

## The Connection between Malnutrition and Cognitive Decline in Older Adults

### SCIENTIST BIOGRAPHY



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Before joining Abbott in 2000, Dr. Alish worked in clinical, community, academic, and nutrition research settings. As a clinical dietitian, she provided medical nutrition therapy to adult and pediatric hospitalized patients in medical-surgical units and the ICU. She also provided nutrition counseling and education to adults in outpatient and community settings, including patients with diabetes, cancer, cardiovascular disease, eating disorders, HIV/AIDS, and obesity. Dr. Alish has conducted nutrition research in various areas, including geriatrics, women's health, diabetes, and adult obesity.

Dr. Alish presents to international and domestic audiences and represents Abbott Nutrition at global nutrition congresses and conferences. She has publications in peer-reviewed journals and writes on a variety of nutrition topics for the industry, health care professionals and consumers. Dr. Alish is a member of The Academy of Nutrition and Dietetics and the American Medical Writers Association and is a reviewer for the *Journal of the Academy of Nutrition and Dietetics* and *Geriatric Nursing*. She has served on the boards of local dietetics associations and national dietetics practice and working groups.

Dr. Alish graduated from The Ohio State University in Columbus, OH, with a Bachelor of Science degree in Allied Medical Professions in Medical Dietetics Coordinated Undergraduate Program, her Master's degree from Medical Dietetics, and later her PhD in Human Nutrition.

### INTRODUCTION

In the years following the 1974 publication of Butterworth's article on the "skeleton in the hospital closet",<sup>1</sup> advances to eliminate malnutrition in the hospital have been made, yet it still remains concern. Among older adults, malnutrition is associated with a multitude of geriatric syndromes, including cognitive deficit, suggesting a relationship between nutrition and cognitive function.<sup>2</sup> While some cognitive decline is an expected part of the aging process, more progressive and serious forms of cognitive impairment can occur and can affect the quality of life of patients and families and strain health care resources. Cognitive impairment and dementia are important predictors of disability, dependence and death among older adults.<sup>3-5 6,7</sup> Several studies show that malnutrition is associated with cognitive deficit in older adults

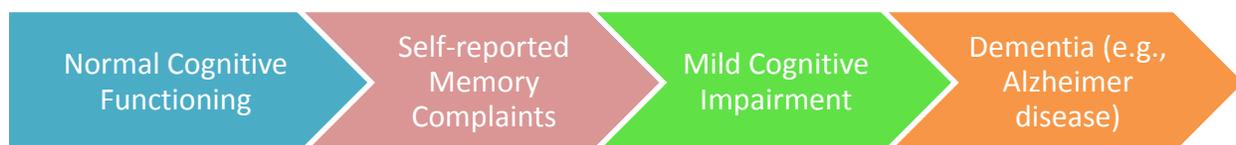
across healthcare settings,<sup>2,8-18</sup> which can impact global healthcare systems and negatively impact quality of life. With the continued expansion of the aging population and longer life expectancies, malnutrition-associated cognitive decline will further burden already-strained health care systems.

## AGE-RELATED CHANGES IN COGNITION

With adults living longer and the increasing number of aging adults, the prevalence of mild cognitive decline and advanced forms of cognitive disorders, such as Alzheimer’s disease (AD), has increased.<sup>19</sup> Worldwide, more than 26 million patients are diagnosed with AD today; its prevalence is expected to exceed 106 million by 2050.<sup>20</sup> In addition, there is mounting evidence that a sizable portion of individuals 70 years of age and older likely have cognitive impairment without dementia, affecting not only their ability to carry out activities of daily living, but also to continue living independently. An estimated 22% of adults over 71 years of age have significant cognitive impairment without dementia.<sup>21</sup>

## COGNITION AND AGING

Cognition is a neuropsychological function that refers to the act of processing and manipulation information. It includes processes such as awareness, perception, learning, memory, and reasoning.<sup>21</sup> With aging, the changes in cognition showing gradual decline include attention, memory and activities requiring complex cognitive functions. Longitudinal data show that cognitive decline likely begins in middle-age and accelerates with advancing age.<sup>22</sup> While most aging adults tend to experience a gradual decline in cognitive abilities over time, there is variability in the type of cognitive function affected and the extent of the decline.<sup>4</sup> Moreover, not everyone who experiences cognitive decline will go on to develop dementia or severe cognitive disease, like AD. The spectrum of cognitive function and decline is shown in the Figure.



