pISSN 2394-6032 | eISSN 2394-6040

Original Research Article

DOI: http://dx.doi.org/10.18203/2394-6040.ijcmph20183100

Prevalence of malnutrition and its determinants in an elderly people in South India

Satyanarayana Konda¹*, Ravi Kumar B. P.¹, Purushottam A. Giri²

Department of Community Medicine, ¹Mamata Medical College, Khammam, Telangana, ²IIMSR Medical College, Badnapur, Jalna, Maharashtra, India

Received: 20 May 2018 Revised: 12 June 2018 Accepted: 13 June 2018

*Correspondence:

Dr. Satyanarayana Konda, E-mail: sgkonda@yahoo.co.in

Copyright: © the author(s), publisher and licensee Medip Academy. This is an open-access article distributed under the terms of the Creative Commons Attribution Non-Commercial License, which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

ABSTRACT

Background: The population of elderly people aged \geq 60 years is increasing worldwide and is projected to reach 1.5 billion by 2050. In India, the elderly people constitute 8.1% of the total population. Malnutrition is highly prevalent in the elderly population due to various diseases and impairments.

Methods: A cross-sectional study was carried out amongst 209 elderly people from February 2018 to April 2018. A questionnaire was used to collect data related to socio-demographic characteristics, Mini Nutritional Assessment (MNA) and regarding medication use, comorbidity, use of a walking aid, smoking and alcohol consumption. The MNA tool was used for the assessment of nutrition status. For an assessment of functional status, the activities of daily living scale and instrumental activities of daily living scale were used. Descriptive analysis and Chi-square test were used to present the data.

Results: The average MNA score was 23.5 (SD=4.3, range: 7-30) and that of BMI was 23.8 (SD=3.9, range: 15.6-38.9). Of 209 study participants, 9.1% were malnourished, 32.5% were at risk of malnutrition and remaining 58.4% were having normal nutritional status. The possible predictors of malnutrition were older age, lower education level, staying single, unemployed, low income and less than three meals daily.

Conclusions: The overall prevalence of malnutrition was found to be 9.1% but the proportion of elderly people at risk of malnutrition was relatively high. Diagnosis and treatment of elderly people at high risk for malnutrition based on the findings of this study may improve functional status and prognosis of elderly people.

Keywords: Malnutrition, Elderly, Mini nutritional assessment, Risk factors, South India

INTRODUCTION

According to the World Health Organization (WHO), the population of worldwide elderly people aged ≥60 years is projected to reach 1.5 billion by 2050, a dramatic threefold increase from 524 million in 2010, with the highest increase in developing countries. India's elderly population is also growing rapidly and accounted for 8.1% of the total population in 2011. Such a rapid rise in the elderly population will definitely pose several challenges such asscanty income to support themselves,

absence of social security, loss of social status and lack of opportunities for use of their time. Therefore, India needs to prepare to address these social, psychological, economic and health needs of this aging population. According to the 2016 Global Nutrition Report, malnutrition affects 1 in 3 people worldwide making it a growing public health challenge.³ Studies suggest that 31 to 46% of elderly population, depending on the subgroup studied, are at risk for malnutrition.⁴ Malnutrition is highly prevalent in the elderly population due to various diseases and impairments such as cognitive and physical

decline, depressive symptoms, emotional variations, poor oral health and socioeconomic changes.⁵ It is associated with a number of adverse events such as increased risk for falls and pressure sores, impaired wound healing, decreased locomotor activity with delayed reflexes, high incidence of non-communicable diseases, weight lossand increased morbidity. It is also linked to decreased muscle mass, alteration in the structure and function of gastrointestinal system, higher infection rates, poor health outcomes and impaired quality of life.^{6,7} These can be prevented if nutritional status among elderly people is assessed with simple nutritional measures and treated malnutrition on time. The Mini Nutritional Assessment (MNA) is a useful screening tool to detect malnutrition and risk of malnutrition among elderly people. The tool was first developed and published in 1994. It has been widely validated in elderly people and has been extensively used in studies worldwide. The MNA tool involves anthropometric measures, dietary problems, weight changes, mobility issues and neuropsychological status. The tool classifies individuals into categories of well nourished, at risk of malnutrition or malnourished.

