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Why is the skeleton still in the hospital closet? A look at the complex aetiology of protein-energy malnutrition and its implications for the nutrition care team

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Introduction

The acknowledgement of protein-energy malnutrition (PEM) as one of "…*the most serious nutritional problems of our time*" was actually made by Dr Butterworth Jr in 1974 in his seminal article, "the skeleton in the hospital closet" (1). In most cases, major health problems prevalent in the 1970s have been addressed and improved, such as vast improvements in vaccination rates, pain management and contraception efficacy (4-6). But when it comes to PEM, the continuing high prevalence across all settings (10 – 65% in our home-dwelling, hospitalised and institutionalised elderly) (7-10) and hefty economic burden (>USD$156 billion per annum) (11-13) at first appears to suggest that medicine and medical nutrition therapy may have failed to achieve any significant improvement in the past 40 years. However, PEM (the unintentional loss of lean tissues caused by inadequate energy, protein and nutrient intake) is unique compared with many other medical and nutritional problems, due to not only having a deeply complex physiological cause, but also a multifactorial environmental, economic and psychosocial origin. Furthermore, PEM is often underdiagnosed and/or overlooked in the presence of similar conditions such as sarcopenia (age-related loss of muscle mass and physical function) and cachexia (loss of muscle mass due to disease-related increases in proinflammatory cytokines and a prolonged acute phase protein response) (9). Beyond the economic consequences of PEM, the high prevalence is significant for the individual, who may experience broad health problems such as decreased cardiac, respiratory, hepatic, immune function; decreased quality of life; and a significantly increased risk of hospitalisation, institutionalisation and mortality (8, 14).

Therefore, a renewed examination of what we have learned about the complex aetiology of PEM over the past 40 years and its implications for practice may be useful in helping to prevent and manage this long-term geriatric syndrome across the continuum of care.

The physiological causes of protein-energy malnutrition

The physiological causes of PEM may be broadly categorised as a) impaired dietary intake, b) altered metabolic requirements, c) impaired digestion and/or absorption, and d) excessive nutrient losses. However, in most cases, a combination of factors reflecting the individual and the setting may be responsible (2). A simple example may be an individual with ill-fitting dentures (impairing dietary intake); where as a more complex example may be an individual with oesophageal cancer (impairing dietary intake; altering metabolic requirements), having undergone surgery (impairing dietary intake; altering metabolic requirements) and experiencing

nausea and vomiting due to chemotherapy (excessive nutrient losses; impairing dietary intake) and also taking antibiotics (impairing digestion and absorption).

Impaired intake

Sometimes referred to as the 'anorexia of ageing', decreased appetite occurs as part of normal ageing (15). Appetite is controlled by interactions between the cortex, limbic system and midbrain as well as peripheral inputs from the gut, adipose tissue and endocrine system (15). These processes may work less efficiently with increasing age leading to the consumption of a less varied and lower quality diet (15). PEM may occur in all age groups, but the physiological and psychosocial changes that occur in ageing, such as a decreased appetite and increased comorbidities, place older adults at significantly higher risk (16). Although appetite loss is common, PEM is not part of the normal ageing process and is preventable and treatable (17). Overall, impaired dietary intake may be due to both poor appetite (figure 1) and/or an inability to eat (figure 2), both of which have numerous and overlapping causes. Regarding dentition, edentulousness, which is common in older adults, has been found to increase the risk of PEM (18). When adjusting for confounders, the risk of PEM increased 1.15 times (95%CI 1.06-1.25) for a decrease in masticatory percentage of 10 points (equivalent to the loss of two molars) (19).