**Figure: Spectrum of cognitive function**

Mild cognitive impairment (MCI) is a transitional stage between normal cognitive aging and dementia. While small changes in cognition do not impact quality of life or threaten independence, more severe declines are associated with loss of functional abilities and independence and increased disability, loss of independence, hospitalization, increased healthcare costs and mortality.<sup>5,23-26</sup> Emerging evidence demonstrates that lifestyle factors, including nutrition and nutritional status, are associated with cognitive function in older adults.<sup>19,27-29</sup>

## THE RELATIONSHIP BETWEEN NUTRITIONAL STATUS AND COGNITIVE DECLINE

Compromised nutritional status, including malnutrition or risk for malnutrition, is prevalent among older adults.<sup>30-32</sup> There are several studies showing that nutritional status, specifically the presence of or the



risk for malnutrition is associated with impaired cognition in aging adults in a variety of settings ranging from hospital to living in the community.<sup>2,12,13,18,33</sup>

The prevalence of malnutrition in hospitalized older adults and its consequences are well established. Cognitive deficit is cited as a frequent and common finding seen in hospitalized patients who are malnourished. Two cross-sectional studies showed that inpatients 65 years of age and older admitted to the geriatric unit of a hospital showed that just over 80% of the inpatient samples were at risk for malnutrition or malnourished. Compared to patients 65 years of age and older who did not have cognitive impairment, older patients with mild cognitive impairment (MCI; OR = 4.7,  $p < 0.0001$ ) and dementia (OR = 3.2,  $p < 0.0001$ ) had a significantly higher frequency of malnutrition.<sup>2,8</sup> Another cross-sectional study found that 55.8% of patients admitted for hip fracture surgery were either malnourished or at risk of malnutrition and 42% were cognitively impaired. In addition, there were significantly more well-nourished patients with normal cognitive status group than patients with impaired cognitive status (84.2% v. 15.8%, respectively,  $p < 0.001$ ).<sup>9</sup>

Research on the relationship between cognitive decline and nutritional status has been conducted in nursing homes and has shown similar results.<sup>10-15</sup> Khater and Abouelezz<sup>13</sup> evaluated the association between nutritional risk between older adults with normal cognitive function and those with MCI living in elderly care homes. Nutritional status was identified using the Mini-Nutritional Assessment (MNA); cognitive impairment was determined using the Mini-Mental State Examination (MMSE), a valid and reliable questionnaire used in both clinical and research settings. Results indicated that 51.6% of the study participants were either malnourished or at risk for malnutrition. Among the patients with MCI, there was a significantly higher frequency of malnutrition as well as risk for malnutrition, compared with those who had no cognitive impairment ( $p = 0.002$ ). The adjusted odds ratio (OR) for MCI in the presence of nutritional deficit was significant (OR = 6.62,  $p = 0.003$ ). The results of this study echo those of other studies and demonstrate that older adults in nursing and care homes who were malnourished or at risk for malnutrition had significantly lower cognitive performance.

The association between nutritional status and cognitive function in older adults is well documented and appears strong. However, the cross-sectional design of the studies prevents us from drawing any conclusions that malnutrition causes cognitive decline or vice versa. The relationship between nutritional status and cognitive decline and performance is complex and reciprocal: the presence or risk of malnutrition may influence cognitive performance; and the presence of cognitive decline may affect the ability to perform daily living activities, affecting food intake and hence, influence nutritional risk.<sup>33</sup>

Whether interventions to improve nutritional status positively affect cognitive performance is not entirely clear. However, a recent meta-analysis of four studies demonstrated that benefits of the long-term use of oral nutritional supplements (ONS) on cognition, as demonstrated by improved MMSE scores evaluations in patients with dementia.<sup>34</sup> Additionally, an earlier study by Collins et al showed that additional calories and protein was associated with greater improvement in MMSE scores in older adults who were malnourished and receiving home nursing care. The results of these two studies suggest that nutritional interventions that include ONS to improve nutritional status may positively affect cognitive performance.<sup>35</sup>



