



## NUTRITIONAL ASSESSMENT OF THE ELDERLY IN A BRAZILIAN COMMUNITY

<sup>1</sup>Danilo Cangussu Mendes, <sup>2</sup>Deborah de Farias Lelis, <sup>3</sup>Jadson Rabelo Assis, <sup>2</sup>Angeliny Tamarana Lima Tabosa, <sup>2</sup>Daniela Fernanda de Freitas, <sup>4</sup>João Marcus Oliveira Andrade and <sup>5,\*</sup>Marcos Vinícius Macedo de Oliveira

<sup>1</sup>Department of Dentistry, Universidade Estadual de Montes Claros, 39401-001, Montes Claros, MG, Brazil

<sup>2</sup>Health Science Postgraduate Program, Universidade Estadual de Montes Claros, 39401-001, Montes Claros, MG, Brazil

<sup>3</sup> Department of Education, Universidade Estadual de Montes Claros, 39401-001, Montes Claros, MG, Brazil

<sup>4</sup>Department of Nursing, Universidade Estadual de Montes Claros, 39401-001, Montes Claros, MG, Brazil

<sup>5</sup>Department of Medicine, Faculdades Integradas de Montes Claros, Montes Claros, 39408-007, Montes Claros, MG, Brazil

### ARTICLE INFO

#### Article History:

Received 09<sup>th</sup> July, 2017  
Received in revised form  
24<sup>th</sup> August, 2017  
Accepted 27<sup>th</sup> September, 2017  
Published online 10<sup>th</sup> October, 2017

#### Key Words:

Malnutrition,  
Elderly,  
Nutritional Status,  
Mini Nutritional Assessment.

#### \*Corresponding author

### ABSTRACT

The number of elderly people has increased worldwide in the last years and a key determinant for life quality that has an important repercussion for the elderly is a good nutrition status. This study aimed to analyze the influence of sociodemographic factors, risk behaviors, oral health conditions, and cognitive deficit on nutritional status in a cohort of 508 non-institutionalized elderly people from a community in Brazil. Data from the Mini Nutritional Assessment, sociodemographic factors, risk behaviors, oral health conditions and cognitive evaluation using Mini-mental State Examination were used. Multiple regression analysis was applied. Older participants, illiterate elders and those presenting cognitive deficit were more likely to be at risk of malnutrition as well as advanced age elders and males when compared to younger and female participants. Significant differences were noted in the distribution of malnutrition among elders that used denture and those who had cognitive deficit. These findings provide an improved understanding of the nutritional profile of the elderly population and highlight the need for an adequate nutrition and social programs for the elderly.

Copyright ©2017, Danilo Cangussu Mendes et al. This is an open access article distributed under the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

Citation: Danilo Cangussu Mendes, Deborah de Farias Lelis, Jadson Rabelo Assis, Angeliny Tamarana Lima Tabosa, Daniela Fernanda de Freitas, João Marcus Oliveira Andrade, Marcos Vinícius Macedo de Oliveira. 2017. "Nutritional assessment of the elderly in a Brazilian community.", *International Journal of Development Research*, 7, (10), 16169-16176.

## INTRODUCTION

A key indicator of inadequate education and social conditions, poor health, poverty and hunger conditions is the nutritional status. For example, malnourished children have difficulties to grow and develop correctly, to resist infections or learn with their full potential.

Poorly nourished adults are less capable of performing work and are and severely hit by the social issues and economic security (1). The nutritional status of elder population as well as diseases are directly influence by the combination of environmental and individual factors, which can in addition act as an influencing factor to the functional capacity of the individual (2).

In this context, improper dietary intake, low income and social exclusion make the elderly more vulnerable to develop malnutrition (3). Normal aging processes, medical conditions or lifestyle are changes that may be related to nutritional requirements transition throughout life. Hence, the assessment of nutritional status becomes essential for preventing or maintaining a chronic disease stable and for healing. As observed in Sarcopenia, characterized by the loss of lean muscle mass, a gain in body fat may happen without being observable by the simple measurement of body weight, becoming noticeable only symptoms such as loss of strength, functional decline, and poor endurance, symptoms corroborated in other studies as well (4). In this context, the recognition of causes that underlies nutritional needs and dietary preferences is of paramount importance to understand a patient's nutritional status (5). Furthermore, it is necessary to develop an approach between the alimentation and nutrition in order to improve the population's quality of life (6), focusing on elderly for the purpose of this paper.

