

Evaluating the Nutritional and Gerontological Status of Hospitalized Diabetic Patients Over 70

Rym Ben Othman^{1,*}, Yasmine Jallouli², Ramla Mizouri², Olfa Berriche²,
Cyine Trabelsi², Rania Tamboura², Amel Gamoudi², Henda Jamoussi²

¹university of Tunis El Manar Faculty of Medicine of Tunis

²institut National de Nutrition et de Technologie Alimentaire de Tunis

*Corresponding author: benothmant@gmail.com

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Abstract Introduction: Malnutrition is a pressing public health concern among elderly individuals with diabetes, and North Africa is no exception to this issue. Objective: to determine the prevalence of malnutrition and its predictive factors among hospitalized elderly patients aged 70 and above with diabetes. Methods: This was a multicentric cross-sectional study conducted at the Institute of Nutrition and Food Technology in Tunis from September 2022 to March 2023. A total of 100 patients were included, with the diagnosis of malnutrition based on criteria from the High Health Authority, including etiological and phenotypic factors. Hospitalization was considered an etiological criterion. Results: Malnourished patients (MN+) had a mean age of 74.51 ± 4.41 years, while well-nourished patients (MN-) averaged 72.76 ± 3.27 years ($p=0.02$). Females constituted 65% of the sample. The average BMI was 28.75 ± 5.89 kg/m², with MN+ patients having an average BMI of 27.99 kg/m² compared to 29.51 kg/m² for MN- patients ($p=0.02$). Malnutrition was present in 49% of the population. Risk factors of malnutrition in the multivariate analysis were as a history of hospitalization, low appendicular muscle mass, and infrequent poultry consumption. Conclusion: our findings underscore the importance of addressing malnutrition in this vulnerable population to improve their overall health.

Keywords: nutritional status, gerontology, hospitalization, type 2 diabetes, Sarcopenia, Depression, Frailty, Autonomy, Alimentary survey, nutrient intake

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1. Introduction

The advancement of medicine and improved access to healthcare have led to a significant increase in life expectancy, not only globally but also in countries like Tunisia, where demographic trends have undergone a marked transformation in recent years, with a clear aging population. The elderly population in Tunisia has shown continuous growth, increasing from 7.94% in 2000 to 10.28% in 2018 [1]. In this context, special attention must be given to "frail" patients, as frailty is a reversible condition that, without intervention, can lead to dependence.

The physiological aging process is complex, progressive, and irreversible, but certain environmental factors can be modified. Among the well-known determinants, healthcare professionals need to focus on modifiable factors. Nutritional status is one of these crucial factors throughout aging. Protein-energy malnutrition can worsen a precarious state or dependence, predispose to the development of comorbidities and geriatric syndromes.

Malnutrition is one of the most common geriatric syndromes, and its prevalence increases with age. It affects between 4 to 10% of the general elderly population and can affect up to 30 to 70% of hospitalized elderly patients [2]. Its deleterious consequences are well established, impacting physical, psychological, and social health, in addition to generating significant healthcare costs. With the increasing aging of the population, malnutrition becomes a genuine public health challenge.

Concurrently, diabetes is also a major health issue both globally and in Tunisia. It is one of the most prevalent chronic diseases among the elderly, and recent data suggest that diabetes prevalence significantly rises after the age of 60 [3].

Moreover, patients with type 2 diabetes experience progressive changes in body composition and function related to aging, making them even more vulnerable to malnutrition. A balanced and healthy diet is essential at all stages of life, but it becomes increasingly important during aging, where nutritional priorities often shift towards preserving micro and macronutrients to minimize muscle mass loss.

Assessing the nutritional status in elderly diabetic patients is, therefore, crucial as it allows for the detection of malnutrition, which could lead to increased morbidity and mortality, and prolonged hospitalization.

The objective of our study is twofold: firstly, to describe the prevalence of malnutrition among elderly patients with type 2 diabetes. Secondly, we aim to identify factors that influence this malnutrition.

