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Nutritional Status and Cognitive Impairment in Elderly

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Abstract: The elderly population is increasing worldwide and it has been suggested that senior citizens will continue to constitute the bulk of the population in many countries. Nutritional status of senior citizens are adversely affected by their frailty, chronic condition and declining cognitive functioning. Conversely, malnourished elderly further deteriorate their frailty, chronic disease and cognitive functioning. The aim of this review article is to recognize the importance of nutritional assessment of elderly population particularly those with cognitive impairment. First part is to highlight characteristic cognitive impairment among senior citizens and the second one highlight the background in which malnutrition is a factor that leads to increased risk of morbidity and mortality in the elderly. This review also highlight algorithms for safeguarding nutritional status among senior citizen and focuses on importance of nutritional screening, assessment and early intervention for safeguarding further deterioration of elderly who are likely to prone to cognitive impairment.

Key words: Elderly, geriatric, dementia, malnutrition, mini-nutritional assessment, Oman

INTRODUCTION

The elderly population is increasing worldwide and it has been suggested that senior citizens will continue to constitute the bulk of the population in many countries all over the globe (Al-Sinawi *et al.*, 2012). According to World Health Organization, “by 2020 more than 1000 million people aged 60 years and older will be living in the world, more than 700 million of them in developing countries” (WHO, 1998).

Emerging trends as quantified by the global disease burden (Murray *et al.*, 2013) has unequivocally indicated the shift from communicable diseases to disease of affluence and/or non-communicable diseases. While communicable diseases still cause devastation in many parts of sub-Saharan Africa and low income countries of the Middle East and Northern Africa (Sousa *et al.*, 2009), the high income countries including Gulf Cooperation Council (GCC), are increasingly witnessing burden from mental and behavioral disorders and other non-communicable diseases sometimes dubbed as ‘lifestyle diseases’ or ‘diseases of longevity’ (Al-Adawi, 2006).

While longevity is common denominators in the expression of such type of diseases, in the instance of GCC, some of the lifestyle diseases appear to afflict ‘young-old’ age group into compromised health status that often is reserved for ‘old-old’. This appears to be orthogonal to common wisdom that lifestyle diseases tend to be associated by longer lifespan. GCC appears to be marked with paradoxical situation. Increased standard of living has generally mitigated ‘old enemies of health’, namely, communicable diseases or environment-related and infectious diseases. Recent affluence has changed life expectancy in GCC as some of the other developing countries. The average life expectancy that was around 40 years continue to rise to an estimate of above 70 by year 2020 (WHO, 1998). In the instance of Oman, life expectancy has risen from 50 years to 74 according to the recent estimate (Al-Sinawi *et al.*, 2012). In Oman, recent affluence and modern healthcare infrastructure have been instrumental in prevention and cure of some of the intractable childhood diseases that were previously associated with premature death (Al-Lawati *et al.*, 2008). Similarly, available ‘high tech’ medical treatment and adequate public health services have largely reduced

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environment-related and infectious diseases (Alshishtawy, 2010). This has rendered some individuals to survive into adulthood but with poor health that echoes characteristic of 'old-old'. This means that, as elsewhere around the world, in the GCC safeguarding the welfare of the senior citizen will continue to demand more attention.

One of the major challenges common among the elderly is increased frailty and the resultant dependency, disability and poor quality of life (Al-Sinawi *et al.*, 2012). One of the strong predictors of poor quality of life among senior citizens who succumb into degenerative diseases is the erosion of the essence of being human; thinking and remembering. Previous discussion on the wellbeing of senior citizens have largely focused on emergency of refractory and debilitating medical, orthopedic and overt neurological conditions (Sousa *et al.*, 2009). What is often overlooked from such discourse is the role of impaired thinking in the trajectory of wellbeing among senior citizens. Compromised thinking that manifest as cognitive impairment is likely to have direct bearing on wellbeing of senior citizens. This means that the characteristics that qualify one as human, such as thinking, are compromised to the extent that one loses his or her personal identity (Klein, 2012). This sometimes culminates into intransigent and debilitating cognitive impairment.