**CONCLUSION:**

While some cognitive decline is expected to occur with aging, cognitive impairment and dementia are important predictors of disability, dependence and death among older adults. With adults living longer and the expansion of the aging population, the prevalence of mild cognitive decline and advanced forms of cognitive disorders, including such as Alzheimer's disease has increased. The association between cognitive deficit and malnutrition in older adults across healthcare settings and in the community is clear: individuals who are malnourished are more likely to have poor cognitive function. Likewise, individuals with cognitive impairment, such as MCI or dementia, are more likely to be malnourished or at risk for malnutrition, regardless of health care setting or living arrangement. However, because the studies are cross-sectional, they do not show causality, only association. The ability of nutrition interventions to reverse or improve cognitive deficit is unclear, yet there are some studies showing a benefit of ONS on improvements in tests to detect cognitive impairment, such as the MMSE.

**References:**

1. Butterworth CE, Jr. [The skeleton in the hospital closet. 1974]. *Nutricion hospitalaria*. Jul-Aug 2005;20(4):302-307, 301; discussion 297-300.
2. Orsitto G, Fulvio F, Tria D, Turi V, Venezia A, Manca C. Nutritional status in hospitalized elderly patients with mild cognitive impairment. *Clin Nutr*. 2/2009 2009;28(1):100-102.
3. Agüero-Torres H, Thomas VS, Winblad B, Fratiglioni L. The impact of somatic and cognitive disorders on the functional status of the elderly. *J.Clin.Epidemiol*. 10/2002 2002;55(10):1007-1012.
4. Glisky EL. Changes in Cognitive Function in Human Aging. In: DR R, ed. *Brain Aging: Models, Methods and Mechanisms*. Boca Raton, FL: CRC Press; 2007:4-20.
5. Orsitto G, Cascavilla L, Franceschi M, et al. Influence of cognitive impairment and comorbidity on disability in hospitalized elderly patients. *J.Nutr.Health Aging*. 2005 2005;9(3):194-198.
6. Pirlich M, Lochs H. Nutrition in the elderly. *Best Pract.Res Clin Gastroenterol*. 12/2001 2001;15(6):869-884.
7. Agarwal E, Miller M, Yaxley A, Isenring E. Malnutrition in the elderly: A narrative review. *Maturitas*. Dec 2013;76(4):296-302.
8. Orsitto G. Different components of nutritional status in older inpatients with cognitive impairment. *J Nutr Health Aging*. May 2012;16(5):468-471.
9. Koren-Hakim T, Weiss A, HersHKovitz A, et al. The relationship between nutritional status of hip fracture operated elderly patients and their functioning, comorbidity and outcome. *Clin Nutr*. Dec 2012;31(6):917-921.
10. Irving GF, Olsson BA, Cederholm T. Nutritional and cognitive status in elderly subjects living in service flats, and the effect of nutrition education on personnel. *Gerontology*. Jul-Aug 1999;45(4):187-194.
11. Odlund Olin A, Koochek A, Ljungqvist O, Cederholm T. Nutritional status, well-being and functional ability in frail elderly service flat residents. *Eur J Clin Nutr*. Feb 2005;59(2):263-270.
12. Amer MS, Elawam AE, Alsadany MA, Farag NM. Effect of malnutrition on executive function in older Egyptians in geriatric homes. *J.Am.Geriatr.Soc*. 10/2010 2010;58(10):2036.
13. Khater MS, Abouelezz NF. Nutritional status in older adults with mild cognitive impairment living in elderly homes in Cairo, Egypt. *J.Nutr.Health Aging*. 2/2011 2011;15(2):104-108.
14. Torma J, Winblad U, Cederholm T, Saletti A. Does undernutrition still prevail among nursing home residents? *Clin Nutr*. Oct 23 2012.
15. Stange I, Poeschl K, Stehle P, Sieber CC, Volkert D. Screening for malnutrition in nursing home residents: comparison of different risk markers and their association to functional impairment. *J Nutr Health Aging*. Apr 2013;17(4):357-363.
16. Rodriguez-Tadeo A, Wall-Medrano A, Gaytan-Vidana ME, Campos A, Ornelas-Contreras M, Novelo-Huerta HI. Malnutrition risk factors among the elderly from the US-Mexico border: the "one thousand" study. *J Nutr Health Aging*. May 2012;16(5):426-431.
17. Fagerstrom C, Palmqvist R, Carlsson J, Hellstrom Y. Malnutrition and cognitive impairment among people 60 years of age and above living in regular housing and in special housing in Sweden: a population-based cohort study. *Int.J.Nurs.Stud*. 7/2011 2011;48(7):863-871.
18. Ferdous T, Cederholm T, Kabir ZN, Hamadani JD, Wahlin A. Nutritional status and cognitive function in community-living rural Bangladeshi older adults: data from the poverty and health in ageing project. *J Am Geriatr Soc*. 5/2010 2010;58(5):919-924.
19. Solfrizzi V, Panza F, Frisardi V, et al. Diet and Alzheimer's disease risk factors or prevention: the current evidence. *Expert.Rev.Neurother*. 5/2011 2011;11(5):677-708.
20. Brookmeyer R, Johnson E, Ziegler-Graham K, Arrighi HM. Forecasting the global burden of Alzheimer's disease. *Alzheimers.Dement*. 7/2007 2007;3(3):186-191.

