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Research Paper

Association between cognitive function and nutritional status in elderly: A cross-sectional study in three institutions of Beirut—Lebanon ☆

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ABSTRACT

Introduction: The percentage of demented elderly is increasing worldwide and in Lebanon. Improvement in nutritional status would improve cognition in elderly. The purpose of this work is to investigate the presence of an association between nutritional status and cognitive function in elderly living in Lebanese institutions.
Materials and methods: This is a cross-sectional study performed in three long-stay elderly institutions in Beirut. Subjects who met the inclusion criteria filled out a questionnaire consisting of nutritional status scale (Mini Nutritional Assessment: MNA), cognitive function (Mini Mental State Evaluation: MMSE) and other parts (demographic, self-assessment of the state health, smoking and alcohol, physical dependence, quality of life, frailty, depression, social isolation and loneliness).
Results: Among 111 elderly (55 men and 56 women), 14(12.6%) elderly are malnourished, 54(48.7%) are at risk of malnutrition and 43(38.7%) had adequate nutrition. The majority of malnourished elderly (71.43%) showed a cognitive function deterioration (MMSE $<$ 24). The MMSE mean scores of malnourished elderly (20.21 ± 4.61) was significantly lower ($P=0.008$) than elderly at risk of malnutrition and elderly with normal nutritional status (respectively 22.61 ± 4.25 and 24.37 ± 3.63). There was a significant positive correlation between the MMSE score and the MNA score ($r=0.208$, $P=0.028$). Multivariate analysis showed that cognitive state of elderly was only explained by lower nutrition status (ORa = 3.03) and education (ORa = 1.72).
Conclusion: Nutritional status is associated with cognitive function. Monitoring the status of elderly can help in preventing malnutrition and possibly their cognitive impairment.

1. Introduction

Aging is a programmed physiological process that starts at birth; it is an evolutionary process which may transform a healthy adult to a fragile and vulnerable elderly (Trivalle, 2000). Depending on genotype and lifestyle, each elderly has a special aging process: some are active and independent, while others in the same age group are dependent (Fried, 2000). Successful aging is the absence of disease or a minimal alteration of physiological functions and musculoskeletal system (Rowe and kahn 1987); it is linked to balanced nutritional intake. Thus, nutrition affects the aging process, determining the general state of health (Gaudreau et al., 2007) and quality of life, particularly for those living in institutions (Crogan and Pasvogel et al., 2003).

Elderly have special dietary requirements for maintaining good health and doing various activities (Ferry et al., 2002; Martin et al., 2001). In institutions, malnutrition prevalence is high; it presents as deficiency, excess or imbalance of energy, protein and other nutrients (Westergren et al., 2001; Stratton et al., 2003). In developed countries, the percentage of malnourished elderly living in institutions outnumbers those living at home (Morely, 1997). A new prospective study on 120 elderly living in a long-stay hospital in a developing country revealed that 62.5% showed malnutrition (Binan et al., 2012). When malnutrition occurs, the elderly suffers from deterioration in functional status, decreased strength and muscle mass, decreased bone density, immune system dysfunction,

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anemia, delayed wound healing, development of pressure bedsores, increased risk of hospitalization, morbidity and mortality (Chapman, 2006).

Nutrition is also critical in determining cognitive state of elderly and for preventing potential cognitive decline (Kivipelto et al., 2009; Wengreen et al., 2009). The latter may directly influence autonomy and social interaction, depending on genetic factors (Holling Worth et al., 2011), and lifestyle (Baltes, 1987). In addition to high educational level, enriched social network and active engagement in mental, social and physical activities (Qiu et al., 2009; Coley et al., 2008), epidemiological data suggest that some nutrients may also have a protective role (Gillette Guyonnet et al., 2007).

Some evidence exists that macronutrients have influence on cognitive decline, such as glycemic load, which has an impact on insulin resistance and glucose handling in brain (Hsu et al., 2011), omega-3 fatty acids that would promote neuronal plasticity and improve learning capacities and cognitive functions (Sinclair et al., 2007) and Vitamin D3 that could in case of deficiency to alters adult behavior and brain function by increasing risk of obesity and cardiovascular diseases, impairing insulin secretion and increasing insulin resistance (Norman and Bouillon, 2010). Other micronutrients (vitamins B6, B12 and folate) play a protective role against cognitive decline (Ortega et al., 1997; Murakami et al., 2010; Lee et al., 2009). The relationship between nutrient intake and cognitive impairment is thus complex; it is very unlikely that a single compound plays a major role. Some studies showed that overall nutrition plays a role in maintaining cognitive capacities in elderly (Requejo et al., 2003; Johansson et al., 2009), particularly food diversification (Barberger-Gateau et al., 2007). Higher intake of fruits, vegetables, fish, nuts and legumes, and lower intake of meats, high fat dairy, and sweets seemed to be associated with reducing risk of cognitive deficits and Alzheimer disease (Gu and Scarmeas, 2011). Furthermore, Mediterranean diet seems to have a significant role on the level of cognitive function: adhesion to this type of diet was significantly associated with lower risk of Alzheimer disease, better cognitive function and slower deterioration (Scarmeas et al., 2006; Knopman, 2009; Roman et al., 2008; Feart et al., 2010).