2. Methods

2.1. Study Population

This is a multicenter cross-sectional descriptive study conducted over a period of 7 months, from September 2022 to March 2023, among hospitalized patients in Services A and C of the National Institute of Nutrition in Tunis. We included the first 100 hospitalized patients aged over 70 years in the study population. The total sample size was determined using the Cochran formula [4] to ensure adequate precision of the estimates. With a confidence level of 95%, a precision of 5%, and an estimated prevalence of malnutrition in elderly diabetic subjects in Africa at 50.2%, we rounded the required sample size to 100.

The study included patients who were 70 years old and above and who gave their consent to participate. Patients who did not provide consent were excluded from the study. Additionally, individuals with diabetic foot, prostheses, or pacemakers, which could hinder impedance measurements, were excluded. Patients with a diagnosis of cancer were also excluded from the study. Furthermore, individuals with cognitive disorders, such as dementia or Alzheimer's disease, which could impair their ability to respond to the questionnaire, were not included in the study.

3. Data Collection

3.1. General Characteristics of the Population

Data on age, sex, rural or urban origin, marital status, living arrangements, occupation, socioeconomic level, educational level, smoking, alcohol consumption, family and personal history, polypharmacy (more than five medications) and physical activity were collected.

3.2. Characteristics of Diabetes

The recruited patients are already known to have diabetes, and the diagnosis of diabetes was made according to the criteria of the American Diabetes Association [5].

Details regarding the duration of diabetes, type of diabetes treatment (oral antidiabetic agents, human insulin, insulin analogs), and microvascular and macrovascular diabetic complications were documented.

3.3. Nutritional Assessment

Anthropometric measurements were taken, including weight and height. Body mass index (BMI) was calculated. The bio-impedancemetry method was used to assess body

composition, including measurements of body fat mass, lean mass, appendicular muscle mass, and body water. Sarcopenia was evaluated based on reduced muscle strength (handgrip and chair-stand tests) and low appendicular muscle mass. The criteria for diagnosing malnutrition were defined based on the High Authority of Health guidelines [6]. Clinical malnutrition was defined as the presence of either weight loss which reflects a catabolic state ($>5\%$ in 1 month or $>10\%$ in 6 months) and/or low BMI (below 22 kg/m^2).

That allows us to divide our population in two groups MN+ (presence of malnutrition) and MN – (absence of malnutrition).

3.4. Dietary Survey

An experienced dietitian conducted an individual dietary survey using the dietary history method to assess the patients' food consumption habits of the last 6 months and 24 h recall. The Nutralog software, based on the ANSES CIQUAL 2020 food composition table, was used to estimate spontaneous nutrient intake.

3.5. Biological Evaluation

Various laboratory tests, including fasting blood glucose and HbA1c, HDL cholesterol, calculated LDL cholesterol, haemoglobin and creatinine. Kidney function was assessed by determining creatinine clearance through the utilization of the MDRD method.

3.6. Gerontological Evaluation

- The Geriatric Depression Scale (GDS) [7] was utilized to evaluate depression within the study. The GDS serves as a screening test designed to detect depressive symptoms among the elderly. It boasts a sensitivity of 80% and a specificity of 75% [8]. The scale comprises 15 items, with a total score determined by assigning one point for each negative response to questions 1, 5, 7, 9, and 15, and one point for each positive response to the remaining questions. The interpretation of the GDS scores is as follows: A score of 0 to 4 suggests an absence of depression, while scores ranging from 5 to 9 indicate a mildly depressive state. A score falling within the range of 10 to 15 is indicative of a moderately or severely depressive state.
- The Katz index [9] in assessing the level of independence in daily activities. This index encompasses six questions that evaluate an individual's autonomy in daily tasks, including personal hygiene, dressing, using the toilet, maintaining continence, mobility, and eating. For each activity completed independently, one point was assigned. A perfect score of six points indicated complete autonomy, signifying that the individual could perform all assessed activities without assistance. In contrast, a score falling between three and six points denoted partial autonomy, suggesting that the participant required some level of support in certain daily tasks. A score below three points on the Katz Index indicated a

state of dependence, highlighting a greater reliance on external assistance for these essential activities.

