1054. [PubMed: 10983903]
7. Mitchell SL, Teno JM, Roy J, et al. Clinical and organizational factors associated with feeding tube use among nursing home residents with advanced cognitive impairment. JAMA. 2003; 290:73–80. [PubMed: 12837714]
8. Mitchell SL, Kiely DK, Lipsitz LA. The risk factors and impact on survival of feeding tubes in nursing home residents with advanced dementia. Arch Intern Med. 1997; 157:327–332. [PubMed: 9040301]
9. Meier DE, Aronheim JC, Morris J, et al. High short-term mortality in hospitalized patients with advanced dementia: lack of benefit of tube feeding. Arch Intern Med. 2001; 161:594–599. [PubMed: 11252121]
10. Murphy LM, Lipman TO. Percutaneous endoscopic gastrostomy does not prolong survival in patients with dementia. Arch Intern Med. 2003; 163:1351–1353. [PubMed: 12796072]
11. Sampson, EL.; Candy, B.; Jones, L. Enteral tube feeding for older people with advanced dementia. http://www2.cochrane.org/reviews/en/ab007209.html. Published Jan, 2009, viewed May 20, 2009
12. Carey TS, Hanson LC, Garrett JM, et al. Expectations and outcomes of gastric feeding tubes. Am J Med. 2006; 119:527.e11–16. [PubMed: 16750971]
13. Hanson LC, Garrett JM, Lewis C, et al. Physicians' expectations of benefit from tube feeding. J Pall Med. 2008; 11:1130–1134.
14. Brett AS, Rosenberg JC. The adequacy of informed consent for placement of gastrostomy tubes. Arch Intern Med. 2001; 161:745–748. [PubMed: 11231709]
15. Lewis CL, Hanson LC, Golin C, et al. Surrogates' perceptions about feeding tube placement decisions. Patient Educ Couns. 2006; 61:246–52. [PubMed: 16503108]
16. Rios LP, Ye C, Thabane L. Association between framing of the research question using the PICOT format and reporting quality of randomized controlled trials. BMC Med Res Methodol. 2010; 10:11. Published online 2010 February 5. 10.1186/1471-2288-10-11 [PubMed: 20137069]
17. Higgins, JPT.; Green, S., editors. Cochrane Handbook for Systematic Reviews of Interventions version 5.0.0. The Cochrane Collaboration; 2008. www.cochranehandbook.org. Viewed 12/10/09
18. Moher D, Liberati A, Tetzlaff J, et al. Preferred reporting items for systematic reviews and meta-analyses: the PRISMA Statement. Ann Intern Med. 2009; 151:264–269. [PubMed: 19622511]
19. Owens, DK.; Lohr, KN.; Atkins, D., et al. Grading the strength of a body of evidence when comparing medical interventions. Agency for Healthcare Research and Quality; http://www.effectivehealthcare.ahrq.gov/ehc/products/122/328/2009_0805_grading.pdf. Viewed 7/13/10
20. Guyatt GH, Oxman AD, Vist GE, et al. GRADE Working Group. GRADE: An emerging consensus on rating quality of evidence and strength of recommendations. BMJ. 2008; 336:924–926. [PubMed: 18436948]
21. Beck AM, Ovesen L, Schroll M. Home-made oral supplement as nutritional support of old nursing home residents, who are undernourished or at risk of undernutrition based on the MNA. A pilot trial. mini nutritional assessment. Aging Clin Exp Res. 2002; 14:212–215. [PubMed: 12387530]
22. Carver AD, Dobson AM. Effects of dietary supplementation of elderly demented hospital residents. J Hum Nutr Dietet. 1995; 8:389–394.
23. Cereda E, Gini A, Pedrolli C, et al. Disease-specific, versus standard, nutritional support for the treatment of pressure ulcers in institutionalized older adults: A randomized controlled trial. J Am Geriatr Soc. 2009; 57:1395–1402. [PubMed: 19563522]