Although the prevalence of malnutrition among elderly patients is considered high, nutritional problems are still not recognized as a priority by health professionals. Nutritional assessment and intervention are crucial in this age group, in which the high incidence of chronic illness and a myriad of socio-economic factors contribute to the likelihood of malnutrition that could be considered as an element of frailty among the old, leading to increased risk of many geriatric syndromes such as falls, delirium, functional decline, depressed immunity, and many others. If malnutrition is suggested by such screening tests, then a supplemental conventional nutritional assessment should be performed before treatment is planned (5). In this context, it is important to note that the number of elderly people has increased worldwide in the last few years (7) and a key determinant for quality of life that has important repercussions for the elderly is a good nutrition status (8). However, malnutrition it is considered a major public health problem nowadays for the elderly population that affects around 6% of older people living in the community, 15% of nursing home residents, and 40% of older hospitalized patients (9). It negatively affects the physical and emotional well-being of older people, including increased mortality and vulnerability to infections, clinical complications, depression, anxiety, and decreased quality of life (10, 11). In addition, it is twice as expensive to treat malnourished adults than managing non-malnourished patients (12).

Research shows that clinical malnutrition is preceded by a state of nutritional risk that can be identified through screenings that can assess the state of poor nutrition or impaired nutritional status (11, 13). Therefore, early detection of malnutrition should be a key component of the geriatric assessment, as it is possible with the Mini Nutritional Assessment (MNA) that has been developed as a reliable screening test (14). In this context, the diversity of nutrition associated factors indicates that the evaluation of nutritional state of the elderly relies not only on anthropometric data analysis, but also on general and subjective aspects of health as it is observed in age related changes in oral health their impact on nutrition. Globally, it has been shown the situation of poor oral health among older people, which has been represented by a high number of tooth loss, dental caries and periodontal disease. The aging process itself is an important player on the dentition compromised condition found in elderly.

Furthermore, the negative impact of poor oral conditions on a daily basis is significant among edentulous people, where extensive tooth loss negatively influences ability to masticate, limiting food choices and consequently affecting the nutritional intake (15-18). In addition, It has been demonstrated that the nutritional status is closely associated with alterations in the oral cavity (19), which draw the attention to the importance of the subjective analysis of the oral conditions in addition to the already used indicators of nutritional status (20). The impact on general health caused by tooth loss may give rise to many problems such as disability, increase of the dependence, impairment of quality of life, and more importantly is considered a risk factor for malnutrition. Several factors affect tooth loss in older age. However, there is a lack of evidence that correlates factors such as smoking, alcohol use and tooth loss with nutrition in the elderly (21-23).

Various studies have also pointed to the relationship between nutritional factors and cognitive ability in the elderly (24-29). Cognitive status is a determinant of functional capacity, and the physical and social performances. The decrease of cognitive function implies the loss of autonomy and increases the degree of dependence, affecting the daily lives of the elderly with gradual decline of abilities such as reasoning, memory loss and loss of judgment (27). There are relationships between cognition and nutrition, but the mechanisms are not well characterized yet. It is unclear whether protein-energy malnutrition precedes or follows cognitive deficit (30). Therefore, due to the need for a better understanding of this complex and multidimensional relationship, this study aimed to analyze the influence of sociodemographic and risk behavior, oral health conditions, and cognitive deficit on nutritional risk in a population of non-institutionalized elderly from a community in Brazil.

## METHODS

### Design

This cross-sectional study was performed in the Elderly Care Reference Center in Montes Claros (a city in southeastern Brazil, with an estimated total population of 360,000 inhabitants in 2010). The cohort under study was composed by 508 people over 60 years old who were assisted from February 2008 to January 2011 at the Reference Center. The present study was approved by the Institutional Review Board of the State University of Montes Claros (Protocol 152.340/2012).

### Dependent variable

The use of Mini Nutritional Assessment (MNA) for measurement of malnutrition in the elderly has been extensively described in the literature, being considered highly sensitive, specific, reliable and a well validated test in different population studies (14, 31, 32). Nutritional evaluation was obtained from the data collection methods set out in the Portuguese version of the MNA, including: anthropometric parameters (weight and height, circumference of the arm and the calf muscle), the general status of the patient, a diet questionnaire and a subjective evaluation. The total MNA score ranges from 0 to 30. An MNA score of 24 or higher identifies the patient with a good nutritional status. Scores between 17 and 23.5 predict patients at risk for malnutrition. An MNA score less than 17 identifies protein-caloric malnourished patients.

## Independent variables

**Socio-demographic factors:** Data was collected regarding the following socio-demographic variables: sex (male and female), age (in years, as a continuous variable), schooling (literate and illiterate), and marital status (married and non-married).

**Risk behaviors:** The participants were asked about aspects of their lifestyle, such as smoking (smoker and non-smoker), and alcohol use (yes and no).

**Oral health related conditions:** The clinical variables of oral health included: edentulism (dentate and edentulous), use of dentures (yes and no), chewing problems (yes and no) and oral mucosal problem (yes and no).

**Cognitive status:** Cognitive functions of the patients were evaluated with the Mini-mental state examination (MMSE) test (33). Time and space orientation, registration, language and motor, immediate and delayed recall and attention/calculation skills of the patients were determined in 11 questions. MMSE scores considered years of education to detect cognitive deficit (34): cut off point of 24 for elders with more than 9 years of education and cut off point of 17 for lower education.