In Lebanon, a Mediterranean Middle Eastern country, a single study has been published by Sibai and collaborators in 2003. It compared the nutritional status of 100 institutionalized elderly against 100 living at home in Beirut, and showed that institutionalized elderly had a body mass index and albumin level lower than those living at home, thus a worse nutritional status (Sibai et al., 2003). However, since they excluded elderly with cognitive impairment and they published no findings concerning the relationship between cognitive and nutritional status, we wanted to investigate the presence of such an association in elderly living in Lebanese institutions, a population considered at higher risk of malnutrition.

2. Methods

2.1. Study design and population

This is a cross-sectional study performed in three of the five long-stay institutions for elderly in the area of Beirut. In these institutions, elderly are monitored by a medical and paramedical team and are supported by nurses during realization of the activities of daily living. The sample was selected between March and June 2012, composed from people aged over 65 years and who had been admitted for more than four weeks. Four hundred and ninty five elderly live in the five institutions; among them, 460 (92.9%) lived in the three institutions participating to the study, distributed as follows: 350 in Dar Al-Ajaza Al-Islamia Hospital, 75 in Saint George Foyer, and 35 in Dar Al-Karama. The remaining 7.1% (35 elderly) are housed in the other two non-participating institutions.

From 460 elderly, we excluded those who refused to participate in this study (91; 19.8%), those with renal dialysis (28; 6.1%) because renal failure complications are responsible of both of cognitive impairment and malnutrition in renal dialysis patients (Murray et al., 2006; Radić et al., 2011) (inclusion of renal dialysis patients can overestimate the association between malnutrition and cognitive function impairment), and those with a score of Folstein Mini Mental State Examination (MMSE) < 14 (206; 44.8%) for their limited ability to understand, cooperate and communicate verbally during the interview (Folstein et al., 1975). In total, 135 elderly were eligible (29.3%), but 24 refused to continue to participate after MMSE application and only 111 (24.1%) were included in this study: 72 in Dar Al-Ajaza Al-Islamia hospital, 23 in Dar Al-Karama and 16 in Foyer Saint George. Fifty five were men (49.5%) with a mean age of 74.49 ± 1.09, and 56 were women (50.5%) with a mean age of 78.05 ± 1.02.

2.2. Measurements

The questionnaire was completed face to face, after explanation of the study purpose and oral informed consent. The questionnaire was divided into two parts; the first was for the selection of subjects for inclusion in the study, including age, institutionalization length, presence of renal failure with dialysis and evaluation of cognitive function using the MMSE score (Tombaugh and McIntyre 1992). Subjects who met the inclusion criteria continued to fill out the second part of the questionnaire and measurement scales; medical record was used to provide socio-demographic, anthropometric and health related data.

The questionnaire included five parts: socio-demographic data (gender, marital status, number of children, education level, occupation, personal resources, social coverage), health status (diseases, medications, dental problems, insomnia, digestive problems, chronic pain, hospitalization and physician visits), smoking and alcohol consumption, falls during last year and finally the following scales:

- MMSE score was used to evaluate cognitive functions and to classify elderly into two categories: a score between 14 and 24 reflected a cognitive impairment, those with a score equal to or greater than 24 were considered normal (Tombaugh et al., 1992). This test was used to ensure that the subjects included are eligible. The maximum MMSE score is 30 and it consists of seven parts: temporal orientation, spatial orientation, learning, calculation, short-term memory, communication and constructive apraxia (Folstein et al., 1975). This tool showed a high sensitivity (87%) and specificity (82%) for the detection of dementia of hospitalized elderly (Anthony et al., 1982). The normality of this test is beyond 24, a score below 24 means a cognitive impairment (Tombaugh and McIntyre 1992).
- The Mini Nutritional Assessment (MNA) was used to assess nutritional status and diagnosing protein-energy malnutrition (Guigoz et al., 1994). It is a questionnaire of 18 items including anthropometry measures (Body Mass Index (BMI), arm circumference, calf circumference and weight loss during the last three months), global evaluation (housing, medications number, acute diseases during the last three months, psychological stress during the last three months, mobility, bedsores), evaluation of dietary habits (number of meals per day, daily consumption of protein, consumption of fruits and vegetables, appetite during the last three months, weekly consumption of liquids and the ability to eat independently), and subjective assessment (health and nutritional status) (Guigoz et al., 1994). This test is easy to use, highly sensitive (96%) and specific (98%),