When calculated among those who are ≥ 60 years old, rate of impaired thinking or cognitive impairment has been shown to vary from 2-8.5% in different parts of the world. In 2010, there was suggestion that 35.6 million were afflicted with cognitive impairment and this figure has been estimated to quadruple by 2030 (Prince *et al.*, 2013).

Impaired thinking may render senior citizens, not only as less affable but with compromised judgment and awareness that would have direct bearing on their appetitive behavior and nutritional status. Therefore, discussion on trajectory of cognitive impaired elderly on indices of nutritional status comes to the forefront. It has been estimated that the poor dietary habit is common among 27-37% of senior citizens (Ulger *et al.*, 2010; Challa *et al.*, 2007). Previously, this was attributed to metabolic alterations but this view has not been further substantiated (Niskanen *et al.*, 1993). What is becoming increasingly apparent is that impaired cognitive functioning has direct bearing with nutritional status of elderly population (Coin *et al.*, 2012). There are a plethora of studies indicating that many nutrients serve a protective role in cognitive functioning (Guyonnet *et al.*, 2007). Similarly, poor nutritional status of senior citizens is associated with an increased cognitive impairment

(El Zoghbi *et al.*, 2013). There is also reason to assume that cognitive impairment tend to exacerbate one's poor nutritional status. Therefore, this issue is not about 'the chicken or the egg' but rather the temporal relationship between nutrition and cognition.

The aim of the review is to first highlight characteristic cognitive impairment among senior citizens. Secondly, within the background that malnutrition as a factor that leads to increased risk of morbidity and mortality in the elderly (Bowen and Atwood, 2004), this review also highlights algorithms for safeguarding nutritional status among senior citizens.

Cognitive impairment: According to Bowen and Atwood (2004), ageing is the progressive transformation in physical, psychological and social domains. At a biological level, the process of ageing is marked with reduction in mental efficiency which is underlined by reduction of neuronal plasticity. This is caused by the structural defects which manifest functional impairment. Because of the progressive nature of structural defect, one of the organs that fall prey to such predicament is the brain or the mind. Thus, functional impairment stems from reduced efficiency of the brain.

The term that often encapsulates the decline of the brain is known as "cognitive impairment". Cognitive impairment is the impairment of a wide variety of brain functions relating to the ability to remember, learn at a normal pace, adapt behavior in social settings and process or understand information. Using the neuropsychological model, cognitive impairment has been divided into those that have direct bearing on poor attention (inattention) which in turn is likely to render one with inability to learn and remember (memory impairment). Some of the interplay between impaired attention and poor memory could manifest as impaired executive function.

'Attention' has been defined as the ability to identify and select specific sensory experiences and respond to them in an appropriate and timely fashion (Posner, 1987), relatedly, 'arousal' has been described as the general state of an organism in terms of attentional processing. Elevated arousal has been linked to heighten the processing of salient exteroceptive or interoceptive information. This means attention is likely to act as a general energiser of behaviour. It is common observation that senior citizens tend to have impaired attention. There is strong empirical evidence suggesting that the diminished attentional capacity tends to result in various functional impairments including attenuation of motor