Altered metabolic requirements

Trauma, sepsis, inflammation, fever and serious illnesses, such as cancer, respiratory disease and acquired immunodeficiency syndrome, increase the body's metabolic rate and can result in catabolic stress. During catabolic stress there is increased protein breakdown and disrupted protein synthesis. This means the body's protein cycle is no longer in homeostasis and the net loss of protein in the post-absorptive state is not compensated for by net postprandial gain (3). Net protein losses may be up to 20%, which is usually from the breakdown of skeletal muscle but also from organs including the liver, gastrointestinal tract, kidneys and heart (3). These hypermetabolic states increase the requirement for protein, energy and nutrient intake. Medications, polypharmacy and treatments such as haemodialysis can also alter the metabolic requirements for nutrients (2).

Impaired digestion and/or absorption

The loss of gastrointestinal integrity as a result of protein catabolism can further exacerbate the protein-energy deficit due to mucosal atrophy and resulting malabsorption (3). In addition, there are multiple disease states which may prevent the digestion and/or absorption of nutrients in the

gastrointestinal tract (2). Acute conditions include bacterial or parasitic infections which may cause gastritis or impair the breakdown of ingested food as well as contribute to diarrhoea. Chronic conditions include those that affect the stomach, intestine, pancreas and liver such as cystic fibrosis, inflammatory bowel disease, short bowel syndrome, pancreatitis, hepatic cirrhosis or bariatric surgery (20-25).

Excessive nutrient losses

Nutrient losses may occur during gastrointestinal dysfunction such as diarrhoea, steatorrhoea, vomiting and protein losing enteropathy, which may cause a loss of up to 60% of the albumin pool (26). Losses also occur through internal or gastrointestinal bleeding, stomas, fistulae or surgically placed drains for the removal of intra-abdominal fluid, which may contain up to 12g of protein per litre of fluid drained (2, 27).

Psychosocial and economic risk factors for protein-energy malnutrition

For most individuals, the physiological causes of malnutrition may be confounded by psychosocial and economic risk factors for PEM (figure 1). For example, the individual with poor fitting dentures may also be self-conscious of eating in front of others, which increases their social isolation and may contribute to a decreased appetite. The individual with oesophageal cancer may also be under financial stress due to the need to take extended leave from work, and be unable to afford a suitable diet and/or prescribed oral nutrition supplements.

The influence of gender upon risk of PEM is unclear, due to the confounding effects of age, medical status and ethnicity (28). However, the characterisation of PEM in older hospitalised patients has been found to differ based on gender. Nutritional risk in men has been found to be more often associated with higher depression scores, increased length of stay and poor appetite; whereas nutritional risk in women was found to be associated with lower functional status and higher number of disease states (29). The association between depression and nutritional status is multifactorial and it is unclear if it is a cause and consequence of malnutrition in older adults (30). As shown in figure 1, depression is associated with loss of appetite. Research has found depression to be further associated with weight loss, and malnourished community-dwelling older adults are significantly more likely to have higher depression scores (OR=4.38; 95%CI: 2.23-8.64) (31-34). Self-perceived health has also been found to influence nutritional risk, perhaps due to its influence on behaviours and attitudes (28).

Living alone, social isolation, financial strain and socio-economic disadvantage have been found to increase the risk of PEM in older adults (28). Financial strain, represented by not having enough money to make ends meet, was found to increase the risk of older women four-fold (OR: 4.08; 95%CI 1.95-8.52), accounting for income and education in a sample from Maryland, USA. Using nationally representative data, communities in the USA with higher levels of social isolation, such as lack of access to telephones and cars, socioeconomic disadvantage and higher levels of disability among the older adult population were found to have high rates of malnutrition-related mortality (35). A one standard deviation increase in socioeconomic/physical disadvantage was associated with a substantial 12% increase in the rate of malnutrition-related mortality in older adults (P<0.001) (35).

Conclusion and implications for practice

Examining the aetiology of PEM in a purely physiological way is critical in order to understand nutrient requirements and develop appropriate strategies. However, examining the physiological aetiology alone will fail to recognise the significant psychological, social and economic factors that influence the risk of PEM. This may lead to an inability for older adults to follow the prescribed recommendations, or prevent their long term efficacy, because they fail to address the complete picture for the individual. In addition, PEM, which is usually identified during admissions to acute, subacute or residential care, must be recognised as a long-term condition requiring ongoing multidisciplinary treatment across the continuum of care (16, 36). Health practitioners need to recognise and address all the causes of malnutrition in an individual, which may only be achieved through individualised assessment and ongoing and flexible nutrition intervention. This may reveal why standardised nutritional interventions employed in many health facilities, such as oral nutrition supplement protocol programs, fail to make any significant impact in the prevalence of malnutrition.