- frailty score [10] The scoring system categorized individuals based on their total scores: A score of 8 or lower indicated that the person was not very frail, suggesting a relatively robust state of health and functionality. Scores ranging from 9 to 11 identified individuals as frail, reflecting a moderate degree of vulnerability and potential health concerns. Finally, a score of 12 or higher categorized individuals as very frail, signifying a higher level of frailty and a greater need for care and support in their daily lives.

4. Statistical Analysis

Data were entered and analyzed using SPSS. Descriptive statistics, including frequencies, percentages, means, standard deviations, and ranges, were calculated for various variables. Student's t-test and ANOVA were employed for comparisons, and Pearson's correlation coefficient was utilized to assess linear relationships between quantitative variables. In addition, multivariate analysis techniques, such as logistic regression or principal component analysis, were conducted to explore complex relationships involving multiple variables simultaneously. These variables were chosen based on their theoretical relevance, prior research findings, or observed bivariate relationships with the dependent variable (p -value < 0.05 in bivariate analysis). Variables included were: age, recent hospitalization, BMI, appendicular muscle mass, poultry and eggs consumption, haemoglobin and vitamin A intake. The significance level for all tests was set at $p < 0.05$.

5. Ethical Considerations

The study was approved by the ethics committee of the national institute of nutrition of Tunis, and informed

consent was obtained from all participants. The study is registered under number 12/2022.

6. Results

We included 100 patients in our study, among whom we identified 49 malnourished patients (MN+) and 51 well-nourished patients (MN-), thus the incidence of malnutrition in our population is 49%.

General characteristics, past medical history, habits and quality of sleep according to nutritional status are present in Table 1.

All patients aged over 85 years ($n=3$) were malnourished. 3 malnourished patients lived alone compared to 8. The majority of our population lived with family (36 vs 35). The difference was not statistically significant ($p=0.14$). The majority of patients were illiterate in both groups (27% in the MN+ group versus 29% in the MN- group). The patients only engaged in walking as physical activity. Sleep disorders were very common in our population, with a frequency of 75%.

Diabetes characteristics: In this study, the duration of diabetes was found to be almost identical in both groups, with 16.67 ± 8.32 years in the MN+ group compared to 16.7 ± 8.3 years in the MN- group; $p=0.98$.

Among the MN+ group, 20% were treated with insulin, 16% with Oral Antidiabetic Agents (ADO), and 13% with a combination of both insulin and ADO. In contrast, within the MN- group, 30% were treated with insulin, 10% with ADO, and 11% with the combined regimen ($p=0.12$).

The study's findings indicated that there were no notable disparities in the prevalence of macrovascular complications, like strokes and coronary events, between the two groups. Similarly, when considering microvascular complications, such as nephropathy (10 vs 12; $p=0.54$) and retinopathy (30 vs 31; $p=0.96$), there was no significant divergence observed.

Table 1. General Characteristics, Medical History, Habits, and Sleep Quality Based on Nutritional Status

		MN+	MN-	p
	Age (years)	74.51±4.41	72.76 ±3.27	0.02
	Women (n)	28	37	0.08
Marital status (n)	single	0	2	0.29
	married	36	30	
	divorced	1	1	
	widowed	12	18	
	Walking activity (n)	17	15	0.57
	Duration of walking (min)	20±5,6	24±7,2	0.78
	Active smoker (n)	11	6	0.15
	Regular alcohol consumption (n)	1	2	0.51
	Fragmented sleep (n)	24	19	0.23
	Total insomnia (n)	1	1	0.97
	hours of sleep per night (hours)	6.51	6.66	0.61
Personnal history (n)	hypertension	38	44	0.19
	dyslipidemia	41	40	0.34
	stroke	4	1	0.15
	CVD	11	12	0.54
	Fall or fracture	19	23	0.33
	Polypharmacy (n)	30	34	0.36
	Vitamin intake (n)	4	7	0.28
	Recent hospitalization (other than diabetes) (n)	20	8	0.005

MN+: presence of malnutrition; MN-: absence of malnutrition; CVD: cardiovascular disease

Nutritional assessment

Our nutritional assessment includes oral health, anthropometry, bioelectrical impedance analysis, a food frequency questionnaire, and the results of the dietary survey. All these findings are presented in Table 2.