24. Gazzotti C, Arnaud-Battandier F, Parello M, et al. Prevention of malnutrition in older people during and after hospitalisation: Results from a randomised controlled clinical trial. Age Ageing. 2003; 32:321–325. [PubMed: 12720620]
25. Gil Gregorio P, Ramirez Diaz SP, Casado Ribera, et al. Dementia and nutrition. intervention study in institutionalized patients with Alzheimer disease. J Nutr Health Aging. 2003; 7:304–308. [PubMed: 12917745]
26. Kwok T, Woo J, Kwan M. Does low lactose milk powder improve the nutritional intake and nutritional status of frail older Chinese people living in nursing homes? J Nutr Health Aging. 2001; 5:17–21. [PubMed: 11250664]
27. Lauque S, Arnaud-Battandier F, Mansourian R, et al. Protein-energy oral supplementation in malnourished nursing-home residents. A controlled trial. Age Ageing. 2000; 29:51–56. [PubMed: 10690696]
28. Lauque S, Arnaud-Battandier F, Gillette S, et al. Improvement of weight and fat-free mass with oral nutritional supplementation in patients with alzheimer's disease at risk of malnutrition: A prospective randomized study. J Am Geriatr Soc. 2004; 52:1702–1707. [PubMed: 15450048]
29. Parrott MD, Young KW, Greenwood CE. Energy-containing nutritional supplements can affect usual energy intake postsupplementation in institutionalized seniors with probable Alzheimer's disease. J Am Geriatr Soc. 2006; 54:1382–1387. [PubMed: 16970646]
30. Planas M, Conde M, Audivert S, et al. Micronutrient supplementation in mild Alzheimer disease patients. Clin Nutr. 2004; 23:265–272. [PubMed: 15030967]
31. Wouters-Wesseling W, Wouters AE, Kleijer CN, et al. Study of the effect of a liquid nutrition supplement on the nutritional status of psycho-geriatric nursing home patients. Eur J Clin Nutr. 2002; 56:245–251. [PubMed: 11960300]
32. Wouters-Wesseling W, Slump E, Kleijer CN, et al. Early nutritional supplementation immediately after diagnosis of infectious disease improves body weight in psychogeriatric nursing home residents. Aging Clin Exp Res. 2006; 18:70–74. [PubMed: 16608139]
33. Young KW, Greenwood CE, van Reekum R, et al. Providing nutrition supplements to institutionalized seniors with probable Alzheimer's disease is least beneficial to those with low body weight status. J Am Geriatr Soc. 2004; 52:1305–1312. [PubMed: 15271118]
34. Beck AM, Damkjaer K, Beyer N. Multifaceted nutritional intervention among nursing-home residents has a positive influence on nutrition and function. Nutrition. 2008; 24:1073–1080. [PubMed: 18586458]
35. Crogan NL, Alvine C, Pasvogel A. Improving nutrition care for nursing home residents using the INRx process. J Nutr Elder. 2006; 25:89–103. [PubMed: 18032218]
36. Goddaer J, Abraham IL. Effects of relaxing music on agitation during meals among nursing home residents with severe cognitive impairment. Arch Psych Nurs. 1994; 8:150–158.
37. Keller HK, Gibbs AJ, Boudreau LD, et al. Prevention of weight loss in dementia with comprehensive nutritional treatment. J Am Geriatr Soc. 2003; 51:945–951. [PubMed: 12834514]
38. Remsburg, Re; Luking, A.; Baran, CR., et al. Impact of a buffet-style dining program on weight and biochemical indicators of nutritional status in nursing home residents: A pilot study. J Am Diet Assoc. 2001; 101:1460–1463. [PubMed: 11762743]
39. Robbins J, Gensler G, Hind J, et al. Comparison of two interventions for liquid aspiration on pneumonia incidence: A randomized trial. Ann Intern Med. 2008; 148:509–518. [PubMed: 18378947]
40. Salas-Salvado J, Torres M, Planas M, et al. Effect of oral administration of a shole formula diet on nutritional and cognitive status in patients with Alzheimer's disease. Clin Nutr. 2005; 24:390–397. [PubMed: 15896425]
41. Simmons SF, Walker KA, Osterweil D. The effect of megestrol acetate on oral food and fluid intake in nursing home residents: A pilot study. J Am Med Dir Assoc. 2004; 4:24–30. [PubMed: 14706125]
42. Simmons SF, Keeler E, Zhuo X, et al. Prevention of unintentional weight loss in nursing home residents: A controlled trial of feeding assistance. J Am Geriatr Soc. 2008; 56:1466–1473. [PubMed: 18637983]