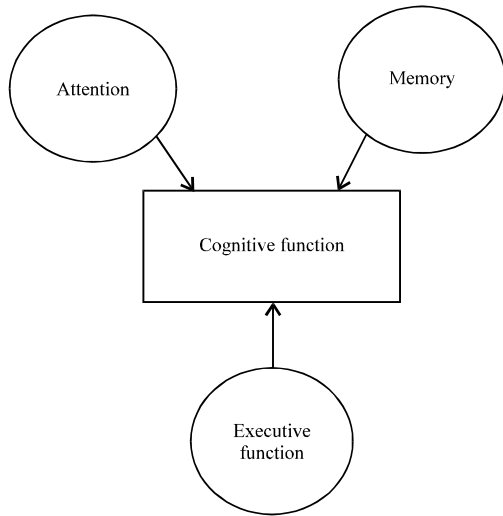


Fig. 1: Measures related to cognitive function

performance. According to Inzitari *et al.* (2007), on one hand, impaired attention vis-a-vis arousal system is likely to handicap senior citizens. On the other hand, attentional impairment is a major determinant of mobility disability among senior citizens. If appetitive behaviour is strongly linked to intact motor domain, then it should be expected that inattention and resultant motor performance would have direct bearing on nutritional status among senior citizens. This, in turn, suggests that cognitive impairment, in this case, impaired attention has negative repercussion on senior citizens that could extent to those related to food and liquid intake (Fig. 1).

Among attributes of being human, none appears central to human wellbeing than the ability to learn and remember. This idea owes its origin to the teaching of empiricism philosopher such as John Locke, who suggested an intimate link between memory and the selfhood or personal identity (Jolley, 1999). Such teaching encapsulate the view that selfhood is directly linked to one's past, or what one can recall from the past with the reference to the present (Klein and Kihlstrom, 1986). According to Kihlstrom *et al.* (2002), "... past experiences, thoughts, or actions that the person does not remember are not part of his identity. Selfhood consists entirely in continuity of memory. A person who remembers nothing of his or her past literally has no identity".

In modern neuropsychological nomenclature, memory or self-identity has been divided into three different processes involving memory. The first process goes by the name of "encoding". In a nutshell, this is the input process that receives information from the outside. Among elderly, due to impaired attention, their attentiveness is likely to be compromised. Integrity of

encoding would require intact visual as well as acoustic encoding. Both of these have impact on factors leading to not only to one's wellbeing but are also likely to disturb appetitive behavior which in turn may affect one's nutritional status. Second process is the cognitive repertoire that works as "storage or consolidation" of the information and the resultant retrieval. Senior citizens with compromised storage systems are bound to be socially incompetent and this is likely to impact on their feeding behaviors. For example, poor storage system means individual will not learn or remember. Similarly, failure in retrieval system has similar consequences. This may result hyper or hypophagia which, in both cases, is likely to result in disturbance of nutritional status. There is vast empirical studies suggesting one of the extreme form of cognitive impairment among senior citizens, known as dementia, is invariably marked with impairment in encoding, storage and retrieval (Thambirajah, 2005). Beside vagary of dementia, some senior citizens are likely to have memory failure or forgetting which can be due to failure or faulty functioning at each of these stages: (I) Defective encoding at the time of acquisition (for example, due to absent-mindedness), (ii) Poor storage of information and (iii) Inadequate retrieval (Thambirajah, 2005).

The third interrelated aspect of cognitive impairment that often afflict senior citizens often known as "executive impairment" which is thought to stem from frontal pathology. Individual frontal system impairment often leads to deficits in the organisational skills necessary for normal daily activity. According to Norman and Shallice (1986), the essential role played by frontal cortex is supervisory, consisting in the analysis and direction of on-going behaviour with respect to the desired outcome. Dysfunction of this system could lead not only to impulsive, disorganised behaviour (where automatic responses are not being adequately monitored or inhibited) but alternatively to behavioural passivity. Thus, if an individual has difficulty in generating and/or activating the appropriate goal-directed behaviour then at the extreme this will manifest apparent lack of motivation which is often termed as 'dysexecutive syndrome' (Al-Adawi, 1998; Al-Adawi *et al.*, 1998). There is strong indication that senior citizens with impaired frontal system tend to be marked with voracious appetite or conversely its counterpart, namely, poor appetite. In either case, these erratic eating behaviours are likely to dent one's nutritional status with vast repercussion to one's health (Suda *et al.*, 2010).