Weight loss of more than 10% over 6 months was observed in 7% of the population, with 4% having a normal BMI.

Moving to sarcopenia, it was detected in 42% of the patients, of which 31% exhibited reduced muscle strength, 9% showed diminished muscle mass, and 2% had both decreased strength and muscle mass. In the context of sarcopenic obesity, our study identified a prevalence of 21%, where individuals had a BMI exceeding 30kg/m² along with a decline in muscle strength or mass.

Table 2. Anthropometric Measurements, Dietary Frequency Questionnaire, and Survey Results

	MN +	MN -	P
Dental issues (n)	45	46	0.77
weight (kg)	71.60	75.38	0.15
BMI (kg/m ²)	27.99±6.9	29.51±4.5	0.02
Body fat mass (kg)	23.96	25.83	0.49
Lean body mass (kg)	45.78	47.93	0.21
Appendicular muscle mass (Kg)	18.74	20.67	0.02
Green tea (n/week)	1.79	3.23	0.23
Poultry (n/week)	4.79	3.65	0.02
Fruits (portions/day)	2.06	1.96	0.65
Vegetables (frequency/day)	0.83	0.94	0.19
Red meat (frequency/week)	0.78	0.86	0.69
Fish (frequency/week)	1.11	0.89	0.12
Eggs (frequency/week)	2.16	1.39	0.02
Protides (g)	60	59	0.28
Lipids (g)	85	95	0.55
Carbohydrates (g)	219.52	209.53	0.13
SFA (g)	16.38	19.48	0.09
MUFA (g)	42.43	47.70	0.93
PUFA (g)	16.86	16.66	0.87
Ratio w6/w3	14.98	13.72	0.23
iron (mg)	6.91	7.08	0.8
Calcium (mg)	595.43	592.59	0.54
Sodium (mg)	4770.86	4830.18	0.3
Magnesium (mg)	220.51	222.01	0.75
Vitamin C (mg)	102.09	83.19	0.13
Vitamin D (µg)	8.40	8.29	0.41
Vitamin A (µg)	89.38	102.58	0.01
Vitamin E (mg)	19.61	20.23	0.85
Vitamin B9 (µg)	213.12	226.09	0.42
Vitamin B12(µg)	2.34	2.38	0.9
Fibers (g)	21.21	23.45	0.8
sucrose (g)	90.02	69.25	0.13

BMI: body mass index; SFA : Saturated Fatty Acids; MUFA: Monounsaturated Fatty Acids; PUFA: Polyunsaturated Fatty Acids; w3: omega 3; W6: omega 6

Regarding protein intake, the average consumption was 1g/kg of ideal body weight. However, 16% of the MN+ group and 21% of the MN- group had protein intake below 1g/kg of ideal body weight (p=0.79). For

carbohydrates, 6% of the MN+ group and 9% of the MN-group had an intake exceeding 5g/kg of ideal body weight (p=0.65). As for fat intake, an excessive consumption was noted in 26% of the MN+ group and 32% of the MN- group, with intake surpassing 1g/kg of ideal body weight (p=0.29).

Diagnosis of malnutrition according to the criteria of the French National Health Authority

The diagnostic criteria established by the French National Health Authority (HAS) were applied to assess the prevalence of malnutrition. Among the patients, 14% were diagnosed based on their BMI, 4% due to weight loss, 9% as a result of reduced muscle mass, and the highest proportion, 31%, were diagnosed due to decreased muscle strength. Notably, the diagnosis of malnutrition was primarily attributed to reduced muscle strength (31%), followed by BMI and muscle mass reduction.

Clinical scores (table 3)

Table 3. Distribution of the Population Based on GDS, ADL, and Frailty Scores

	MN +	MN -	p
GDS	3.78±3.6	2.61±2.8	0.008
ADL	4.86±1.84	5.24±1.46	0.02
frailty	8.37±4.2	6.78±3.17	0.04

GDS: Geriatric Depression Scale; ADL: Activities of Daily Living

Depression was more prevalent in the MN+ group. The median score was 2 with an interquartile range. Depression was identified in 34% of our patients. Within this, a predominance was observed in the MN+ group, with 16% exhibiting mild depressive symptoms and 3% showing moderate to severe depressive states.