In order to provide suitable and proactive intervention, emerging research supports the integration of multidisciplinary formal and informal care for malnourished patients (36-39). Engaging the family and friends of malnourished persons as a critical part of the nutrition care team may be a cost-effective way of ensuring patients receive highly individualised and cost-effective care across settings and in the long term (37, 40). Research has revealed that family of malnourished patients may already see themselves as having the primary responsibility for providing nutrition support, even during inpatient admissions (37), and when family are provided

with education regarding malnutrition, they can improve the nutrition status, quality of life and physical function of their care-recipients (38).

To support this emerging research, further intervention and feasibility studies are needed which address diverse the physiological, psychosocial and economic risk factors, and which examine the efficacy of integrating multidisciplinary formal and informal care across all settings.

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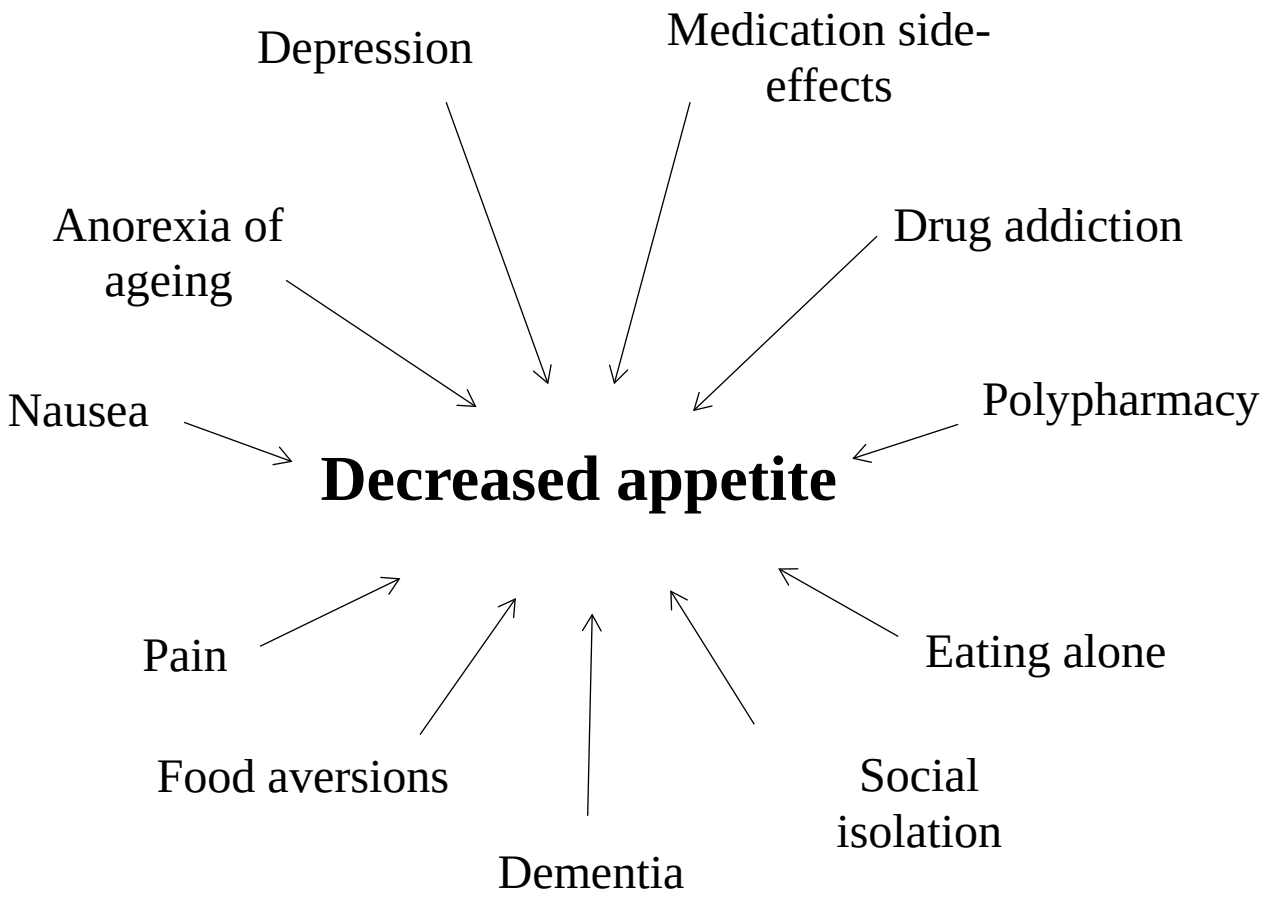