Studies conducted in different parts of India have reported prevalence of malnutrition between 7% and 19% among elderly people using MNA tool and various factors were found to be associated with malnutrition including age, gender, education level, socio-economic status, marital status, number of meals daily, cognitive and physical impairment. However, there is no data available on the prevalence of malnutrition and its associated factors in Khammam district of Telangana state in South India. Keeping this in mind, the present study was designed to assess the nutritional status among community dwelling elderly people in Khammam, and to describe the socio-demographic and health related factors associated with malnutrition.

METHODS

Study design and study population

A cross-sectional study was carried out amongst 209 elderly people from February 2018 to April 2018. The urban health center of Mamata Medical College and Hospital has six areas from which three areas were randomly selected. The total number of households in these three areas was 1175. In 937 houses, there were no elderly people and nonresponse was obtained in 63 houses. Hence, we surveyed 175 households and 209 elderly people were interviewed. A pilot tested and validated structured questionnaire was used to collect the data from elderly people at least 60 years old from these areas.

Data collection techniques and tools

The information obtained from the study participants included socio-demographic characteristics (age, gender, marital status, education level, occupation, living

arrangements), the complete MNA and questions regarding use of oral medications, comorbidity (hypertension, diabetes mellitus, coronary artery disease, congestive heart failure, chronic renal failure, COPD, CVD, osteoporosis and musculoskeletal disease), fall events, use of a walking aid, smoking and alcohol consumption. The interviews were conducted in the community. Before starting the interview, each participant was explained in brief about the need and purpose of the study. The importance for their cooperation for the success of the study and possible benefits to the community through the findings of the study were emphasized. The study protocol and questionnaire was approved by the Institutional Ethical Committee at Mamata Medical College and Hospital. The informed consent was obtained from each interviewee before enrolment in the study and confidentiality of the information was maintained throughout the study.

The MNA, the most established, validated and widespread nutritional assessment tool used among elderly people developed by Guigoz, was used for the purpose of the study. The MNA tool consists of 18 items which provides 4 types of assessment: anthropometric measurements (BMI, MUAC, CC and weight loss), dietary intake (number of meals consumed, food and fluid intake and feeding autonomy), a global assessment (lifestyle, medication, mobility, presence of acute stress and presence of dementia or depression) and a self-assessment (self perception of health and nutrition). The total score is 30 points; a well nourished person would score 24 points or more, a score between 17.0 and 23.5 points indicates a risk for malnutrition and a score of less than 17.0 points indicates the person is malnourished.

Anthropometric measurements consisted of weight, height, mid upper arm circumference (MUAC) and calf circumference (CC). Weight was measured to the nearest 0.1 kg using a portable standardized weighing machine with a maximum capacity of 100 kg. All subjects were weighed barefoot while wearing light clothing. The zero mark on the scale was checked after every reading for accuracy. Height was measured to the nearest 0.1cm using a portable stadiometer while the subject stood barefoot with their head, buttocks and heels touching the instrument and their head in the Frankfurt plane. Body mass index (BMI) was determined using the formula BMI=weight in kg/height in m². Patients with a BMI less than 18.5 kg/m² were considered underweight, those with a BMI of 18.5-22.9 kg/m² were normal weight, those with a BMI 23.0-24.9 kg/m² were overweight and those with a BMI 25.0 kg/m² or above were obese, according to the WHO Asian adult body weight standard. 14 MUAC and CC measurements performed twice using a portable tape with the smallest division of 0.1 cm. For an assessment of functional status, the activities of daily living (ADL) scale containing 6 items (bathing, dressing, carrying out personal toileting, moving from bed to chair, bowel or urine continence and eating) and the instrumental activities of daily living (IADL) scale containing 8 items (telephone usage, shopping, cooking, housekeeping, laundry, transportation, ability to take medications and financial management) were used.

Statistical analysis

All statistical analyses were performed using SPSS, version 18.0 (SPSS Inc., Chicago, IL). For continuous variables means and standard deviations (SD) were used to present the data, while categorical variables were presented as frequency and percentages. Appropriate tests of significance (Chi-square, Student's t and F-tests) were applied wherever necessary at the 5% level of significance. The p<0.05 was considered as statistically significant at 95% confidence level.

RESULTS

Table 1: Socio-demographic characteristics of study participants.