The majority of patients demonstrated autonomy, with only 18% of the population being dependent.

Individuals classified as "Very Frail" were more numerous in the MN+ group (10 vs 3; p=0.03).

Biological parameters

The mean fasting blood glucose levels and HbA1c levels were compared between MN+ and MN- groups (13.46±6.6 mmol/l vs 11.15±4.7 mmol/l and 10.26±2 vs 10.66±2.36 %). Although the mean fasting blood glucose level was slightly higher in the MN+ group, the difference did not attain statistical significance (p=0.06). Similarly, the mean HbA1c levels were found to be comparable in both groups (P=0.41).

Despite variations in these parameters, the mean lipid profiles were observed to be similar in both groups. The prevalence of conditions like hypertriglyceridemia, hypercholesterolemia, hypoHDL, and LDL outside recommended levels also showed no significant differences between the two groups.

Hemoglobin levels displayed a noteworthy difference, with a lower average in the MN+ group compared to the MN- group (12.38 vs 13.59 g/dl; p=0.002). Anemia was more prevalent in the MN+ group than in the MN- group (p=0.04). There were no significant differences between the groups regarding the stage of nephropathy (P=0.21).

Multivariate analysis

The univariate analysis was complemented by a multivariate analysis using logistic regression, and after adjustment, the model identified 3 independent variables

significantly associated with the occurrence of malnutrition in elderly diabetic subjects (Table 4).

Table 4. Statistical Analysis of Variables: P-Values, Odds Ratios, and Confidence Intervals

Variable	P-Value	Odds Ratio (OR)	95% Confidence Interval (CI)
History of Hospitalization	0.016	210.69	(2.69 - 16484.21)
Appendicular Muscle Mass (KG)	0.018	1.77	(1.10 - 2.84)
Frequency of Poultry Consumption per Week	0.03	0.54	(0.31 - 0.95)

Variables included in logistic regression were: age, recent hospitalization, BMI, appendicular muscle mass, poultry and eggs consumption, haemoglobin and vitamin A intake.

7. Discussion

In our study, we found that malnutrition, as defined by the French National Authority for Health, affected 49% of the diabetic patients. Many European registries and studies have indicated a high prevalence of malnutrition. A multicenter cross-sectional study in Belgium, involving over 2000 patients, revealed that 33% of them were suffering from malnutrition, with up to 76% being at risk of malnutrition [11]. A Dutch study found a malnutrition rate of 32.9% among patients in a geriatric hospital [12]. A German study showed an even higher prevalence at 56.2% [13]. The variability in prevalence between these studies can be attributed to the use of different scoring systems and diagnostic criteria, which could impact the comparability of their results.

In some countries, the average age was higher than our diabetic patients. This difference can be attributed to a higher socioeconomic level in these countries, better healthcare quality, and a longer life expectancy. Age is a major factor in malnutrition, as it is well-established that the older one gets, the higher the risk of becoming malnourished [11,14]. It is widely demonstrated that aging is associated with quantitative and qualitative changes in body composition, with the most significant being a decrease in lean mass and alterations in the distribution of body fat [15]. These changes, coupled with factors like sedentary lifestyles, comorbidities, polypharmacy, and psychiatric disorders, make this age group more vulnerable to disruptions in their nutritional status. Brownie has reported that aging is linked to reduced gastric and salivary secretion, digestive malabsorption, dental issues, decreased taste sensation, and electrolyte regulation disorders, all of which can increase the risk of malnutrition [16].

Several studies have shown that the prevalence of malnutrition in a hospital setting can reach up to 60% among elderly patients [17,18].