Figure 1. Diverse factors which may lead to a decreased appetite and subsequent impaired dietary intake in older adults (2, 3)

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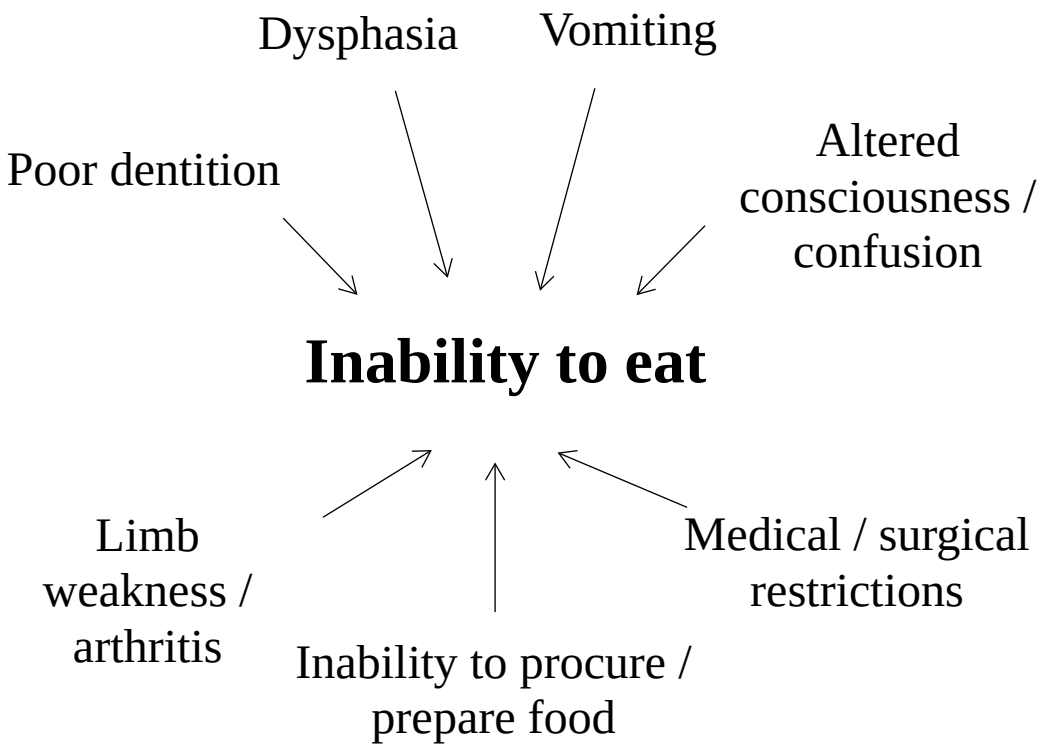

Figure 2. Diverse factors which may lead to an inability to eat and subsequent impaired dietary intake in older adults (2, 3).