		No. (%)					
Socio-demographic characteristics							
	<65	93 (44.5)					
Age (in yrs)	65-75	97 (46.4)					
	>75	19 (9.1)					
G	Female	80 (38.3)					
Sex	Male	129 (61.7)					
Completed secondary	No	159 (76.1)					
school	Yes	50 (23.9)					
Marital status	Single	62 (29.7)					
Maritai status	Married	147 (70.3)					
Occupation	Non-working	144 (68.9)					
Occupation	Working	65 (31.1)					
No. of household	<4	98 (46.9)					
members	≥4	111 (53.1)					
Per conite income (INIP)	< 7000	110 (52.6)					
Per-capita income (INR)	≥7000	99 (47.4)					
C.m. alain a	No	172 (82.3)					
Smoking	Yes	37 (17.7)					
Alcoholism	No	173 (82.8)					
Alcoholisiii	Yes	36 (17.2)					
Compubidity	No	80 (38.3)					
Comorbidity	Yes	129 (61.7)					
Oral medication	No	123 (58.9)					
Oral medication	Yes	86 (41.1)					
	<17	19 (9.1)					
MNA score	17-23.5	68 (32.5)					
	>23.5	122 (58.4)					
Living alone	No	179 (85.6)					
Living alone	Yes	30 (14.4)					
Number of mode doily	<3	70 (33.5)					
Number of meals daily	≥3	139 (66.5)					
Functional characteristics							
ADL independent	Yes	183 (87.6)					
	No	26 (12.4)					
IADL independent	Yes	153 (73.2)					
IADE macpenaem	No	56 (26.8)					

We collected data from 209 elderly people with almost equal representation from each of three areas. The average age of the total participants was 66.8 (SD=6.3, range: 60-90) years and 61.7% were males. The sociodemographic and descriptive characteristics of study participants are shown in Table 1. Mean heights and weights were greater among men compared with women, the difference being statistically significant. The average MNA score was 23.5 (SD=4.3, range: 7-30) and that of BMI was 23.8 (SD=3.9, range: 15.6-38.9). Mean MNA score was almost equal for both men and women. Of 209 study participants, 183 showed functional independence based on ADL scores and 153 based on IADL scores. According to BMI, 8.1% of the elderly people were underweight, 25.8% were overweight and 34.4% were obese. The total MNA score was significantly correlated with BMI (r=0.47; p<0.001) (As shown in Figure 1). Thirty subjects lived alone and majority were not requiring any support services.

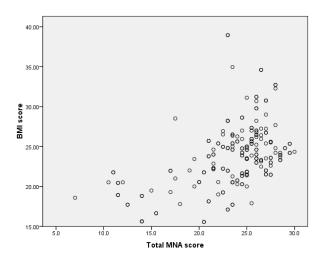


Figure 1: Scatter plot and Spearman correlation coefficient (r) of BMI and total MNA score.

BMI=Body Mass Index; MNA=Mini Nutritional Assessment

Nineteen participants (9.1%) were classified as malnourished, 68 (32.5%) participants were at risk of malnutrition and the remaining 122 (58.4%) were classified as having normal nutritional Malnutrition status (MNA score <17) was seen almost equally between men and women. Sixty-six per cent of the elderly consumed three meals daily, 34% had two meals daily and consumption patterns varied significantly nutritional status. Smoking and alcohol consumption, each were seen in nearly 17% of elderly people. No significant association was observed between smoking or alcohol consumption with malnutrition.

The comparison between well nourished, at risk of malnutrition and malnourished groups showed significant differences with respect to the mean values of weight, BMI, MUAC and CC whereas groups were similar with

respect to the mean height and gender distribution (As shown in Table 2). The risk factors associated with malnutrition were old age, low education level, staying single, unemployed, low socio-economic status, less than

three meals daily and use of oral medications (As shown in Table 3). Among the functional characteristics studied, both ADL and IADL dependence was significantly associated with malnutrition.

Table 2: Association between MNA scores and anthropometric measurements of elderly people (n=209).