In a study focusing on the nutritional status of elderly individuals during hospitalization [19], several factors contribute to the decline in food intake among these patients. These include limited food choices and unappetizing menus, rigid meal schedules, and inadequate communication between the healthcare team and meal service providers. Challenges range from trays being placed out of reach for bedridden patients to difficulties in using utensils and eating

without assistance, particularly for patients with conditions such as stroke, dementia, delirium, or arthritic hand deformities [19]. Furthermore, hospitalization often involves extended fasting periods before specific medical tests. Post-hospitalization, the metropolitan SAFE cohort (comprising 1306 individuals aged 75 and above) identified malnutrition as a significant factor associated with functional decline, dependency, and a substantial impact on two-year mortality [19]. This underscores malnutrition as a critical public health concern.

It is important to mention that only 5% of malnourished patients had a normal BMI, 11% were overweight, and 20% were obese. In contrast, 14% had a BMI lower than 22 (indicative of malnutrition). Sanz-Paris et al. reported in their study that, based on BMI, 36% of patients were overweight, 31.8% were obese, and 29.3% had a normal BMI, using 25 kg/m² as the threshold. Interestingly, the authors highlight that 15.5% of patients had a BMI $\geq$ 30 kg/m² while being classified as malnourished according to the MNA score [20]. In fact, there is a close relationship between weight, obesity, diabetes, malnutrition, and glycemic control. On one hand, obesity is prevalent in diabetic patients, especially in type 2 diabetes, and plays a significant role in the pathophysiology of diabetes and glycemic control through insulin resistance and the metabolic syndrome. On the other hand, weight loss is strongly recommended and is the cornerstone of lifestyle changes in diabetes management, as weight reduction is associated with improved metabolism, glycemic control, and lipid profile [21]. Relying solely on weight to diagnose malnutrition is likely insufficient, although screening for malnutrition using scores can be challenging due to the time required, especially in elderly individuals. Indeed, the elderly often suffer from hearing loss, communication problems, and memory issues, which can lengthen the consultation process. While there are several validated scores proposed in the literature, most of these scores require gathering various clinical, biological, and anthropometric measures, which further adds to the time needed. In our daily practice, we have noticed that many doctors tend to simplify this process by merely weighing the patient [22–24]. This misconception may be more common in a population where obesity is more prevalent than in the general population, such as the Tunisian diabetic patients. Although a high BMI is often associated with a higher risk of mortality [25], this relationship is not straightforward in elderly individuals, especially those with chronic diseases like diabetes [26,27]. Conversely, a high BMI seems to be correlated with a lower risk of mortality, a phenomenon known as the "obesity paradox" [28].

In our study, sarcopenia was diagnosed based on the decrease in muscle mass or muscle strength. Consequently, 42% of our diabetic patients were found to be sarcopenic. Our results were higher than those found in the literature [29,30].

Diabetes is characterized by a state of chronic hyperglycemia associated with alterations in carbohydrate, lipid, and protein metabolism, resulting in both impaired secretion and insulin resistance, which are involved in proteolysis. High levels of cytokines, such as TNF α , IL-1, IL-5, or IL-6, which are common in patients with type 2 diabetes (DT2), can worsen insulin resistance. Additionally, the typical mitochondrial dysfunction in diabetic patients

promotes lipid oxidation, increased lipid accumulation in muscle cells, and insulin resistance, all of which contribute to the development of frailty and sarcopenia [31].

The results of our study indicated that recent hospitalization (within the last 6 months for reasons other than diabetes) was significantly more common in the MN+ group (30% versus 8%). In multivariate analysis, patients with a history of hospitalization had a 210-fold higher risk of malnutrition. In the literature, several studies have shown that the prevalence of malnutrition in a hospital setting can reach up to 60% among elderly patients [17,18]. Hospitalization brings about significant changes, including alterations in the environment, meal schedules, and dietary habits. A report on the nutrition of hospitalized elderly individuals by the Association of Community Health Councils for England and Wales highlighted various dysfunctions that could explain the decrease in food intake among these patients, such as limited food choices, unappetizing menus, rigid meal schedules, and inadequate communication between the healthcare team and those responsible for meal service when trays remain untouched or unfinished [32]. Reasons for untouched or unfinished meals can vary, from trays being placed out of reach for bedridden patients to difficulties in using utensils and eating without assistance, especially in patients with conditions like stroke, dementia, confusion, or arthritic hand deformities. Additionally, during hospitalization, there are significant fasting periods before certain diagnostic tests. Furthermore, in post-hospitalization settings, malnutrition has been identified in the metropolitan SAFE cohort (comprising 1306 subjects over 75 years old) as a factor associated with functional decline, dependence, and a significant influence on two-year mortality, emphasizing it as a significant public health concern [19].