References

1. Butterworth Jr CE. The skeleton in the hospital closet. Nutrition today. 1974;9(2):4-8.
2. Nutrition support in adults: oral nutrition support, enteral tube feeding and parenteral nutrition. London: National Collaborating Centre for Acute Care; 2006.
3. Pleuss J. Alterations in nutritional status. In: Porth CM, editor. Pathophysiology, concepts of altered health states. 7th e.d. Philadelphia: Lippincott Williams & Wilkins; 2005. p. 217 - 38.
4. Potts M, Campbell M. History of contraception. Gynecology and Obstetrics. 2002;6(8):18-22.
5. Meldrum ML. A capsule history of pain management. JAMA. 2003;290(18):2470-5.
6. Plotkin S. History of vaccination. Proceedings of the National Academy of Sciences. 2014;111(34):12283-7.
7. Agarwal E, Banks M, Ferguson M, Bauer J, Capra S, Isenring E. Nutritional status and dietary intake of acute care patients: results from the Nutrition Care Day survey 2010. Clin Nutr. 2012;31:41 - 7.
8. Agarwal E, Marshall S, Miller M, Isenring E. Optimising nutrition in residential aged care: a narrative review. Maturitas. 2016;92:70-8.
9. Marshall S. Protein-energy malnutrition in the rehabilitation setting: evidence to improve identification. Maturitas. 2016;86:77-85.
10. Marshall S. Malnutrition in the older australian rural rehabilitation community: identification, patient outcomes and the role of informal caregivers: Bond University; 2016.
11. Guest JF, Panca M, Baeyens J-P, de Man F, Ljungqvist O, Pichard C, et al. Health economic impact of managing patients following a community-based diagnosis of malnutrition in the UK. Clin Nutr. 2011;30(4):422-9.
12. Elia M, Stratton R. The cost of disease-related malnutrition in the UK and economic considerations for the use of oral nutritional supplements (ONS) in adults. Redditch: BAPEN; 2005.
13. Snider JT, Linthicum MT, Wu Y, LaVallee C, Lakdawalla DN, Hegazi R, et al. Economic burden of community-based disease-associated malnutrition in the United States. Journal of Parenteral and Enteral Nutrition. 2014;38(2 suppl):77S-85S.
14. Marshall S, Bauer J, Isenring E. The consequences of malnutrition following discharge from rehabilitation to the community: a systematic review of current evidence in older adults. J Hum Nutr Diet. 2014;27(2):133-41.
15. Visvanathan R. Under-nutrition in older people: A serious and growing global problem! J Postgrad Med. 2003;49(4):352 - 60.
16. Watterson C, Fraser A, Banks M, Isenring E, Miller M, Silvester C, et al. Evidence based practice guidelines for the nutritional management of malnutrition in patients across the continuum of care. Nutrition & Dietetics. 2009;66(Suppl 3):S1 - S34.
17. Huffman GB. Evaluating and treating unintentional weight loss in the elderly. Am Fam Physician. 2002;65(4):640 - 51.
18. Saarela RK, Soini H, Hiltunen K, Muurinen S, Suominen M, Pitkala K. Dentition status, malnutrition and mortality among older service housing residents. J Nutr Health Aging. 2014;18(1):34-8.
19. Dion N, Cotart J-L, Rabilloud M. Correction of nutrition test errors for more accurate quantification of the link between dental health and malnutrition. Nutrition. 2007;23(4):301-7.
20. Dray X, Kanaan R, Bienvenu T, Desmazes-Dufeu N, Dusser D, Marteau P, et al. Malnutrition in adults with cystic fibrosis. Eur J Clin Nutr. 2005;59(1):152-4.