43. Volicer L, Stelly M, Morris J, et al. Effects of dronabinol on anorexia and disturbed behavior in patients with Alzheimer's disease. Int J Geriat Psychiatry. 1997; 12:913–919.
44. Yeh SS, Wu SU, Lee TP, 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 Am Geriatr Soc. 2000; 48:485–492. [PubMed: 10811540]
45. Young KWH, Greenwood CE, van Reekum R, et al. A randomized, crossover trial of high-carbohydrate foods in nursing home residents with Alzheimer's disease: Associations among intervention response, body mass index, and behavioral and cognitive function. J Gerontol A Biol Sci Med Sci. 2005; 60A:1039–1045. [PubMed: 16127110]
46. Milne AC, Avenell A, Potter J. Meta-analysis: Protein and energy supplementation in older people. Ann Intern Med. 2006; 144:37–48. [PubMed: 16389253]
47. Stratton RJ, Ek AC, Engfer M, et al. Enteral nutritional support in prevention and treatment of pressure ulcers: A systematic review and meta-analysis. Ageing Res Rev. 2005; 4:422–450. [PubMed: 16081325]
48. Simmons SF, Patel AV. Nursing home staff delivery of oral liquid nutritional supplements to residents at risk for unintentional weight loss. J Am Geriatr Soc. 2006; 54:1372–1376. [PubMed: 16970644]
49. Ritchie CS, Wilcox CM, Kvale E. Ethical and medicolegal issues related to percutaneous endoscopic gastrostomy placement. Gastrointest Endosc Clin N Am. 2007; 17:805–815. [PubMed: 17967384]
50. Palecek EJ, Teno JM, Casarett D, et al. Comfort feeding only: A proposal to bring clarity to decision making regarding difficulty with eating for persons with advanced dementia. J Am Geriatr Soc. 2010; 58:580–584. [PubMed: 20398123]

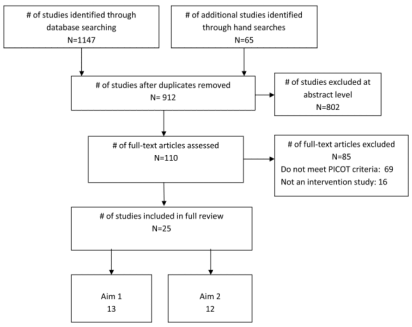

Figure.
Flow of information for systematic review of feeding interventions

Table 1

Search Terms Used for All Databases

Dementia – dementia OR Alzheimer disease, OR dementia, multi- infarct
Long-term care populations – nursing homes OR long-term care OR institutionalized elders OR institutionalized seniors
Feeding – malnutrition OR weight loss OR inhalation OR dehydration OR eating problems OR decreased intake OR nutrition OR eating OR deglutition disorders, OR weight gain, OR anorexia, OR airway obstruction OR choking OR energy intake, OR feeding behavior, OR failure to thrive OR aspiration OR dysphagia OR dietary supplements
Feeding methods – feeding methods OR hand feeding OR feeding programs OR assisted feeding OR dining program OR restorative dining OR feeding aide OR nutritional support OR supplementation
Clinical trial or intervention study or systematic review – randomized controlled trials OR single-blind method OR double-blind method OR random allocation OR systematic reviews OR evaluation studies OR program evaluation