## Data analysis

Initially, descriptive statistics were performed to examine the socio-demographic, risk behavior, oral health, cognitive status and Mini Nutritional Assessment features of the sample. When appropriate, results were expressed as absolute numbers (n), percentages (%), means, and standard deviations ( $\pm$ SD). In order to test the association between the dependent and independent variables, chi-square ( $\chi^2$ ) bivariate analyses were performed for all variables, except for age (Kruskal Wallis test). All independent variables that demonstrated an association with a p-value  $<0.20$  were subjected to multiple analysis (multinomial logistic regression). In the multinomial logistic regression model, the elders with no risk of malnutrition played as the reference group for all comparisons. The final model was performed by following the backward technique in order to determine which factors were independent predictors of the nutritional status. Results with a confidence interval above 95% ( $p < 0.05$ ) were considered significant. All analyses were performed by using the statistical package SPSS<sup>®</sup> (SPSS Inc., Chicago, IL, USA), version 18.0 for Windows<sup>®</sup>.

## RESULTS

Overall, 508 elders, varying from 60 to 99 years old attended the study. The mean age was 74.72 ( $\pm 8.498$  years old). Table 1 shows the socio-demographic, risk behavior, oral health, cognitive status and Mini Nutritional Assessment features of the studied sample. Most participants were represented by female (76.4%), non-married (56.5%) and illiterate (70.3%) people. The majority was non-smokers (93.1) and did not drink alcohol (95.9%). Regarding oral health related variables, most participants were edentulous (94.6%), they used dentures (81.7%), had no chewing problems (60.6) and nor oral mucosal lesion (81.5%). According to MMSE, cognitive deficit was observed in 33.1% in this sample. High rates of risk of malnutrition (44.7%) and malnutrition (19.1%) were identified through MNA.

**Table 1. Socio-demographic factors, risk behaviour, oral health related variables, cognitive status, and nutritional evaluation of the elderly sample. Montes Claros (MG), Brazil, 2013**

Variables	n	%
Socio-demographic factors		
Age (mean+ standard deviation)	74.72+ 8.498	
Sex		
Male	120	23.6
Female	388	76.4
Schooling		
Literate	151	29.7
Illiterate	357	70.3
Marital status		
Married	221	43.5
Non-married	287	56.5
Risk behavior		
Smoking		
Smoker	35	6.9
Non-smoker	473	93.1
Alcohol use		
Yes	21	4.1
No	487	95.9
Oral health related variables		
Edentulism		
Dentate	27	5.4
Edentulous	473	94.6
Use of dentures		
Yes	414	81.7
No	93	18.3
Chewing problems		
Yes	200	39.4
No	308	60.6
Oral mucosal lesion		
Yes	94	18.5
No	413	81.5
Cognitive status		
Cognitive impairment		
Yes	168	33.1
No	340	66.9
Nutritional evaluation		
Mini Nutritional Assessment		
No risk of malnutrition	184	36.2
Risk of malnutrition	227	44.7
Malnutrition	97	19.1

Bivariate analysis by using chi square ( $\chi^2$ ) and Kruskal-Wallis statistical tests (table 2) were performed in order to test independent association between MNA and all independent variables. The variables age ( $p=0.000$ ), sex ( $p=0.024$ ), schooling ( $p=0.000$ ), alcohol intake ( $p=0.123$ ), use of dentures ( $p=0.000$ ) and cognitive deficit ( $p=0.000$ ) showed a p-value equal or less than 0.20 and were submitted to multiple regression analysis. Table 3 presents multinomial logistic regression results. Older participants ( $p < 0.000$ , OR = 1.068, 95% CI = 1.038-1.099), illiterate elders ( $p=0.041$ , OR = 1.693, 95% CI = 1.022-2.806) and those presenting cognitive deficit ( $p=0.001$ , OR = 2.424, 95% CI = 1.434-4.098) were more likely to be at risk of malnutrition. Older elders ( $p < 0.000$ , OR = 1.077, 95% CI = 1.039-1.117) and males ( $p=0.019$ , OR = 2.121, 95% CI = 1.130-3.981) were also more likely to be undernourished when compared with their counterparts younger elders and female participants. Additionally, significant differences were noted in the distribution of malnutrition among elders that used dentures ( $p=0.011$ , OR = 2.469, 95% CI = 1.233-4.942) and those who had cognitive deficit ( $p < 0.000$ , OR = 5.510, 95% CI = 2.938-10.334).

