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Nutrition status and its associated factors among the elderly in a Vietnam rural medical centre: A cross-sectional study

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ABSTRACT

Background: Malnutrition is one of countless health risks for the elderly, especially in areas with difficult economic conditions.

Objectives: The purpose of this study was to describe the nutritional status of senior citizens visiting the district health center and identify the associated factors.

Methods: A cross-sectional study was conducted at Ea H'leo District Medical Centre, Dak Lak Province in 2023. A total of 251 participants who visited the district medical centre for examination were interviewed. The nutritional status of the elderly was evaluated using the Mini Nutritional Assessment (MNA) scale. Logistic regression was used to identify factors associated with their nutritional status.

Results: Among 251 elderly, 12% suffered from malnutrition, and 41.4% were at risk. Protective factors included having a university or postgraduate education level (Adjusted Odds Ratio (AOR) = 0.08, 95% Confidence Interval (CI): 0.01-0.7), poor economic status (AOR= 0.13, 95% CI: 0.03-0.6), married (AOR= 0.48, 95% CI: 0.2-0.9), good dental status (AOR= 0.33, 95% CI:0.1-0.8), and engaging in a regular exercise (AOR= 0.47, 95% CI: 0.3-0.8), whereas heavy physical activity was identified as a risk factor (AOR= 6.0, 95% CI: 1.1-32.3).

Conclusion: There is a significant number of participants at risk of malnutrition. Providing support to improve difficult economic conditions and increasing access to nutritional healthcare knowledge are measures that help to reduce the risk of malnutrition and disease in the elderly.

Keywords: Associated factors, Elderly, Nutrition status, Rural

1. Introduction

Malnutrition is one of the many health risks associated with inadequate nutrition [1]. As people age nearly all systems structures of the human body are influenced by their nutritional status. Moreover, malnutrition during old age can accelerate an individual's "aging rate" [2]. With the ever-growing elderly population, the problems of aging population are garnering more and more attention. According to World Health Organization (WHO), the ageing population in Southeast Asia is increasing rapidly. In 2017, the proportion of people aged 60 and over was 9.8% which is projected to increase 3.7% by 2030 and 20.3% by 2050 [3]. However, malnutrition is frequently misdiagnosed and untreated in the majority of hospitals nowadays. This is evident from the surveys showing high number of elderly people who either have malnutrition or at risk of it [4]. A cross-sectional study conducted in Northwest region of Nigeria among 348 patients aged 60 years and above attending a Family Medicine Clinic showed a malnutrition prevalence of 25.3% and a risk of malnutrition in 56.6% of the participants. Older age, underweight, low education and income, and sedentary lifestyle were found to be associated with malnutrition [5]. Another study at Peking Union Medical College Hospital in China found that among the 358 elderly patients, 50.3% were at nutritional risk, and 36.0% were malnourished. Age and number of chronic diseases were key factors associated with malnutrition [6]. While tools like MNA, MNA-SF, and GLIM are effective, convenient and fast, their inconsistent use during hospital admissions remains a significant challenge [7].

Furthermore, the causes of malnutrition are complex, so understanding the factors influencing malnutrition in the elderly can help in developing effective plans and strategies to improve nutrition. Therefore, this present study aimed to achieve two objectives: 1) to assess the nutritional status of the elderly people visiting a district medical center in rural areas of Vietnam in 2023; 2) to determine factors associated with the nutritional status.

2. Methods

2.1 Study Area

The study was conducted in Ea H'leo District Medical Centre, Dak Lak province, Vietnam. It lies in Central Highlands region where majority of the population have poor economic status and belong to ethnic minorities.

2.2 Study Design

A cross-sectional study was applied.

2.3 Sample size and sampling

The quantitative survey was conducted among elderly individuals aged 60 years and older who visited the centre for medical examination from March to June 2023. The following formula was used to calculate the sample size:

$$n = Z^2_{(1-\frac{\alpha}{2})}.\frac{p(1-p)}{(p.\varepsilon)^2}$$

In the formula, p = 0.63, represents the percentage of elderly people at risk of malnutrition or malnourished according to MNA in a rural southern India [8]; ε = 0,1. The calculated sample size was 225. However, during the data collection process, the data collector approached and interviewed more people, resulting in a total of 251 subjects.