The elderly population tends to experience various nutritional problems such as difficulty in swallowing and chewing and ultimately malnutrition problems

(Van Nes *et al.*, 2001). Poor dietary intake leads to low nutrients threshold required for normal brain function. Several geriatric syndromes including cognitive deficit is considered as common disabling condition in elderly population (Leite *et al.*, 2001; Magri *et al.*, 2003; Saka *et al.*, 2010; Orsitto *et al.*, 2004). In elderly, functional decline may be a result of cognitive impairment (Petersen *et al.*, 1999; Petersen *et al.*, 2001). Increased morbidity-mortality rate and decline of functional disability is associated with poor nutritional status in elderly (Kagansky *et al.*, 2005; Donini *et al.*, 2004; Visvanathan, 2003; Vivanti *et al.*, 2011).

Infection, frailty disability and dependency are common and frequent complications of weight loss and malnutrition which leads to general health status alteration, cognitive deficit and other geriatric syndromes are related to increase morbidity-mortality incidence in malnourished elderly. If malnutrition is prevented/at least improved through early intervention and appropriate nutritional management which direct more interest and focus on early nutritional assessment and evaluation might be able to delay the onset of dementia in elderly (Guerin *et al.*, 2005; Spaccavento *et al.*, 2009).

Nutritional assessment of severe demented patients:

Muscle atrophy and weight reduction are common signs among Alzheimer's Disease (AD) patients (Poehlman and Dvorak, 2000). High rate of infection and increased energy expenditure as a result of repetitive movement and decline of cognitive abilities that leads to patients independencies and weight (Du *et al.*, 1993). "A significant association has been found between low body weight and atrophy of the mesial temporal cortex in the region of the central nervous system responsible for eating behavior" (Riviere *et al.*, 2001). A recent study showed that the severity of the disease was related positively with losing weight, recurrent infections and frequent hospital admissions (Guerin *et al.*, 2005). Nutritional intervention may be beneficial for high risk group and it has been concluded that the nutritional assessment of demented patients is crucially important (Munoz *et al.*, 2006). Based on these findings that metabolic balance is impaired as the disease progresses as indicated by impaired Body Mass Index (BMI), as well as impaired lean mass and brachial fatty in the advanced stages.

Elderly nutritional status evaluation, especially demented patients, can be done through various methods depending on malnutrition indicators, anthropometry measurements and assessment of oral intake. Guigoz *et al.* (1996), Vellas *et al.* (1999), Vellas *et al.* (2000) and Reisberg (1987) developed, "Mini Nutrition Assessment (MNA) which is the best validated and most

widely utilized screening test for malnutrition among elderly population because it is developed to assess the risk of malnutrition in the elderly and to identify those who are malnourished and others who could benefit from early intervention. This evaluation consists of 18 items including anthropometric, nutritional evaluation, clinical evaluation and self-perception of health. MNA is used for both screening and evaluating the nutritional status by trained health professionals and nutritionists. The MNA was used to classify subjects as well-nourished (score 24-30), at risk for malnutrition (score 17-23.5) or malnourished (score >17)".

Nutrition screening initiative is another tool of assessment, that is developed to evaluate primary health care consist of self applied 10 questions. Due to its, weakness to predict elderly mortality it is not widely recommended (Guigoz *et al.*, 1994). The relation between the cognitive function, neuropsychiatric deficit and nutritional status in AD patients was studied by using MNA (Spaccavento *et al.*, 2009). It was reported that the impairment of Daily Life Activities (DLA), hallucination, apathy and nocturnal motor behavior on Neuro-Psychiatric Index (NPI) was higher in patients at risk of malnutrition (Spaccavento *et al.*, 2009). Prognosis of AD is negatively affected by weight loss, as malnutrition severity increases, the clinical progression leading to patient death increases (Grundman, 2005). Anthropometric measurements (weight, height, BMI) along with biochemical profile such as albumin, hemoglobin, transferrin, total lymphocyte and blood cholesterol are considered as gold standard for nutritional assessment and evaluation (Bohmer and Mowe, 2000). Caiuby and Valiaco (2009) found that 36.6% of long-term stay institution with dementia, depression and cardiovascular diseases were malnourished by using anthropometric measurements, indicating the important role of early nutrition intervention (Caiuby and Valiaco, 2009).