## DISCUSSION

Malnutrition is the state that can be associated with insufficient intake of macro or micronutrients, consequently calories, that, in turn, can cause adverse effects on body composition, function and clinical features, failure on digestive mechanisms

**Table 2. Bivariate analysis between socio-demographic factors, risk behavior, oral health related variables and the nutritional evaluation of the elderly sample. Montes Claros (MG), Brazil, 2013**

Variables	Mini Nutritional Assessment			p
	No risk of malnutrition	Risk of malnutrition	Malnutrition	
Socio-demographic factors				
Age (mean)	71.13	76.12	78.25	0.000*
Sex				
Male	34	54	32	0.024*
Female	150	173	65	
Schooling				
Literate	152	150	55	0.000*
Illiterate	32	77	42	
Marital status				
Married	86	94	41	0.536
Non-married	98	133	56	
Risk behavior				
Smoking				
Smoker	12	14	9	0.581
Non-smoker	172	213	88	
Alcohol use				
Yes	12	6	3	0.123
No	172	221	94	
Oral health related variables				
Edentulism				
Dentate	11	13	3	0.572
Edentulous	171	211	91	
Use of dentures				
Yes	162	187	65	0.000*
No	21	40	32	
Chewing problems				
Yes	73	85	42	0.611
No	111	142	55	
Oral mucosal lesion				
Yes	29	46	19	0.475
No	155	181	77	
Cognitive status				
Cognitive impairment				
Yes	26	84	58	0.000*
No	158	143	39	

Note: \* p-value statistically significant (p<0.05)

**Table 3. Multinomial regression analysis between socio-demographic factors, risk behaviour, oral health related variables and the nutritional evaluation of the elderly sample. Montes Claros (MG), Brazil, 2013**

	Covariates	Categories	OR	95% CI	p
Risk of malnutrition	Socio-demographic factors				
	Age (mean)		1.068	1.038-1.099	0.000*
	Sex	Female	Referent		
		Male	1.370	0.820-2.289	0.230
	Schooling	Literate	Referent		
		Illiterate	1.693	1.022-2.806	0.041*
	Oral health related variables				
	Use of dentures	Yes	Referent		
		No	1.237	0.674-2.272	0.492
	Cognitive status				
Cognitive impairment	No	Referent			
	Yes	2.424	1.434-4.098	0.001*	
Malnutrition	Socio-demographic factors				
	Age (mean)		1.077	1.039-1.117	0.000*
	Sex	Female	Referent		
		Male	2.121	1.130-3.981	0.019*
	Schooling	Literate	Referent		
		Illiterate	1.859	0.993-3.481	0.053
	Oral health related variables				
	Use of dentures	Yes			
		No	2.469	1.233-4.942	0.011*
	Cognitive status				
Cognitive impairment	No	Referent			
	Yes	5.510	2.938-10.334	0.000*	

Note: \* p-value statistically significant (<0.05)

or even decreased absorption of the nutrients (35-37). Studies show a high prevalence of older people malnutrition during hospitalization and it should be noted that almost 50% of patients were at risk of malnutrition (38, 39), however it is important to note that malnourished is considered an important health problem in aged people not only in hospitals and institutional care settings but also in the community in general (37). Malnourishment has a negative impact on functional status, psychosocial well-being, and life quality of the elderly contributing to higher complication and mortality rates in comparison with normally nourished patients (37, 40). Our study, where the elder patients were assisted by a multidisciplinary group, showed an malnutrition rate of 19.1% and a risk of malnutrition of 44.7%, less than the percentage found in a study with elderly from long-term institutions of southeastern Brazil (28.1% and 50.6%, respectively) (41). Malnutrition has been associated with medical, social and psychological causes (37)]. Poverty, social isolation, substance misuse, cognitive impairment, socio-cultural aspects and oral health related problems may contribute to the onset of the problem in elderly according to researches (37, 42-44). Although institutionalization has been reported to facilitate the onset of the malnutrition state (43), our study shows a high rate in non-institutionalized elderly, demonstrating the importance of diverse risk factors and the severity of the problem even in the elderly patients community.

### **Malnutrition and age**

Worldwide, the population is aging, and older persons represent the fastest growing age group. Malnutrition is a broad term encompassing both undernutrition and overnutrition, but most often refers to undernourishment (45). This study shows that higher age was associated with both risk of malnutrition and malnutrition. Age has been previously reported to be a predictor for malnutrition (46). This relationship could be explained by the problems and morbidities associated with aging, for example, changes in body composition and gastrointestinal function, which might reduce motility rates and disrupt digestion or absorption (47, 48). In addition, aging affects appetite and sensory organs, leading to decreased ability to visualize, smell and taste food, which may affect the desire for food and independency of the elderly people. To illustrate the decreased abilities aforementioned, we can cite the decline on the sweet and salty tastes, which leads the elderly to taste sour or bitter flavors only (47, 49).

### **Malnutrition and Gender**

Gender seems to be a controversial risk factor for malnutrition. More prevalent rate of malnutrition in women have been found in some studies (50-52) but they do not corroborate with other publications that report similar prevalence rates for either men and women (53, 54) or higher rates in men (51). The present study shows that males are more likely to be undernourished. Nutritional risk for men was associated with higher Geriatric Depression Scale (GDS) score, length of hospitalization, and poor appetite (51).