Table 2

PICOT Criteria and Search Strategy

Population of interest	Inclusions: Adults (age 50 years and older) with any type or stage of dementia who have evidence of a feeding problem as defined by weight loss, dysphagia, or decreased intake or other evidence of risk of nutritional decline
Intervention of Interest	Inclusions: high calorie and/or high protein supplements, assisted feeding, feeding aide programs, enhanced dining programs, modified diets, appetite stimulants Exclusion: supplements without caloric value, e.g., vitamin supplements
Comparison	Any comparison group, including randomized control group; historical control; matched, nonrandom comparison; pre-post design with subject as own control Comparison group may have received: 1) no intervention, or “usual care,” or 2) alternative feeding intervention including tube feeding
Outcomes	Inclusions: One or more of the following outcomes: survival, hospitalization, pneumonia, aspiration, function, quality of life, weight change, or wound healing, measured over follow-up of at least 1 month Exclusion: Study reports only intermediate outcomes such as serum protein levels or amount of intake
Time Frame	Follow-up of one month or longer

Table 3

Summary of Evidence for Feeding interventions and Major Outcomes

Studies	Population	Intervention Type	Major Outcomes	Difference
		High calorie supplement		
Beck 2002	n=66	Liquid supplement	Weight	No
Carver 1995	n=46	Liquid supplement	Weight	Yes
Cereda 2009	n=28	Liquid supplement	Pressure ulcer healing	Yes
Gazzotti 2003	n= 80	Liquid supplement & soup	Weight	Yes
Gil Gregorio 2003	n=99	Liquid supplement	BMI	Yes
			Morbidity	Yes
			Mortality	No
Kwok 2001	n=47	Milk powder	Weight	No
			Cognition	No
			Physical Function	No
Lauque 2000	n=78	Liquid supplement, soup, fruit & dessert	Weight	Yes
			BMI	No
			Grip strength	No
Lauque 2004	n=91	Liquid supplement, soup & dessert	Weight	Yes
			BMI	Yes
			Cognition	No
			Physical Function	No
Parrott 2006	n=30	Liquid supplement & high calorie bar	BMI	Yes
Planas 2004	n=44	Liquid supplement	BMI	No
			Cognition	No
Wouters-Wessling 2002	n=35	Micronutrient-enriched liquid supplement	Weight	Yes
Wouters-Wessling 2006	n=34	Liquid supplement	Weight	Yes
			Physical Function	No
Young 2004	n=34	Liquid supplement & high calorie bar	Weight	Yes
		Other Feeding Interventions		
Beck 2008	n=121	Chocolate, hot chocolate, homemade supplement, exercise	Weight	Yes
			BMI	Yes
Crogan 2006	n=61	Individualized nutrition therapy process and care plans	BMI	No
			Physical Function	No

Studies	Population	Intervention Type	Major Outcomes	Difference
Goddaer 1994	n=29	Relaxing music played at lunchtime	Behaviors	Yes
Keller 2003	n=82	Enhanced dietician time and menu	Weight	Yes
Remsburg 2001	n=40	Buffet style dining program	Weight	No
Robbins 2008	n=515	Chin down posture vs thickened liquids	Pneumonia	No
			Mortality	No
Salas-Salvado 2005	n=56	Lyophilized foods	Weight	Yes
Simmons 2005	n=17	Megestrol acetate and assistance	Weight	No
Simmons 2008	n=69	Feeding assistance	Weight	Yes
			BMI	Yes
Volicer 1997	n=12	Dronabinol	Weight	Yes
			Negative affect	Yes
			Disruptive behavior	No
Yeh 2000	n=68	Megestrol acetate	Weight	Yes
Young 2005	n=34	Meals high in carbohydrates	Weight	No
			Cognition	No
			Behavior	No