21. Horning S, Davis HP. Aging and Cognition. 2012;44-52.
22. Singh-Manoux A, Kivimaki M, Glymour MM, et al. Timing of onset of cognitive decline: results from Whitehall II prospective cohort study. *BMJ*. 2012 2012;344:d7622.
23. Chodosh J, Seeman TE, Keeler E, et al. Cognitive decline in high-functioning older persons is associated with an increased risk of hospitalization. *J.Am.Geriatr.Soc.* 9/2004 2004;52(9):1456-1462.
24. Petersen RC. Clinical practice. Mild cognitive impairment. *N.Engl.J.Med.* 6/9/2011 2011;364(23):2227-2234.
25. Bynum JP, Rabins PV, Weller W, Niefeld M, Anderson GF, Wu AW. The relationship between a dementia diagnosis, chronic illness, medicare expenditures, and hospital use. *J.Am.Geriatr.Soc.* 2/2004 2004;52(2):187-194.
26. Gussekloo J, Westendorp RG, Remarque EJ, Lagaay AM, Heeren TJ, Knook DL. Impact of mild cognitive impairment on survival in very elderly people: cohort study. *BMJ*. 10/25/1997 1997;315(7115):1053-1054.
27. Lee Y, Back JH, Kim J, et al. Systematic review of health behavioral risks and cognitive health in older adults. *Int.Psychogeriatr.* 3/2010 2010;22(2):174-187.
28. Panza F, Frisardi V, Seripa D, Imbimbo BP, Pilotto A, Solfrizzi V. Dietary unsaturated fatty acids and risk of mild cognitive impairment. *J Alzheimer's.Dis.* 2010 2010;21(3):867-870.
29. Morris MC. Nutritional determinants of cognitive aging and dementia. *Proc.Nutr.Soc.* 2/2012 2012;71(1):1-13.
30. Pirlich M, Schutz T, Norman K, et al. The German hospital malnutrition study. *Clin Nutr.* 8/2006 2006;25(4):563-572.
31. Guigoz Y. The Mini Nutritional Assessment (MNA) review of the literature--What does it tell us? *J Nutr Health Aging.* 11/2006 2006;10(6):466-485.
32. de Groot LC, Beck AM, Schroll M, van Staveren WA. Evaluating the DETERMINE Your Nutritional Health Checklist and the Mini Nutritional Assessment as tools to identify nutritional problems in elderly Europeans. *Eur J Clin Nutr.* 12/1998 1998;52(12):877-883.
33. Del Parigi A, Panza F, Capurso C, Solfrizzi V. Nutritional factors, cognitive decline, and dementia. *Brain Res.Bull.* 3/15/2006 2006;69(1):1-19.
34. Allen VJ, Methven L, Gosney MA. Use of nutritional complete supplements in older adults with dementia: Systematic review and meta-analysis of clinical outcomes. *Clin Nutr.* Dec 2013;32(6):950-957.
35. Collins CE, Kershaw J, Brockington S. Effect of nutritional supplements on wound healing in home-nursed elderly: a randomized trial. *Nutrition.* Feb 2005;21(2):147-155.