2.4 Data Collection

Participants were interviewed using questionnaire. This questionnaire was adapted and standardized based on previous studies [8]**.** Participants voluntarily enrolled in the study after being informed about the study objectives and the benefits of participation. The data collection was carried out by medical staff of the centre.

Variables

Part 1: Demographic information, included characteristics such as age, gender, ethnicity, religion, education level, who you live with, area of residence, number of comorbidities, dental condition, chewing and swallowing status, smoking habits, alcohol use habits, and regular exercise habits.

Part 2: Subject's anthropometric indexes, including weight, height, body mass index (BMI), arm circumference, leg circumference, waist circumference, and buttocks circumference.

Part 3: Mini Nutritional Assessment (MNA) scale [9]. The total MNA score is obtained by summing the scores from the two screening and assessment parts. The maximum total score was 30 points, of which <17 points indicate malnutrition, 17-23.5 points indicates a risk of malnutrition and 24-30 points is considered normal.

2.5 Data Analysis

Descriptive analysis was performed using Stata 16.0 software for the quantitative study. The Chi-square test and Fisher exact test were used to compare the differences between ratios. Logistic regression was used to identify factors associated with the nutritional status of the elderly.

2.6 Ethical Clearance

The study was reviewed and approved by the Board of Dissertation Assessment, Dak Lak Provincial Department of Health under Decision 170/SYT dated February 1, 2023.

3. Results

Among 251 participants, the mean age of study subjects was 68.1 ± 8.91 (years) with the highest proportion (64.54%) in the 60-69 age group. Most of them were female (58.6%) and about four-fifths were Kinh ethnicity (80.5%). The majority of participants had an education level ranging from primary to high school (9.8%). Most participants were married (74.9%), and currently not living alone (93.6%). More than half of them resided in the countryside (68.1%) and had a well-off economic status (76.1%) (Table 1).

Table 1: Demographic characteristics of study subjects (n=251)

Characteristics	Frequency (n)	Percentage (%)
Age groups		
60-69	162	64.54
70-79	72	28.69
≥80	17	6.77
Mean (±SD)	68.1 (± 8.91)	
Gender		
Male	104	41.4
Female	147	58.6
Ethnic		
Kinh	202	80.5
Minorities	49	19.5
Religion		
No	212	84.5
Yes	39	15.5
Education level		
No formal education	10	4.0
Primary to high school	228	90.8
University/ postgraduate	13	5.2
Marital status		
Single	6	2.4
Widow	50	19.9
Divorce	7	2.8
Married	188	74.9
Live alone		
No	235	93.6
Yes	16	6.4
Living area		
Countryside	171	68.1
City	80	31.9
Economic status		
Poor	10	4.0
Near poor	43	17.1
Well-off	191	76.1
Rich	7	2.8

Table 2 illustrates dental status and lifestyle behaviors of study subjects. Most of them had normal dental status (56.2%) and normal chewing and swallowing condition (84.1%). The majority of participants did not smoke (88.4%), and consumed alcohol (79.3%). About half of participants exercised regularly (52.6%), with moderate levels of physical activity (52.6%).

Table 2: Dental status and lifestyle behaviours of study subjects (n-251).

Characteristics	Frequency (n)	Percentage (%)
Dental status		
Poor	51	20.3
Normal	141	56.2
Good	59	23.5
Chewing and swallowing condition		
Normal	211	84.1
Difficult	40	15.9
Smoking		
No	222	88.4
Yes	29	11.6
Using alcohol		
No	199	79.3
Yes	52	20.7
Regular exercise		
No	119	47.4
Yes	132	52.6
Level of physical activity		
Light	109	43.4
Medium	132	52.6
Heavy	10	4.0

Table 3 depicts the nutritional characteristics of study participants according to MNA-SF. More than half of participants reported no decrease in food intake (55.8%), and no weight loss (57%) over the last 3 months. Regarding mobility, most people were able to go out (91.6%). The majority of them did not experience psychological stress or acute disease (90.8%), no neuropsychological problems (88.8%).