BMI=Body mass index

Table 4

Methodological Characteristics and Quality of Included Studies

Supplementation					
Source	**Population**	**Intervention**	**Methods**	**Outcomes, Intervention vs. Control**	**Quality/Bias**
Beck 2002	66 undernourished nursing home residents in Denmark, mean age 84, mild to moderate cognitive impairment	Home-made oral supplement, 384 Kcal	RCT, 1–2 months follow-up	Weight change: 1.3 (−1.0–3.0) vs 1.5 (−2.3–9.0), NSD	Grade B/High
Carver 1995	46 elderly dementia residents with pressure ulcers, mean age for men 68 ± 9 in intervention, 68 ± 7 in control, for women, 80± 10 in intervention, and 79 ± 10 in control, no indication of dementia severity	200 ml oral supplement twice daily, 600 Kcal	RCT, 12 weeks follow-up	Weight change: +3.5 ± 1.8 kg vs 0.6±1.7, p<0.001 for within intervention group weight change, control group NSD	Grade B/Low
Cereda 2009	28 nursing home residents in Italy, mean age 82 ± 10 in intervention and 81 ± 10 in control, 50% with vascular dementia or Alzheimer's	30 kcal/kg per day nutritional supplement and two 400-ml, 500 Kcal enriched supplement	RCT, 12 weeks follow-up	Pressure ulcer healing by Pressure Ulcer Scale for Healing (PUSH) score: −6.1±2.7 vs. −3.3±2.4	Grade A/Low
Gazzotti 2003	80 geriatric ward patients in Belgium, mean age 80 ± 7, mean MMSE 21 ± 7 indicating mild cognitive impairment	200 ml supplement, received either soup or a nutritional supplement, 500 Kcal	RCT, 2 months follow-up	Weight change: +.28 ± 3.8 kg vs −1.23 ± 2.5 kg; p=0.05 between group comparison	Grade B/Low
Gil Gegorio 2003	99 malnourished nursing home residents in Spain, mean age 86.5 ± 6.1, mean MMSE, 12.7 ± 5.3, indicating moderate to severe dementia	125 Kcal enriched oral supplement	RCT, one year follow-up	Weight change: +1.6 vs. −0.3, p=0.05 Infection: 47% vs. 66%, p=0.05 Days in bed: 7.5 vs 17.3, p=0.05 Mortality: NSD	Grade B/Medium
Kwok 2001	47 nursing home residents with poor intake in China, mean age 81 ± 10 in intervention group and 80 ±10 in control group, 32% dementia in supplement group and 9% in control; dementia severity is moderate to severe	Milk powder twice daily	RCT, 7 weeks follow-up, controls received same foods as the intervention	Weight change: intervention group increased from 42.94 to 44.39, controls decreased from 46.73 to 46.39, NSD Grip strength, mental function, disability measures, NSD	Grade B/Medium
Lauque 2000	78 malnourished nursing home residents in France, mean age range from 84 ± 8 to 88 ± 4, dementia percentage ranges from 47–91% in each group	Nutritional supplements, 300–500 Kcal, four different supplements offered: soup, fruit, dessert, or a liquid supplement	Concurrent controls, 60 days follow-up	Malnourished group, weight gain of 1.5 ± 0.4 kg, p<0.05 At risk group, weight gain of +1.4 ±0.5 kg, NSD Control group, no change in weight BMI, grip strength, NSD	Grade C/Medium
Lauque 2004	91 patients from geriatric wards and day centers in France with Alzheimer's disease and risk of malnutrition, mean age 79, mean MMSE, 15 ± 8, indicating moderate impairment	Oral supplements, 150–300 Kcal: soup, dessert, or a liquid supplement. Dietician made home visits and provided education	RCT, intervention time 3 months, 6 months follow-up	Weight change: +1.57 ±3.35 vs 0.67±3.55 kg, p=.001 BMI change: +0.66 ± 1.39 vs 0.29±1.38 kg/m2, p=.001 Cognition: NSD Physical function: NSD	Grade B/Low
Parrott 2006	30 geriatric care facility patients in Canada, mean age 88 ± 4 with probable moderate to severe Alzheimer's	Mid morning supplement (supplement bars or liquids) containing 250–258 Kcal	Pre-post study design, 10 weeks follow-up	BMI change: 23.7 ± 3.8 to 24.3 ±4.1 kg/m2, p<.001 and sustained one week after stopping intervention	Grade C/Medium