Variable	Well nourished MNA >23.5	At risk of malnutrition MNA 17-23.5	Malnourished MNA <17	P value
No. (%)	122 (58.4)	68 (32.5)	19 (9.1)	
Age (mean \pm SD)	65.6±5.1	66.7±5.7	75.3±8.7	< 0.001
Male / Female	76/46	41/27	12/7	0.955
Weight (kg)	67.8±10.1	61.3±11.0	50.3±7.3	< 0.001
Height (cm)	164.5±8.4	162.8±6.2	163.7±4.5	0.310
BMI (kg/m ²)	25.0±3.1	23.2±4.4	18.7±1.9	< 0.001
MUAC (cm)	25.4±6.9	24.3±5.5	20.2±1.2	0.004
CC (cm)	34.1±3.7	31.5±4.6	27.4±1.4	< 0.001

MNA = Mini Nutritional Assessment; BMI = Body Mass Index; MUAC = Mid Upper Arm Circumference; CC = Calf Circumference

Table 3: Comparison of socio-demographic characteristics with nutritional status according to MNA scores of elderly people.

Socio-demographic character	istics	Well nourished N (%)	At risk of malnutrition N (%)	Malnourished N (%)	P value
Age (in years)	<65	63 (67.7)	28 (30.1)	2 (2.2)	
	65-75	52 (53.6)	39 (40.2)	6 (6.2)	<0.001
	>75	7 (36.8)	1 (5.3)	11 (57.9)	
Sex	Female	46 (57.5)	27 (33.8)	7 (8.8)	0.055
	Male	76 (58.9)	41 (31.8)	12 (9.3)	0.955
Committed and all and a language	No	84 (52.8)	59 (37.1)	16 (10.1)	0.016
Completed secondary school	Yes	38 (76.0)	9 (18.0)	3 (6.0)	0.016
Marital status	Single	24 (38.7)	22 (35.5)	16 (25.8)	< 0.001
	Married	98 (66.7)	46 (31.3)	3 (2.0)	<0.001
Occupation	Non-working	79 (54.9)	47 (32.6)	18 (12.5)	0.032
	working	43 (66.2)	21 (32.3)	1 (1.5)	0.032
No. of household members	<4	65 (66.3)	26 (26.5)	7 (7.1)	0.090
No. of flousefiold flieffibers	>=4	57 (51.4)	42 (37.8)	12 (10.8)	0.090
Dan comita incoma (INID)	< 7000	53 (48.2)	44 (40.0)	13 (11.8)	0.007
Per-capita income (INR)	>=7000	69 (69.7)	24 (24.2)	6 (6.1)	
Cmalring	Yes	23 (62.2)	10 (27.0)	4 (10.8)	0.677
Smoking	No	99 (57.6)	58 (33.7)	15 (8.7)	
Alcoholism	Yes	23 (63.9)	9 (25.0)	4 (11.1)	0.547
Alcoholism	No	99 (57.2)	59 (34.1)	15 (8.7)	
Comorbidity	Yes	71 (55.0)	42 (32.6)	16 (12.4)	0.095
	No	51 (63.8)	26 (32.5)	3 (3.8)	
Oral medication	Yes	29 (33.7)	43 (50.0)	14 (16.3)	<0.001
	No	93 (75.6)	25 (20.3)	5 (4.1)	
Living alone	Yes	18 (60.0)	9 (30.0)	3 (10.0)	0.914
	No	104 (58.1)	59 (33.0)	16 (8.9)	
Number of mode doily	<3	31 (44.3)	31 (44.3)	8 (11.4)	0.013
Number of meals daily	≥3	91 (65.5)	37 (26.6)	11 (7.9)	
Functional characteristics					
ADL independent	Yes	115 (62.8)	59 (32.2)	9 (4.9)	<0.001
	No	7 (26.9)	9 (34.6)	10 (38.5)	
IADL independent	Yes	100 (65.4)	46 (30.1)	7 (4.6)	<0.001
	No	22 (39.3)	22 (39.3)	12 (21.4)	

DISCUSSION

The present study used the MNA tool, developed by Guigoz, to determine the prevalence of malnutrition or malnutrition risk in elderly people 60 years and above.8 To our knowledge, this is the first report to describe the prevalence of malnutrition and its associated factors in elderly people in Khammam. In the present study, we found 9.1% of the study participants as malnourished, 32.5% were at risk of malnutrition and the remaining 58.4% were having normal nutritional status. Studies conducted in other parts of India reported prevalence of malnutrition between 7 and 19%. While in other countries it is reported between 0.4 and 24%. ¹⁵⁻¹⁹ These observed different prevalence rates malnutrition due to use of different definitions for malnutrition and different settings such as private practice, communities households, general institutions. Because of these differences, the prevalences found are difficult to compare. Among the sociodemographic characteristics assessed, older age, lower education level, staying single, unemployed, low income, use of oral medications and less than three meals daily were associated with malnutrition.