It is found that majority of participants (83.2) had BMI between 19-21, followed by 13.2% of participants with BMI less than 19. And very small percentages of participants of 2.5% and 1.2% had BMI between 21-23 and greater than 23 respectively.

Table 3: Nutritional characteristics of study subjects according to MNA (n=251)

Characteristics	Frequency (n)	Percentage (%)
Declined food intake over the past 3 months		
Severe decrease in food intake	20	8.0
Moderate decrease in food intake	91	36.2
No decrease in food intake	140	55.8
Weight loss in the last 3 months		

Characteristics	Frequency (n)	Percentage (%)
Weight loss rather than 3kg	11	4.4
Does not know	60	23.9
Weight loss between 1 and 3kg	37	14.7
No weight loss	143	57.0
Mobility		
Bed or chair bound	7	2.8
Able to get out of bed/ chair but does not go out	14	5.6
Able to go out	230	91.6
Psychological stress or acute disease		
Yes	23	9.2
No	228	90.8
Neuropsychological problems		
Severe dementia or depression	2	0.8
Mild dementia	26	10.4
No psychological problems	223	88.8
Body Mass Index		
<19	33	13.2
19-21	209	83.2
21-23	6	2.4
>23	3	1.2
Total MNA-SF score		
Mean (±SD)	10.8 ± 2.3	

Figure 1 illustrates the nutritional status of the study participants according to MNA-SF. The highest proportions of participants were normal (46.6%) followed by at risk of malnutrition (41.4%), Only 12% of participants had malnutrition.

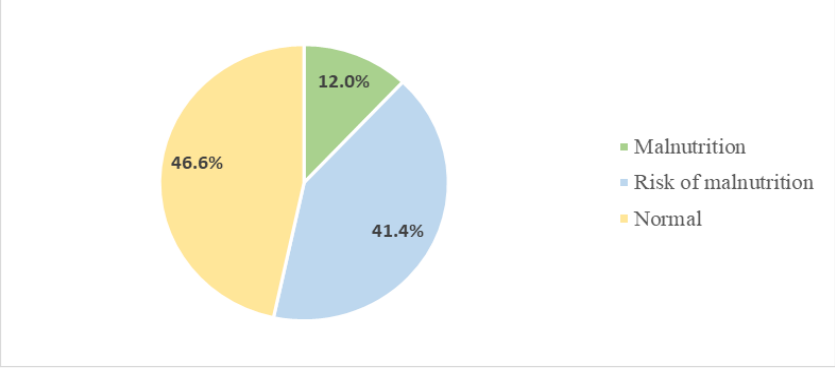

Figure 1: Figure 1. Percentage distribution of nutritional status of study subjects according to MNA (n=251)

Table 4 shows factors associated with nutritional status of study participants. The study found that the factors affecting nutritional status were education level, economic status, marital status, dental status, and regular exercise. Protective factors include university/ postgraduate level education (Crude Odds Ratio (COR) = 0.13, 95% CI: 0.02-0.8; AOR = 0.08. 95% CI: 0.01-0.7), poor economic status (COR = 0.20, 95% CI: 0.04-0.9 ; AOR = 0.13, 95% CI: 0.03-0.6), well-off economic status (COR =

0.28, 95% CI: 0.1-0.6; AOR = 0.32, 95% CI: 0.1-0.7), married (COR = 0.48, 95% CI: 0.2-0.9), normal dental status (COR = 0.31 , 95% CI: 0.1-0.6; AOR = 0.28 95% CI: 0.1-0.6), good dental status(COR = .33, 95% CI: 0.1-0.7); AOR = 0.33, 95% CI: 0.1-0.8), regular exercise (COR = 0.54, 95% CI: 0.3-0.9, AOR = 0.47, 95% CI: 0.3-0.8), and risk factors are heavy physical activity (AOR = 6.0, 95% CI: 1.1-32.3).