Supplementation					
Source	**Population**	**Intervention**	**Methods**	**Outcomes, Intervention vs. Control**	**Quality/Bias**
Planas 2004	44 Alzheimer's day center participants in Spain, mean age 73± 11 in study group and 77 ± 6 in control group, mild dementia and feeding problems	Oral liquid supplements 500 kcal/ day with or without micro nutrient enhancement	RCT, 6 months follow-up	BMI change: 25.4 ±4.4 kg/m to 26.5 ± 4.5 kg/m2 vs. 24.4 ±2.6 kg/m to 26.0 ±3.5 kg/m2, NSD Cognition: NSD	Grade B/Low
Wouters-Wesseling 2002	35 nursing home residents in the Netherlands, mean age 85± 8 in intervention group, 79 ±9 in control group, with moderate to severe dementia and low BMI	Micronutrient-enriched liquid nutrient of 125 ml twice a day between main daytime meals	RCT, placebo controlled, 12 weeks follow-up	Weight change: 1.4 ±2.4 kg vs. −.08 ±3.0 kg, p=0.02	Grade A/Low
Wouters-Wesseling 2006	34 randomized nursing home residents with recent infection from a psychogeriatric unit in the Netherlands, mean age 83± 7	200 ml liquid nutrition enriched supplement after RX of antibiotics and a diagnosis of an acute infection	RCT, 5 weeks follow-up after onset of infection	Weight change: 0.8 kg vs. −0.4 kg, p=0.040 Physical function: NSD	Grade B/Low
Young 2004	34 geriatric care center Alzheimer's unit residents in Canada, mean age 88 ± 4, probable moderate to severe dementia, most with low BMI	¾ of a nutrition supplement bar and juice provided between breakfast and lunch	RCT, crossover with washout periods, 4 phases lasting 21 days	Weight change from baseline during intervention phases: 0.97 ±0.97 kg, p<. 001	Grade B/Low
Assisted Feeding and Other Interventions					
Source	**Population**	**Intervention**	**Methods**	**Outcomes Intervention vs Control**	**Quality/Bias**
Beck 2008	121 nursing home residents in Denmark, mean age 87, moderate cognitive impairment	25 grams of chocolate and 150 ml of hot chocolate, or 150 ml of homemade milk-based supplement, group exercise and oral care twice a week	RCT, 11 weeks follow-up	Weight change: 1.3% (0.6 to 3.2) vs 0.6% (−1.6 to 0.6), p=.005. BMI change: 0.4% (0–1.0) vs −0.2%, p=.003	Grade B/Low
Crogan 2006	61 nursing home residents in the US, mean age 85 intervention, 79 in comparison group, normal to moderately impaired cognition, at risk for malnutrition	6 month Individual Nutrition Rx (INRX) process with assessments, care planning, and interventions	Concurrent controls, 6 months follow-up	BMI change: 25.11 to 25.64 kg/m2 in treatment and 26.38 to 26.81 kg/m2 in controls, NSD Function: no difference	Grade C/Medium
Goddaer 1994	29 nursing home residents in Belgium, mean age 81, severe dementia	Relaxing music played at lunchtime	Pre-post study ABAB repeated measures design, A=no music, B=music, one week intervals	Reduction in cumulative incidence of total agitated behaviors (63%), physically nonaggressive behaviors (56%), and verbally agitated behaviors(75%).	Grade C/Medium
Keller 2003	82 nursing home residents with dementia, mean age 80, moderate cognitive impairment, moderate to severe nutritional risk	Enhanced dietician time and care planning, enhanced menu with increased snack foods, high energy and high protein foods	Concurrent controls, 30 months follow-up	Weight change: 4.8% ± 0.7% vs. −4.5% ± 0.9%, p<0.001 27% intervention subjects gained weight vs. 7% controls	Grade C/Medium
Remsburg 2001	40 nursing home residents, mean age 80, 50% had dementia, moderate cognitive impairment and at risk for malnutrition	Buffet style dining program (supper only), implemented daily	RCT, 3 months follow-up	Weight change: −.11±0.7 vs .32±0.5, NSD	Grade B/Medium
Robbins 2008	515 residents from subacute residential facilities, median age 81, 70% had dementia and evidence for aspiration	Drinking liquids in chin down posture vs. drinking thickened liquids (nectar thick and honey thick) in a head neutral position	RCT, parallel design trial, 3 months follow-up	Incidence of pneumonia, HR 0.84(0.49–1.45), NSD Mortality, NSD	Grade B/Medium