In this study, older age was associated with lower MNA scores. This finding has been shown in some previous studies 13,20 while others have shown that age has no effect on nutritional status. 21,22 We observed that the older participants were less active and reported reduced appetite and decreased food intake. Therefore, increased focus on nutritional status is required as the age of the elderly people increases. Previous studies have shown that age is associated with increased anorexia and further development of malnutrition among the older population. ²³⁻²⁵ In addition, studies have also shown that the prevalence of malnutrition is low in community living elderly people but the risk for malnutrition increase substantially with increase in age. 16,21,26 In the present study, we failed to observe an association between gender and nutritional status in contrast to some previous studies. 13,18 In this study, nutritional status was associated with education. This could be explained by the fact that higher education can lead to higher income and better lifestyle resulting in a better nutritional status. Furthermore, educated people are more informed about the importance of food for health and more able to understand nutrition. Several authors found that a higher educational level contributes to a better nutritional status. 16,18,21

In the current study, malnutrition was more commonly observed among those with a single marital status (unmarried, divorced or widowed). A recent systematic review of 28 observational studies provided strong evidence for the lack of association between the death of a spouse and malnutrition, while some studies have suggested that there is a relationship between marital status and nutritional status, these results remain controversial. 20,27 Although the precise mechanism by

which marriage confers health benefits are unclear, studies have shown that married adults have better health and survival. 18 Hence, the nutritional status of the elderly can be improved by special attention to those who are single. Similar to findings of study in Lebanon, we found strong association between occupation status and malnutrition.⁷ In this study, higher income was inversely associated with malnutrition which was already reported in a study conducted among elderly people in Colombia where no income was significantly associated with a lower MNA score.²⁸ Other authors also revealed the same finding that elderly people who live in poverty are at greater risk of malnutrition. 19 This effect could be due to reduced food availability, consumption of food low in essential nutrients and growing food insecurity as a result of low income. The socio-economic conditions also influence dietary choices and eating patterns thereby affecting the nutritional status. Many studies reported a strong association between smoking or alcoholism with malnutrition.¹⁶ However, in this study, we could not observe any such association.

The present study found that elderly people on oral medications were malnourished than those who were not on oral medications. Oral medications among elderly people may lead to malnutrition by impairing food absorption or enhancing excretion, or by causing nausea, vomiting, diarrhea, constipation. Previous studies have also observed the same association between the use of oral medications and malnutrition. No significant association was found between living status and nutritional status in the current study which was in consonance with studies done by Agarwalla in India and Winter in Australia. However, some studies have shown that malnutrition was more prevalent among elderly people who lived alone. 16

In this study we found that lower MNA scores were associated with those elderly people who had less than three meals daily. A similar finding was reported in south India where most of the elderly malnourished or at risk of malnourishment consumed less than three meals daily. ¹⁰ Other studies have shown that dry mouth, chewing and swallowing problems and difficulty preparing or eating full meals contributed to malnutrition. ³⁰

BMI is often used as a screening tool for the assessment of nutritional status in primary health care. In this study, the elderly people who were identified as being malnourished or at risk of malnutrition had a significantly lower mean weight and BMI than those who were classified as well nourished. Consistent with our findings, a 2017 study conducted in rural Nepal showed similar results. ¹⁸ Interestingly, more than one third (45.5%) of at risk group had a BMI over 23, putting them in the overweight or obese category. Therefore, using BMI as a sole indicator of nutrition would fail to identify nutritional issues in these individuals. Previous studies have linked malnutrition to functional insufficiency. ³¹ Many studies have used activities of daily living (ADL)

and instrumental activities of daily living (IADL) scales for the assessment of functional status among elderly people. ^{13,17,28} In this study, the rates of ADL-dependency and IADL-dependency were significantly higher in malnourished group.