Nutritional management of elderly patients with advanced dementia:

Advanced dementia patients suffer from reduced communication, lack of pleasure in eating and difficulty in swallowing caused by mastication changes and dysphagia (Pivi and Kato, 2011). Comfort in eating process, patient dignity particularly in well-nourished patients who shows loss of muscle mass due to reduce mobility may be provided by nutritional therapy. Nutritional indices including BMI, Brachial Circumference (BC), Brachial Muscle Circumference (BMC) and Total Lymphocyte Count (TLC), were noticed by Kikuchi and Filho (2006). Pivi *et al.* (2011) have reported that an additional 690 kcal day⁻¹ to the diet of patients with

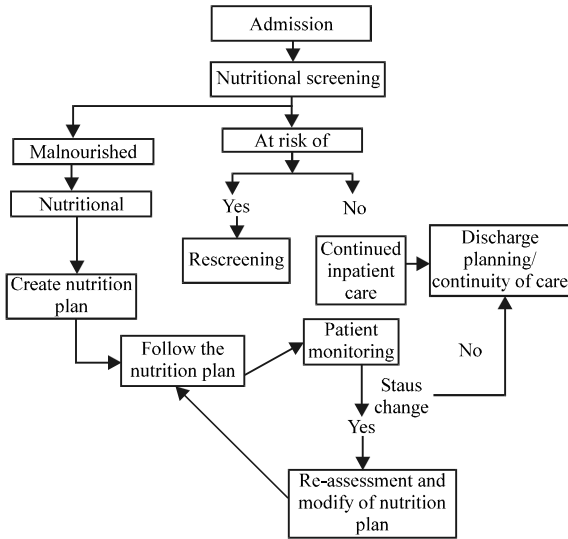


Fig. 2: Flow chart of nutritional management of elderly patients with advanced dementia

different stages of AD led to an improvement of the nutritional indices including BMI, BC, BMC and TLC which suggest that nutritional supplementation is in fact effective at any stage of the disease. On the same line Carver and Dobson (1995) found that body weight, tricipital skin fold and BMC were increased significantly after dietary supplementation in hospitalized elderly dementia patients. Recovery from nutrient deficiencies and convalescence improvement were also reported by Volkert *et al.* (1996) among non-demented elderly patients over 75 years after they supplemented with 500 kcal day⁻¹. To conclude that the dietary supplementations added to the normal diet have effectiveness to improve the nutritional status even in non-demented elderly patients. The flow chart shows the nutritional management of elderly with advanced dementia (Fig. 2).

Other studies showed that dietary supplementation to habitual diet might decrease the habitual diet intake and this might lead to a conclusion that nutritional supplement are more beneficial for malnourished patients with low body weight (Young *et al.*, 2004). Many researchers suggested that diet is a preventive measure and improving factor for the dementia states. Polyphenols and dietary antioxidants are believed to reduce the incidence of AD and other types of dementia (Vingtdeux *et al.*, 2008). Patients with good dietary instruction compliance and if consume daily 0.25 mg of folic acid and 2.5 mg B6 vitamin as supplements showed around 25% reduction

in serum homocysteine concentration which suggested that low homocysteine concentration may inhibit dementia development (De Jong *et al.*, 1999).

In conclusion, the nutritional assessment of elderly, particularly demented people, the MNA usage and early dietary instruction may represent as an important measure to improve the patient's quality of life. It is also essential to encourage and introduce nutritional supplementation particularly natural foods rich in antioxidants and polyphenol to improve nutritional status of elderly which might be able to delay or reduce the progression of neurodegenerative diseases including Alzheimer's disease.

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