### **Malnutrition and Schooling**

Schooling is another socio-demographic factor that has been associated with poor nutrition. Our study shows that illiterate elders had higher odds to present risk of malnutrition (OR=1.693). It has been reported that elderly people with higher

education status may be more likely to obtain information about diseases and nutritional issues and have greater commitment and motivation to acquire healthy eating habits than those with lower levels of education (55-57).

### **Malnutrition and use of dentures**

It is known that oral health related factors might influence nutritional status in elderly directly or indirectly. In conformity with other study (51), our findings showed an association between the use of dentures and malnutrition, with individuals that did not use dentures being more likely to be malnourished than those with natural teeth or using partial or total dentures. It is noteworthy that deterioration of the chewing ability due to tooth loss is one of the most important consequences of oral diseases, especially dental caries and periodontal disease and it could result in reduction of dietary intake and change in food choices (56, 58). Other main risk factors of malnutrition are verbal inconsistency, depression, deglutition disorders and dependency (59). The misuse or non-use of dentures is associated with chewing problems and compromise the intake of hard-to-chew foods, such as some fruits, vegetables and meat leading to a diet with less fibers and carotene. Some studies show that a lower number of occluding pairs of teeth results in significantly lower serum levels for some micronutrients, especially beta carotene, retinol, ascorbic acid, vitamin E and folate, albumin carotenoids. On the other hand, increased cholesterol, saturated fat and energy intake were observed in comparison with people who have retained their teeth or have adequately replaced them (60-63)]. This different pattern of nutrition observed in elderly people that have either natural or artificial teeth and those that lost their teeth and did not replaced them plays important roles on the risk of being undernourished in elderly, being considered an important issue that can be managed to improve quality of life with aging.

### **Malnutrition and Cognitive deficit**

Malnutrition has been associated with diminished cognitive function (64). Our study showed that elderly people with cognitive impairment assessed through the Mini Mental State Examination (MMSE) had a risk 2.424 and 3.737 higher of being at risk of malnutrition and undernourished than those without similar limitation, respectively. In conformity with Requejo (2003) (26), subjects with adequate MMSE scores took more total foods than those who scored lower values in MMSE. Dementia and other cognitive disabilities could change dietary habits in different ways, such as lack of appetite or loss of memory and disorientation, contributing to poor nutrition (65). It could be speculated that some neurocognitive disabilities may rebound to reduced appetite because of lower levels of feeding stimulants (plasma and brain neuropeptide Y and brain neuroadrenaline) (66). Additionally, these patients, which are dependent of caregivers, might have difficulties in expressing their wishes as well as eating per se, or even may suffer from agnosia (difficulties in interpreting sense data related to vision, taste, smell, or touch) and apraxia (incapacity in opening the mouth due to motor disturbance), which can interfere in eating (66). It is important to mention that the study presented here, has some limitations, such as the cross-sectional design, on which data are collected at one point in time not permitting the establishment of causal inferences. In addition, the population of study was referent to elderly patients who sought medical care in a hospital and were seen by a nutritional team, not

necessarily representing the general population. However it was noteworthy to study the malnutrition associated factors aforementioned to the better understanding of this issue and the rise of a potential improvement on the nutrition of the elderly population.

### Conclusion

In summary, the study provides an improvement on the understanding of the nutritional profile of the elderly population and the results show that factors such as age, sex, schooling, use of dentures, cognitive impairment significantly affected the nutritional pattern of the elderly population, and the identification of these factors become relevant to the development of political actions and programs that should be aimed to minimize the malnutrition risks on the non-institutionalized elderly population.

### Acknowledgement

This work was supported by grants from Coordenadoria de Aperfeiçoamento do Pessoal de Nível Superior (CAPES), Conselho Nacional de Desenvolvimento Científico e Tecnológico (CNPq) and Fundação de Amparo à Pesquisa de Minas Gerais (FAPEMIG).