Table 4: Factors related to nutritional status of study subjects (n=251)

Factors	MNA		Crude OR (95%CI)	Adjusted OR (95%CI)	P-value
	Risk of malnutrition n (%)	Normal n (%)			
Education level					
No formal education	7 (5.3)	3 (2.6)	1	1	
Primary to high school	124 (92.5)	104 (88.9)	0.52(0.1-2.0)	0.43(0.1-1.9)	0.331
University/ postgraduate	3 (2.2)	10 (8.5)	0.13(0.02-0.8)	0.08(0.01-0.7)	0.026*
Economic status					
Near poor	33 (24.6)	10 (8.5)	1	1	
Poor	4 (3.0)	6 (5.1)	0.20(0.04-0.9)	0.13(0.03-0.6)	0.011*
Well-off	93 (69.4)	98 (83.8)	0.28(0.1-0.6)	0.32(0.1-0.7)	0.008*
Rich	4 (3.0)	3 (2.6)	0.40(0.1-2.1)	1.47(0.2-12.1)	0.273
Dental status					
Poor	38 (28.4)	13 (11.2)	1	1	
Normal	67 (50.0)	74 (63.2)	0.31(0.1-0.6)	0.28(0.1-0.6)	0.002*
Good	29 (21.6)	30 (25.6)	0.33(0.1-0.7)	0.33(0.1-0.8)	0.025*
Regular exercise					
No	73 (54.5)	46 (39.3)	1	1	
Yes	63 (45.5)	71 (60.7)	0.54 (0.3-0.9)	0.47(0.3-0.8)	0.009*
Level of physical activity					
Light	64 (47.8)	45 (38.5)	1	1	
Medium	62 (46.2)	70 (59.8)	0.62(0.4-1.0)	1.17(0.6-2.2)	0.069
Heavy	8 (6.0)	2 (1.7)	2.8(0.6-13.9)	6.0(1.1-32.3)	0.038*

Univariate and multivariate logistic regression model, *p<0.05: statistically significant, [a] Not included in the multivariable regression model, OR: odd ratio; CI: confidence interval., MNA-SF: Mini Nutritional Assessment – Short Form

4. Discussion

Obesity has become a growing problem among the elderly. This trend is due to a decrease in physical activity and energy expenditure in the elderly coupled with the effects of aging which leads to fat accumulation and redistribution while reducing muscle mass. Obesity is a disease process characterized by excessive accumulation of body fat. For the elderly, being overweight or obese has been shown to increase the risk of cardiovascular disease, diabetes, joint disease, cancer, and dementia [10, 11].

Our study shows that the average MNA score is 10.8 ± 2.3, a result similar to the study of *Nguyen Dang Thoai et al*. In their study, a

total of 821 participants were included with an average age of 82 ± 5.7. Their average MNA score was 12.3 ± 2.0, in which over 75% (n = 621) of the elderly people scored 12 or greater. They found that 21% of older people were at danger of malnutrition and biochemical tests revealed a 3.5% incidence of malnutrition [12]. According to recent studies that assessed the nutritional status of the elderly in the world and in the region using the MNA scale, showed 40% to 60% of the elderly are at risk of malnutrition [13-16]. A study by Nguyen Thi Thu Hoai and colleagues found that 31.0% of diabetic outpatients were either malnourished or at risk of malnutrition [17]. This discrepancy can be explained by the fact that Nguyen Thi Thu Hoai's research was carried out in the capital Hanoi where economic conditions are better while this study focused on elderly patients in a low-income rural areas seeking medical examinations and treatments. Hanoi research participants have better access to health care and a higher standard of living. Therefore, the percentage of study participants who are malnourished or at risk of malnutrition is significantly higher than Nguyen Thi Thu Hoai's study. Our results are similar to a cross-sectional study in Southwest China by *R Shi et al* (2015), a total of 558 elderly people aged 60 years and older in both residential communities and hospitals, the proportion of malnutrition rate and risk of malnutrition are 3.2% and 19.3%, respectively. Several factors independently increase poor nutritional status including self-rated health, comorbidities, chronic obstructive pulmonary disease, gastrointestinal disease, and cognitive impairment [18].