Supplementation					
Source	**Population**	**Intervention**	**Methods**	**Outcomes, Intervention vs. Control**	**Quality/Bias**
Salas-Salvado 2005	56 patients with Alzheimer's dementia, moderate to severe cognitive impairment, with weight loss and requiring a liquid or semi-solid diet	Lyophilized food diet reconstituted to liquid or semi-solid consistency with nutritional advice	RCT, controls received nutritional advice only, 3 months follow-up	Weight change: 2.06 ± 1.9 vs 0.32 ± 3.04 kg Depression scores: NSD	Grade B/Medium
Simmons 2005	17 nursing home residents low BMI or poor intake of food, mean age 92, 41% with mild to moderate dementia	Megestrol acetate 400 mg daily with vs without feeding assistance	Pre-post study design, 63 days follow-up	Weight change: −2.13 ±9.32lb from baseline Intake improved only when combined with optimal feeding assistance	Grade C/Medium
Simmons 2008	69 nursing home residents, mean age 82 intervention and 84 control, 41–43% subjects with dementia of moderate severity, at risk for weight loss	Feeding assistance	RCT, cluster design, 24 weeks follow-up for intervention and 24 weeks for control	Weight change difference: 4 lbs, p=0.009 BMI change: 0.72 kg/m2, p=0.009	Grade B/Medium
Volicer 1997	12 patients from a VA hospital dementia study unit, mean age 73± 5, moderate to severe dementia, mean MMSE 4.0 ±7.4 and exhibiting food refusal	Dronabinol 2.5 mg capsule bid	RCT, placebo controlled crossover design, 12 weeks follow-up	Weight change: intervention group gained 7.0 ±1.5lb and 2.3 ±1.7lb, while controls gained 4.6 ±1.3lb and 1.7 ±2.3lb, p<0.017 Behavior: Negative affect was reduced during intervention (p=0.045), agitated behavior was unchanged	Grade A/Low
Yeh 2000	68 nursing home residents with > 5% weight loss or low body weight, 30% incapable of consent	Megestrol acetate 800 mg daily	RCT, 25 weeks follow-up	Weight change: 43% vs 18% gained 1.82 kg or more; 38% of intervention patients did not gain weight and advanced dementia was associated with lack of gain	Grade A/Low
Young 2005	34 nursing home residents in Canada, mean age 88.2 ± 3.9, probable moderate to severe Alzheimer's dementia, most with low BMI	High carbohydrates meals, received supplements in non intervention phase	RCT, crossover design with four phases, 84 days follow-up	Weight increase of 0.36 ±1.12 kg in intervention group, p=.076, NSD Measures of cognition and behavior did not change	Grade B/Medium

Quality Rating: Grade A=randomization, placebo-controlled, concealed allocation, Grade B=randomization, concealment not clearly defined, Grade C=not randomized, concealment inadequate; RCT=randomized, controlled trial; NSD=non-significant difference; BMI=body mass index