### REFERENCES

- Minhas, A., Sharma, S. 2017. Social predictors of childhood nutrition status of sub Himalayan region. *International Journal of Current Research*. 9, pp. 56536-42.
- Oliveira MR, Fogaca KC, Leandro-Merhi VA. (2009) Nutritional status and functional capacity of hospitalized elderly. *Nutr J*. 8, pp. 54.
- Pirlich, M., Lochs, H. 2001. Nutrition in the elderly. *Best Pract Res Clin Gastroenterol*. 15, pp. 869-84.
- Vilaça, K.H.C., Ferriolli, E., Lima, N.K.C., de Paula, F.J.A., Marchini, J.S., Moriguti, J.C. 2011. Muscle strength and bone mineral density in well-nourished and malnourished elderly *Revista de Nutrição*. 24, pp. 8.
- Pepersack T. 2009. Nutritional problems in the elderly. *Acta Clin Belg*. 64, pp. 85-91.
- Oliveira RBA, Prado, S.D., Carvalho, M.C.V.S., Ferreira, F.R. 2014. *Research in Clinical Nutrition in Brazil*. *Revista de Nutrição*. 27, pp. 10.
- IBGE. Censo demográfico 2010: características gerais da população, religião e pessoas com deficiência. Rio de Janeiro: Ministério do orçamento, planejamento e gestão; 2010. 215 p.
- Bamford C, Heaven B, May C, Moynihan P. 2012 Implementing nutrition guidelines for older people in residential care homes: a qualitative study using Normalization Process Theory. *Implement Sci*. 7, pp. 106.
- Kaiser MJ, Bauer JM, Ramsch C, Uter W, Guigoz Y, Cederholm T, et al. (2010) Frequency of malnutrition in older adults: a multinational perspective using the mini nutritional assessment. *J Am Geriatr Soc*. 58, pp. 1734-8.
- Arvanitakis M, Coppers P, Doughan L, Van Gossum A. 2009. Nutrition in care homes and home care: recommendations - a summary based on the report approved by the Council of Europe. *Clin Nutr*. 28, pp. 492-6.
- McElnay C, Marshall B, O'Sullivan J, Jones L, Ashworth T, Hicks K, et al. 2012. Nutritional risk amongst community-living Maori and non-Maori older people in Hawke's Bay. *J Prim Health Care*. 4, pp. 299-305.
- Guest JF, Panca M, Baeyens JP, de Man F, Ljungqvist O, Pichard C, et al. (2011) Health economic impact of managing patients following a community-based diagnosis of malnutrition in the UK. *Clin Nutr*. 30, pp. 422-9.
- Rolland Y, Perrin A, Gardette V, Filhol N, Vellas B. (2012) Screening older people at risk of malnutrition or malnourished using the Simplified Nutritional Appetite Questionnaire (SNAQ): a comparison with the Mini-Nutritional Assessment (MNA) tool. *J Am Med Dir Assoc*. 13, pp. 31-4.
- Guigoz Y, Lauque S, Vellas BJ. 2002. Identifying the elderly at risk for malnutrition. The Mini Nutritional Assessment. *Clin Geriatr Med*. 18, pp. 737-57.
- Budtz-Jorgensen E, Chung JP, Rapin CH. (2001) Nutrition and oral health. *Best Pract Res Clin Gastroenterol*. 15, pp. 885-96.
- Samnieng P, Ueno M, Shinada K, Zaitso T, Wright FA, Kawaguchi Y. 2011. Oral health status and chewing ability is related to mini-nutritional assessment results in an older adult population in Thailand. *J Nutr Gerontol Geriatr*. 30, pp. 291-304.
- Samnieng P, Ueno M, Shinada K, Zaitso T, Wright FA, Kawaguchi Y. 2012. Association of hyposalivation with oral function, nutrition and oral health in community-dwelling elderly Thai. *Community Dent Health*. 29, pp. 117-23.
- Rodrigues HL, Jr., Scelza MF, Boaventura GT, Custodio SM, Moreira EA, Oliveira Dde L. 2012. Relation between oral health and nutritional condition in the elderly. *J Appl Oral Sci*. 20, pp. 38-44.
- Gil-Montoya JA, Subira C, Ramon JM, Gonzalez-Moles MA. 2008. Oral health-related quality of life and nutritional status. *J Public Health Dent.*, 68, pp. 88-93.
- Kshetrimayum, N., Reddy, C.V., Siddhana, S., Manjunath M., Rudraswamy, S., Sulavai, S. 2012. Oral health-related quality of life and nutritional status of institutionalized elderly population aged 60 years and above in Mysore City, India. *Gerodontology*. 8, pp. 6.
- Clifford, A., Pulver, L.J., Richmond, R., Shakeshaft, A., Ivers, R. 2011. Smoking, nutrition, alcohol and physical activity interventions targeting Indigenous Australians: rigorous evaluations and new directions needed. *Aust N Z J Public Health*. 35, pp. 38-46.
- Hanioka, T., Ojima, M., Tanaka, K., Aoyama, H. 2007. Association of total tooth loss with smoking, drinking alcohol and nutrition in elderly Japanese: analysis of national database. *Gerodontology*. 24, pp. 87-92.
- Musacchio, E., Perissinotto, E., Binotto, P., Sartori, L., Silva-Netto, F., Zambon, S., et al. 2007. Tooth loss in the elderly and its association with nutritional status, socio-economic and lifestyle factors. *Acta Odontol Scand*. 65, pp. 78-86.
- Burns A, Marsh A, Bender DA. (1989) Dietary intake and clinical, anthropometric and biochemical indices of malnutrition in elderly demented patients and non-demented subjects. *Psychol Med*. 19, pp. 383-91.
- Gonzalez-Gross, M., Marcos, A., Pietrzik, K. 2001. Nutrition and cognitive impairment in the elderly. *Br J Nutr*. 86, pp. 313-21.
- Requejo, A.M., Ortega, R.M., Robles, F., Navia, B., Faci, M., Aparicio, A. 2003. Influence of nutrition on cognitive function in a group of elderly, independently living people. *Eur J Clin Nutr*. 57 Suppl 1, pp. S54-7.