The main cause of malnutrition in the elderly is that the body does not receive enough nutrients from daily food to function normally. Essential nutrients include fats, carbohydrates, proteins, vitamins, and minerals. In addition, changes in the physiology of aging can affect malnutrition [19]. Although quality of life is improving but the elderly still faces malnutrition due to reduced physiological functions, especially the senses, especially taste and smell which decreases their desire to eat. Furthermore, the weakening of teeth, the atrophy of jaw muscles, and the tickling causes the metal's strength to decrease quite clearly. The digestive system including stomach, and liver experience reduced function, leading to impaired digestion, food absorption, detoxification, and frequent constipation. In addition, elderly people are susceptible to food allergies which makes them selective in

their food choices. They may avoid certain foods due to the fear that eating them could lead to digestive issues such as nausea, vomiting, diarrhea or stomach pain. Some gastrointestinal diseases also make elderly people more susceptible to malnutrition [20, 21]. Additionally, alcoholism is also a significant cause of malnutrition because alcoholics often experience a loss of appetite and may choose alcohol over food. In some cases, elderly people who live alone often feel that they do not eat properly, and which can lead to malnutrition [22].

Multivariable regression models were used to evaluate the association between MNA nutritional status and factors such as education level, economic status, dental status, exercise habits, and activity level. The analysis revealed that physical activity had statistically significant results. People with university and postgraduate education have significantly lower health risks than illiterate subjects. A study of 620 community-dwelling elderly individuals in southwestern Ethiopia found that those with no formal education or low levels of education were at higher risk of malnutrition (P=0.001) [23]. In economically disadvantaged and near-poor groups, a higher rate of nutritional risk is observed. These findings are consistent with the outcomes of several comparable studies conducted worldwide [23, 24]. The elderly struggle to access a variety of food sources and healthcare services due to difficult financial constraints which exacerbates risk factors for disease and increases the likelihood of malnutrition. One of the elements that directly affects how well-nourished elderly patients are when they visit the hospital is oral health. Additionally, compared to the other group, those with good dental health had fewer nutritional risks, according to the results. Poor oral health can affect dietary choices and intake which can lead to malnutrition in the elderly [25]. According to a systematic review, aspects of oral health and other subjective worries about the oral health of the elderly are associated with indicators of malnutrition including the state of the oral hard and soft tissues, salivary flow, and dry mouth [26]. The majority of older adults who engage in moderate physical activity have a lower nutritional risk. Age related illnesses such as the loss of muscle and bone mass limit an elderly person's mobility lowering their quality of life, and raising their risk of developing chronic illnesses. A Study conducted in the Greek community indicate that older individuals who are not physically active are more likely to suffer from malnutrition and nutritional

risk [27]. Another study conducted in Nepal revealed that the likelihood of malnutrition was 4.67 times higher in older adults who did not engage in physical activity than those who engaged in physical activity [28].

This study has several limitations. First, it was conducted on a small sample at a district medical centre which limits the ability to ensure representation and generalizability to all other units. Furthermore, the study did not include a thorough analysis of other significant anthropometric indicators, such as wing circumference, focusing instead on nutritional assessment based on BMI and limited set of basic anthropometric indicators such as circumference of the arm, leg. Future research on a larger sample size and the examination of additional anthropometric indicators, such as arm and leg circumference are recommended.