In our study, anemia was more common in the malnourished group. In the study of Sahin [32], anemia risk was 2.12-fold higher in participants at risk of malnutrition and 5.05-fold higher in those with malnutrition. The primary causes of anemia are nutritional deficiencies and inflammation [33]. Protein and energy deficiencies can lead to elevated cytokine production, triggering inflammation, immunodeficiency, and anemia. Anorexia and obesity have been associated with anemia, primarily due to increased cytokines and elevated hepcidin serum levels. This can inhibit macrophage activity and result in decreased red blood cells and hemoglobin concentrations due to ineffective erythropoiesis. To mitigate inflammation and enhance iron absorption, it's essential to maintain a diet rich in both protein and energy. For chronic patients, a minimum daily intake of 1700 calories and 1.7 grams of protein per kilogram of body weight is necessary to support anabolic processes, ultimately preventing and treating anemia [34].

With an OR < 1, poultry consumption is protective against malnutrition in our study. Poultry meat offers a versatile and moderately energy-rich source of nutrition with highly digestible, quality proteins, low collagen content, and healthy unsaturated fats, primarily located in the skin, which can be easily trimmed. Additionally, it is rich in essential B-group vitamins, particularly thiamin, vitamin B6, and pantothenic acid, along with important minerals such as iron, zinc, and copper. These nutritional

attributes collectively make poultry meat a valuable dietary choice for preventing malnutrition in the elderly [35].

In our study, we observed the following clinical scores: We found that depression was present in 34% of patients, with a higher prevalence in the MN+ group. The relationship between depression and malnutrition is complex. Studies have shown a strong association between depressive symptoms and the risk of malnutrition. Depression can lead to decreased appetite, disordered eating, weight loss, and apathy, which may contribute to malnutrition. Conversely, diet quality plays a role in depression, with improvements in diet linked to reduced depressive episodes. Nutritional interventions, such as regular snacks, have been associated with fewer depressive symptoms and improved cognitive function [36].

We found that 22% of the diabetic patients were frail, with 13% very frail, and the MN+ group had higher scores. This aligns with existing literature, which suggests that insulin resistance in diabetic individuals can contribute to frailty by impacting muscle strength, vascular health, and hormonal production. Strategies such as physical activity, dietary correction, and better glycemic control appear effective in reducing frailty in elderly diabetic individuals [37].

It's crucial to recognize several limitations in our study. Firstly, the sample size used in our study may be considered limited. A larger and more diverse sample could provide a more comprehensive representation of the population, potentially offering more robust and generalizable results. Additionally, our study may be subject to selection bias, as the individuals included may not fully represent the broader population. Moreover, the cross-sectional design of our study inherently restricts our ability to establish causal relationships. Despite these limitations, our study offers valuable insights and may serve as a foundation for further research with more extensive and rigorous methodologies to address these constraints.

8. Conclusion

The elderly diabetics are particularly vulnerable to malnutrition due to various factors, including changes in body composition and declining organ function. Diabetes, a prevalent chronic condition among the elderly, often coexists with malnutrition but is frequently overlooked. Our study underscores the critical need for systematic malnutrition screening in elderly individuals with diabetes. Regular nutritional assessments should be conducted, regardless of body mass index, to detect signs of malnutrition early and implement appropriate interventions. Additionally, during planned hospitalizations for elderly diabetic patients, comprehensive geriatric assessments should be performed to address their specific needs and prevent malnutrition-related complications. Raising awareness among medical students, providing information to family members, and launching public awareness campaigns are crucial steps in tackling this issue. By following these recommendations, we can enhance the well-being of elderly diabetic individuals, reduce malnutrition risks, and promote healthier aging.

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