21. Burnham JM, Shults J, Semeao E, Foster BJ, Zemel BS, Stallings VA, et al. Body-composition alterations consistent with cachexia in children and young adults with Crohn disease. The American journal of clinical nutrition. 2005;82(2):413-20.
22. Sundaram A, Koutkia P, Apovian CM. Nutritional management of short bowel syndrome in adults. J Clin Gastroenterol. 2002;34(3):207-20.
23. Tandon B, George P, Sama S, Ramachandran K, Gandhi P. Exocrine pancreatic function in protein-calorie malnutrition disease of adults. The American journal of clinical nutrition. 1969;22(11):1476-82.
24. Caregaro L, Alberino F, Amodio P, Merkel C, Bolognesi M, Angeli P, et al. Malnutrition in alcoholic and virus-related cirrhosis. The American journal of clinical nutrition. 1996;63(4):602-9.
25. Kushner R. Managing the obese patient after bariatric surgery: a case report of severe malnutrition and review of the literature. Journal of Parenteral and Enteral Nutrition. 2000;24(2):126-32.
26. Umar SB, DiBaise JK. Protein-losing enteropathy: case illustrations and clinical review. The American journal of gastroenterology. 2010;105(1):43-9.
27. Cheatham ML, Safcsak K, Brzezinski SJ, Lube MW. Nitrogen balance, protein loss, and the open abdomen. Crit Care Med. 2007;35(1):127-31.
28. Heersink JT, Brown CJ, Dimaria-Ghalili A, Locher JL. Undernutrition in hospitalised older adults: Patterns and correlates, outcomes, and opportunities for intervention with a focus on processes of care. J Nutr Elder. 2010;29(1):4-41.
29. Castel H, Shahar A, Harman-Boehm I. gender differences in factors associated with nutritional status of older medical patients. J Am Coll Nutr. 2006;25(2):279-84.
30. Smoliner C, Norman K, Wagner K, Hartig W, Lochs H, Pirlich M. Malnutrition and depression in the institutionalised elderly. Br J Nutr. 2009;102:1663-7.
31. Morley JE, Kraenzle D. Causes of weight loss in a community nursing home. J Am Geriatr Soc. 1994;42:583-85.
32. Blaum CS, Fries BE, Fiatarone MA. Factors associated with low body mass index and weight loss in nursing home residents. The Journals of Gerontology Series A: Biological Sciences and Medical Sciences. 1995;50:M162-M8.
33. German L, Feldblum I, Bilenko N, Castel H, Harman-Boehm I, Shahar A. Depressive symptoms and risk of malnutrition among hospitalised elderly people. J Nutr Health Aging. 2008;12(5):313-8.
34. Cabrera MAS, Mesas AE, Garcia ARL, De Andrade SM. Malnutrition and depression among community-dwelling elderly people. Journal of the American Medical Directors Association. 2007;8(9):582-4.
35. Lee MR, Berthelot ER. Community covariates of malnutrition based mortality among older adults. Ann Epidemiol. 2010;20:371-9.
36. Rypkema G, Adang E, Dicke H, Naber T, De Sward B, Disselhorst LG, et al. Cost-effectiveness of an interdisciplinary intervention in geriatric inpatients to prevent malnutrition. The Journal of Nutrition Health & Aging. 2003;8(2):122-7.
37. Marshall S, Reidlinger DP, Young A, Isenring E. The nutrition and food-related roles, experiences and support needs of female family carers of malnourished older rehabilitation patients. J Hum Nutr Diet. 2016;30(1):16-26.
38. Marshall S, Bauer J, Capra S, Isenring E. Are informal carers and community care workers effective in managing malnutrition in the older adult community? A systematic review of current evidence. The Journal of Nutrition, Health & Aging. 2013;17(8):645-51.
39. Marshall AP, Wake E, Weisbrodt L, Dhaliwal R, Spencer A, Heyland DK. A multi-faceted, family-centred nutrition intervention to optimise nutrition intake of critically ill patients: The OPTICS feasibility study. Aust Crit Care. 2016;29(2):68-76.

40. Correa B, Leandro-Merhi VA, Fogaca K, de Oliveira MRM. Caregiver's education level, not income, as determining factor of dietary intake and nutritional status of individuals cared for at home. Journal of Nutrition Health & Aging. 2009;13(7):609-14.