27. Spaccavento, S., Del Prete, M., Craca, A., Fiore, P. 2009. Influence of nutritional status on cognitive, functional and neuropsychiatric deficits in Alzheimer's disease. *Arch Gerontol Geriatr.* 48, pp. 356-60.
28. Ayers, E., Verghese, J. 2014. Locomotion, cognition and influences of nutrition in ageing. *Proc Nutr Soc.* 73, pp. 302-8.
29. Van Dyk, K., Sano, M. 2007. The impact of nutrition on cognition in the elderly. *Neurochem Res.* 32, pp. 893-904.
30. Correa Leite ML, Nicolosi A, Cristina S, Hauser WA, Nappi G. (2001) Nutrition and cognitive deficit in the elderly: a population study. *Eur J Clin Nutr.* 55, pp. 1053-8.
31. Schrader, E., Baumgartel, C., Gueldenzoph, H., Stehle, P., Uter, W., Sieber, C.C. et al. 2014. Nutritional status according to mini nutritional assessment is related to functional status in geriatric patients--independent of health status. *J Nutr Health Aging.* 18, pp. 257-63.
32. Ghazi, L., Fereshtehnejad, S.M., Abbasi Fard, S., Sadeghi M., Shahidi, G.A., Lokk, J. 2015 Mini Nutritional Assessment (MNA) is Rather a Reliable and Valid Instrument to Assess Nutritional Status in Iranian Healthy Adults and Elderly with a Chronic Disease. *Ecol Food Nutr.* pp. 1-16.
33. Su, Y.P., Chang, C.K., Hayes, R.D., Perera, G., Broadbent, M., To, D. et al. 2014. Mini-mental state examination as a predictor of mortality among older people referred to secondary mental healthcare. *PLoS One.* 9, pp. e105312.
34. Lourenço, R.A., Veras, R. 2006. Mini-Exame do Estado Mental: características psicométricas em idosos ambulatoriais. *Revista de Saúde Pública.* 40, pp. 8.
35. Lopez-Contreras, M.J., Torralba, C., Zamora, S., Perez-Llamas, F. 2012. Nutrition and prevalence of undernutrition assessed by different diagnostic criteria in nursing homes for elderly people. *J Hum Nutr Diet.* 25, pp. 239-46.
36. Omran, M.L., Morley, J.E. 2000. Assessment of protein energy malnutrition in older persons, part I: History, examination, body composition, and screening tools. *Nutrition.* 16, pp. 50-63.
37. Saunders, J., Smith, T., Stroud, M. 2011. Malnutrition and undernutrition. *Medicine.* 39, pp. 45-50.
38. Edwards, D., Carrier, J., Hopkinson, J. 2017. Assistance at mealtimes in hospital settings and rehabilitation units for patients (>65years) from the perspective of patients, families and healthcare professionals: A mixed methods systematic review. *Int J Nurs Stud.* 69, pp. 100-18.
39. Bonetti, L., Terzoni, S., Lusignani, M., Negri, M., Frolidi, M., Destrebecq, A. 2017. Prevalence of malnutrition among older people in medical and surgical wards in hospital and quality of nutritional care: a multicenter, cross-sectional study. *J Clin Nurs.* pp.
40. Crogan, N.L., Pasvogel, A. 2003. The influence of protein-calorie malnutrition on quality of life in nursing homes. *J Gerontol A Biol Sci Med Sci.* 58, pp. 159-64.
41. Ferreira, L.S., Nascimento, L.F., Marucci, M.F. 2008. Use of the mini nutritional assessment tool in elderly people from long-term institutions of southeast of Brazil. *J Nutr Health Aging.* 12, pp. 213-7.
42. Verbrugge, M., Beeckman, D., Van Hecke, A., Vanderwee, K., Van Herck, K., Clays, E. et al. 2012. Malnutrition and associated factors in nursing home residents: A cross-sectional, multi-centre study. *Clin Nutr.* pp.
43. Donini, L.M., Scardella, P., Piombo, L., Neri, B., Asprino, R., Proietti, A.R. et al. 2013. Malnutrition in elderly: social and economic determinants. *J Nutr Health Aging.* 17, pp. 9-15.
44. Hickson, M. 2006. Malnutrition and ageing. *Postgrad Med J.* 82, pp. 2-8.
45. Fakhouri, T.H., Ogden, C.L., Carroll, M.D., Kit, B.K., Flegal, K.M. 2012. Prevalence of obesity among older adults in the United States, 2007-2010. *NCHS Data Brief.* pp. 1-8.
46. Johansson, Y., Bachrach-Lindstrom, M., Carstensen, J., Ek A.C. 2009. Malnutrition in a home-living older population: prevalence, incidence and risk factors. *A prospective study. J Clin Nurs.* 18, pp. 1354-64.
47. Brownie, S. 2006. Why are elderly individuals at risk of nutritional deficiency? *Int J Nurs Pract.* 12, pp. 110-8.
48. Elia, M., Stratton, R.J. 2005. Geographical inequalities in nutrient status and risk of malnutrition among English people aged 65 y and older. *Nutrition.* 21, pp. 1100-6.
49. Chen, C.C., Schilling, L.S., Lyder, C.H. 2001 A concept analysis of malnutrition in the elderly. *J Adv Nurs.* 36, pp. 131-42.
50. Castel, H., Shahar, D., Harman-Boehm, I. 2006. Gender differences in factors associated with nutritional status of older medical patients. *J Am Coll Nutr.* 25, pp. 128-34.
51. Ritchie, C.S., Burgio, K.L., Locher, J.L., Cornwell, A., Thomas, D., Hardin, M. et al. 1997. Nutritional status of urban homebound older adults. *Am J Clin Nutr.* 66, pp. 815-8.
52. Cuervo, M., Ansorena, D., Garcia, A., Astiasaran, I., Martinez, J.A. 2008. Food consumption analysis in spanish elderly based upon the mini nutritional assessment test. *Ann Nutr Metab.* 52, pp. 299-307.
53. Perissinotto, E., Pisent, C., Sergi, G., Grigoletto, F., Group I.W. 2002. Anthropometric measurements in the elderly: age and gender differences. *Br J Nutr.* 87, pp. 177-86.
54. Rea, I.M., Gillen, S., Clarke, E. 1997. Anthropometric measurements from a cross-sectional survey of community dwelling subjects aged over 90 years of age. *Eur J Clin Nutr.* 51, pp. 102-6.
55. Wang, H.H. 1999. Predictors of health promotion lifestyle among three ethnic groups of elderly rural women in Taiwan. *Public Health Nurs.* 16, pp. 321-8.
56. Han, Y., Li, S., Zheng, Y. 2009. Predictors of nutritional status among community-dwelling older adults in Wuhan, China. *Public Health Nutr.* 12, pp. 1189-96.
57. Chen, S.H., Acton, G., Shao, J.H. 2010. Relationships among nutritional self-efficacy, health locus of control and nutritional status in older Taiwanese adults. *J Clin Nurs.* 19, pp. 2117-27.
58. Visvanathan, R., Ahmad, Z. 2006. Good oral health, adequate nutrient consumption and family support are associated with a reduced risk of being underweight amongst older Malaysian residents of publicly funded shelter homes. *Asia Pac J Clin Nutr.* 15, pp. 400-5.
59. Dion, N., Cotart, J.L., Rabilloud, M. 2007. Correction of nutrition test errors for more accurate quantification of the link between dental health and malnutrition. *Nutrition.* 23, pp. 301-7.
60. Brodeur, J.M., Laurin, D., Vallee, R., Lachapelle, D. 1993. Nutrient intake and gastrointestinal disorders related to masticatory performance in the edentulous elderly. *J Prosthet Dent.* 70, pp. 468-73.
61. Moynihan, P.J., Snow, S., Jepson, N.J., Butler, T.J. 1994. Intake of non-starch polysaccharide (dietary fibre) in