In the present study, we observed three limitations. Firstly, the cross-sectional design of the study does not allow examination of causal relationships. Secondly, the association between cognition and nutritional risk is not tested. Finally, the selection of only three areas for the purpose of the study limits the generalization of the results to the whole population.

CONCLUSION

The overall prevalence of malnutrition among elderly people was found to be 9.1%, but the proportion of elderly people at risk of malnutrition was relatively high (32.5%). The possible predictors were older age, lower education level, staying single, unemployed, low income, use of oral medications and less than three meals daily. Functional status, assessed by ADL and IADL, also was correlated with nutrition status. Diagnosis and treatment of elderly people at high risk for malnutrition based on the findings of this study may improve functional status and prognosis of elderly people.

ACKNOWLEDGEMENTS

We profusely thank community social workers at the study sites for their support in this work and interns for their participation in collecting the data. We also thank all the participants for sharing their experiences with us.

Funding: No funding sources Conflict of interest: None declared

Ethical approval: The study was approved by the

Institutional Ethics Committee

REFERENCES

- 1. National Institute on Aging, National Institutes of Health. United States: NIH Publication. Global Health and Ageing. 2011. Available at: http://www.who.int/ageing/publications/global_heal th.pdf. Accessed on 10 April 2018.
- 2. Census of India. Registrar General of India office, Government of India, India; 2011.
- International Food Policy Research Institute. 2016. Global Nutrition Report 2016: From Promise to Impact: Ending Malnutrition by 2030. Washington, DC: IFPRI, 2016.
- 4. Kaiser MJ, Bauer JM, Ramsch C, Uter W, Guigoz Y, Cederholm T, et al. Mini Nutritional Assessment International Group. Frequency of malnutrition in older adults: a multinational perspective using the Mini Nutritional Assessment. J Am GeriatrSoc. 2010;58:1734-8.

- Favaro-Moreira NC, Hofmann SK, Matthys C, Vereecken C, Vanhauwaert E, Declercq A, et al. Risk Factors for Malnutrition in Older Adults: A Systematic Review of the Literature Based on Longitudinal Data. Adv Nutr. 2016;7:507-22
- Bostrom AM, Van Soest D, Kolewaski B, Milke DL, Estabrooks CA. Nutrition Status Among Residents Living in a Veterans' Long-Term Care Facility in Western Canada: A Pilot Study. J Am Med DirAssoc. 2011;12:217-25.
- 7. Boulos C, Salameh P, Barberger-Gateau P. Factors associated with poor nutritional status among community dwelling lebanese elderly subjects living in rural areas: results of the AMEL study. J Nutr Health Aging. 2013:1-8.
- 8. Guigoz Y, Vellas B, Garry PJ. Mini Nutritional Assessment: a practical assessment tool for grading the nutritional state of elderly patients. Facts Res Gerontol. 1994;4(2):15-59.
- Vellas B, Sieber C. The MNA revisited. What does the data tell us? Paris, France: Scientific Symposium Proceedings XIXth IAGG World Congress of Gerontology and Geriatrics; 2009.
- Vedantam A, Subramanian V, Rao NV, John KR. Malnutrition in free-living elderly in rural south India: prevalence and risk factors. Public Health Nutr. 2009:13(9);1328-32.
- 11. Mathew AC, Das D, Sampath S, Vijayakumar M, Ramakrishnan N, Ravishankar SL. Prevalence and correlates of malnutrition among elderly in an urban area in Coimbatore. Indian J Public Health. 2016;60:112-17.
- Majumder M, Saha I, Chaudhuri D. Assessment of Nutritional Risk in Community-Dwelling Older Adults (65 to 75 Years) in Kolkata, India, J Nutr Gerontol Geriatr. 2014;33(2):126-34.
- 13. Agarwalla R, Saikia AM, Baruah R. Assessment of the nutritional status of the elderly and its correlates. J Fam Community Med. 2015;22:39-43.
- 14. Shi R, Duan J, Deng Y, Tu Q, Cao Y, Zhang M, Zhu Q, Lu Y. Nutritional status of an elderly population in southwest China: a cross-sectional study based on comprehensive geriatric assessment. J Nutr Health Aging 2015;19(1):26-32.
- 15. Winter J, Flanagan D, Mcnaughton SA, Nowson C. Nutrition screening of older people in a community General practice, using the MNA-SF. J Nutr Health Aging. 2013;17(4):322-5.
- 16. Lin WQ, Wang HHX, Yuan LX, Li B, Jing MJ, Luo JL, et al. The unhealthy lifestyle factors associated with an increased risk of poor nutrition among the elderly population in China. J Nutr Health Aging. 2017;21(9):943-53.
- 17. Schueren M, Monasch SL, Vries OJ, Danner SA, Kramer MHH, Muller M. Prevalence and determinants for malnutrition in geriatric outpatients. Clinical Nutrition. 2013;32:1007-11.
- 18. Ghimire S, Baral BK, Callahan K. Nutritional assessment of community-dwelling older adults in rural Nepal. PLoS ONE. 2017;12(2):1-15.