5. Conclusion

The study results showed that nearly half of the subjects were at risk of malnutrition assessed by MNA. Factors such as education level, economic status, oral health, and physical activity level were found to be associated with the subject's nutritional status. These above findings underscore the importance of nutritional screening for elderly people visiting the health center of Eah'leo district, Dak Lak province. Addressing economic challenges and improving their knowledge about nutrition are also factors that help reduce the risk of malnutrition and disease in the elderly population. These efforts could contribute to lowering rates of hospital malnutrition, shortening treatment durations and reducing hospital fees for people seeking medical examination and treatment at medical facilities.

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References

[1] Cederholm T, Barazzoni R, Austin P, Ballmer P, Biolo G, Bischoff SC, et al. ESPEN guidelines on definitions and terminology of clinical nutrition. Clin Nutr. 2017;36(1):49-64.

[2] Bardon LA, Corish CA, Lane M, Bizzaro MG, Loayza Villarroel K, Clarke M, et al. Ageing rate of older adults affects the factors associated with, and the determinants of malnutrition in the community: a systematic review and narrative synthesis. BMC Geriatr. 2021;21(1):676.

[3] Tiraphat S, Kasemsup V, Buntup D, Munisamy M, Nguyen TH, Hpone Myint A. Active Aging in ASEAN Countries: Influences from Age-Friendly Environments, Lifestyles, and Socio-Demographic Factors. Int J Environ Res Public Health. 2021;18(16).

[4] Bellanti F, Lo Buglio A, Quiete S, Vendemiale G. Malnutrition in Hospitalized Old Patients: Screening and Diagnosis, Clinical Outcomes, and Management. Nutrients. 2022;14(4).