- edentulous and dentate persons: an observational study. *Br Dent J.* 177, pp. 243-7.
62. Marcenes, W., Steele, J.G., Sheiham, A., Walls, A.W. 2003. The relationship between dental status, food selection, nutrient intake, nutritional status, and body mass index in older people. *Cad Saude Publica.* 19, pp. 809-16.
63. Kazemi, S., Savabi, G., Khazaei, S., Savabi, O., Esmailzadeh, A., Keshteli, A.H. et al. 2011. Association between food intake and oral health in elderly: SEPAHAN systematic review no. 8. *Dent Res J (Isfahan).* 8, pp. S15-20.
64. Pearson, J.M., Schlettwein-Gsell, D., Brzozowska, A., van Staveren, W.A., Bjornsbo, K. 2001. Life style characteristics associated with nutritional risk in elderly subjects aged 80-85 years. *J Nutr Health Aging.* 5, pp. 278-83.
65. Machado, J., Caram, C.L., Frank, A.A., Soares, Ede, A., Laks, J. 2009. [Nutritional status in Alzheimer's disease]. *Rev Assoc Med Bras.* 55, pp. 188-91.
66. Marcus, E.L., Berry, E.M. 1998. Refusal to eat in the elderly. *Nutr Rev.* 56, pp. 163-71.

\*\*\*\*\*