- Gunduz E, Eskin F, Gunduz M, Bentli R, Zengin Y, Dursun R, Icer M, Durgun HM, Gurbuz H, Ekinci M, Yesil Y, Guloglub C. Malnutrition in Community-Dwelling Elderly in Turkey: A Multicenter, Cross-Sectional Study. Med Sci Monit. 2015;21:2750-6.
- Krzyminska-Siemaszko R, Chudek J, Suwalska A, Lewandowicz M, Mossakowska M, Kroll-Balcerzak R, et al. Health status correlates of malnutrition in the polish elderly population-results of the Polsenior study. Eur Rev Med Pharma Sci. 2016;20:4565-73.
- Mitri R, Boulos C, Adib SM. Determinants of the nutritional status of older adults in urban Lebanon. Geriatr Gerontol Int. 2017;17:424-32.
- 22. Maseda A, Diego-Diez C, Lorenzo-Lopez L, Lopez-Lopez R, Regueiro-Folgueira L, Millan-Calenti JC. Quality of life, functional impairment and social factors as determinants of nutritional status in older adults: The VERISAÚDE study. Clin Nutr. 2017;37(3):993-9.
- 23. Chen CC, Chang CK, Chyun DA, McCorkle R. Dynamics of nutritional health in a community sample of American elders: a multidimensional approach using roy adaptation model. Adv Nurs Sci. 2005;28(4):376-89.
- 24. Han Y, Li S, Zheng Y. Predictors of nutritional status among community-dwelling older adults in Wuhan, China. Public Health Nutr 2009;12(8):1189-96.
- 25. Tsai AC, Chang TL, Yang TW, Chang-Lee SN, Tsay SF. A modified mini nutritional assessment without BMI predicts nutritional status of

- community-living elderly in Taiwan. J Nutr Health Aging. 2010;14(3):183-9.
- Kagansky N, Berner Y, Koren-Morag N, Perelman L, Knobler H, Levy S. Poor nutritional habits are predictors of poor outcome in very old hospitalized patients. Am J Clin Nutr. 2005;82(4):784-91.
- 27. Van der Pols-Vijlbrief R, Wijnhoven HA, Schaap LA, Terwee CB, Visser M. Determinants of proteinenergy malnutrition in community-dwelling older adults: a systematic review of observational studies. Ageing Res Rev. 2014;18:112-31.
- Chavarro-Carvajal D, Reyes-Ortiz C, Samper-Ternent R, Arciniegas AJ, Gutierrez CC. Nutritional Assessment and Factors Associated to Malnutrition in Older Adults: A Cross-Sectional Study in Bogota, Colombia. J Aging Health. 2015;27(2):304-19.
- 29. Agarwal E, Miller M, Yaxley A, Isenring E. Malnutrition in the elderly: A narrative review. Maturitas. 2013;76:296-302.
- 30. Nykanen I, Lonnroos E, Kautiainen H, Sulkava R, Hartikainen S. Nutritional screening in a population-based cohort of community-dwelling older people. Eur J Public Health. 2012;23(3):405-9.
- 31. Flodin L, Svensson S, Cederholm T. Body mass index as a predictor of 1 year mortality in geriatric patients. Clin Nutr. 2000;19:121-5.

Cite this article as: Konda S, Ravi Kumar BP, Giri PA. Prevalence of malnutrition and its determinants in an elderly people in South India. Int J Community Med Public Health 2018;5:3570-6.