[5] Olawumi AL, Grema BA, Suleiman AK, Omeiza YS, Michael GC, Shuaibu A. Nutritional status and morbidity patterns of the elderly in a Northwestern Nigerian hospital: A cross-sectional study. Niger Postgrad Med J. 2021;28(3):160-8.
[6] Lai X, Zhu H, Du H, Huo X, Yu K. Nutritional status of Chinese oldest-old adults (≥80 years of age): a cross-sectional study in Beijing. European journal of clinical nutrition. 2021;75(7):1040-6.
[7] Bellanti F, Lo Buglio A, Quiete S, Pellegrino G, Dobrakowski M, Kasperczyk A, et al. Comparison of Three Nutritional Screening Tools with the New Glim Criteria for Malnutrition and Association with Sarcopenia in Hospitalized Older Patients. Journal of clinical medicine. 2020;9(6).
[8] Vedantam A, Subramanian V, Rao NV, John KR. Malnutrition in free-living elderly in rural south India: prevalence and risk factors. Public Health Nutr. 2010;13(9):1328-32.
[9] Y Guigoz BV, P J Garry. Assessing the nutritional status of the elderly: The Mini Nutritional Assessment as part of the geriatric evaluation. 1996.
[10] Fruh SM. Obesity: Risk factors, complications, and strategies for sustainable long-term weight management. Journal of the American Association of Nurse Practitioners. 2017;29(S1):S3-s14.
[11] Tiffany M. Powell-Wiley PP, Lora E. Burke, Jean-Pierre Després, Penny Gordon-Larsen, Carl J. Lavie, Scott A. Lear, Chiadi E. Ndumele, Ian J. Neeland, Prashanthan Sanders, Marie-Pierre St-Onge. Obesity and Cardiovascular Disease: A Scientific Statement From the American Heart Association. Circulation. 2021;143(21).
[12] Thoai Dang Nguyen TTHN, Pol Van Nguyen, Khang Kim Huynh, Hiep Tung Bui. Evaluation of malnutrition among elderly people above 75 years of age. Journal of Critical Reviews. 2020;7(4).
[13] Nhung Thi Hong Huynh TTTN, Huy Kien Tai Pham, Ngoc Thi Hong Huynh, Ngoan Thi Nguyen, Ngoc Thanh Cao, Do Van Dung. Malnutrition, Frailty, and Health-Related Quality of Life Among Rural Older Adults in Vietnam: A Cross-Sectional Study. 2023.
[14] Hongpeng Liu JJ, Chen Zhu, Minglei Zhu, Xianxiu Wen, Jingfen Jin, Hui Wang, Dongmei Lv, Shengxiu Zhao, Xinjuan Wu, Tao Xu. Associations Between Nutritional Status, Sociodemographic Characteristics, and Health-Related Variables and Health-Related Quality of Life Among Chinese Elderly Patients: A Multicenter Prospective Study. 2020.
[15] Savitesh Kushwaha PK, Rachana Srivastava, Rachita Jain, Tarundeep Singh, Tanvi Kiran. Estimates of malnutrition and risk of malnutrition among the elderly (≥60 years) in India: A systematic review and meta-analysis. 2020.
[16] Wojciech Tański JW, Beata Jankowska-Polańska Association between Malnutrition and Quality of Life in Elderly Patients with Rheumatoid Arthritis. 2021.
[17] Nguyen TTH, Vu HTT, Nguyen TN, Dao HT, Nguyen TX, Nguyen HTT, et al. Assessment of nutritional status in older diabetic outpatients and related factors in Hanoi, Vietnam. J Multidiscip Healthc. 2019;12:601-6.
[18] Shi R, Duan J, Deng Y, Tu Q, Cao Y, Zhang M, et al. Nutritional status of an elderly population in Southwest China: a cross-sectional study based on comprehensive geriatric assessment. The journal of nutrition, health & aging. 2015;19(1):26-32.
[19] Kaur D, Rasane P, Singh J, Kaur S, Kumar V, Mahato DK, et al. Nutritional Interventions for Elderly and Considerations for the Development of Geriatric Foods. Current aging science. 2019;12(1):15-27.
[20] Rémond D, Shahar DR, Gille D, Pinto P, Kachal J, Peyron MA, et al. Understanding the gastrointestinal tract of the elderly to develop dietary solutions that prevent malnutrition. Oncotarget. 2015;6(16):13858-98.
[21] Yuqing Mao YX, Yihong Fan, Bin Lv, Xuan Huang, Xu Liang. Advancements in malnutrition in elderly inflammatory bowel disease patients. Gastroenterology & Endoscopy. 2023;1(4):199-206.
[22] Klein S, Iber FL. Alcoholism and associated malnutrition in the elderly. Nutrition. 1991;7(2):75-9.
[23] MulunehShuremu TB, Kalkidan Hassen. Nutritional status and its associated factors among elderly people in Ilu Aba Bor Zone, Southwest Ethiopia: a community-based cross-sectional study. 2023.
[24] Ashok Jadhao RD. Assessment of nutritional status of the geriatric patients attending the outpatient department of an urban health training centre: a cross-sectional study. 2020.
[25] Shailesh M Gondivkar ARG, Rima S Gondivkar, Sachin C Sarode, Gargi S Sarode, Shankargouda Patil, Kamran H Awan 6. Nutrition and oral health. 2019.

[26] Yne Algra EH, Wilhelmina Kok, Faridi van Etten-Jamaludin, Liedeke van Schoot, Vanessa Hollaar, Elke Naumann, Marian de van der Schueren, Katarina Jerković-Ćosić. The Association between Malnutrition and Oral Health in Older People: A Systematic Review. 2021.

[27] Sousana K Papadopoulou MM, Gavriela Voulgaridou, Eleni Pavlidou, Konstantinos Vadikolias, Georgios Antasouras, Theofanis Vorvolakos, Evmorfia Psara, Georgios K Vasios, Aspasia Serdari, Efthymios Poulios, Constantinos Giaginis. Nutritional Status Is Associated with Health-Related Quality of Life, Physical Activity, and Sleep Quality: A Cross-Sectional Study in an Elderly Greek Population. 2023.

[28] Man Kumar Tamang UNY, Hassan Hosseinzadeh, Bharat Kafle, Girish Paudel, Saroj Khatiwada, Varalakshmi Chandra Sekaran. Nutritional assessment and factors associated with malnutrition among the elderly population of Nepal: a cross-sectional study. 2019.