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Shedding Light on Nutritional Status of Karachi's Elderly: A Cross Sectional Study

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Abstract

***Background*:** Malnutrition is a critical public health issue in developing countries, with one in five individuals undernourished (WHO). The Pakistan Nutrition Survey (2011) estimated that 42% of elderly in Pakistan suffer from malnutrition. This study aimed to assess the burden of malnutrition among Karachi's elderly and identify its key determinants.

***Methods*:** A cross-sectional study was conducted from January to December 2023, recruiting 100 participants aged ≥65 via convenience sampling. Exclusion criteria included individuals on artificial nutrition, those with grade 4 comorbidities, severe disabilities, or a high mortality risk based on the Cumulative Illness Rating Scale (CIRS). Each participant underwent a clinical assessment, including anthropometric measurements (Mid-Arm Circumference [MAC], Calf Circumference, and Body Mass Index [BMI]). Dietary habits, comorbid conditions, and food restrictions were evaluated through structured interviews, and nutritional status was assessed using the Nestlé Mini Nutritional Assessment (MNA) tool.

***Results*:** Among participants, 5.6% were malnourished and 30.6% were at risk. Women had a higher malnutrition rate (10.5%), while 35.3% of men were at risk. The mean age was 69.65 ± 5.77 years. Digestive issues were the most commonly reported factor, and malnourished individuals consumed significantly less protein and dairy.

***Conclusion*:** Malnourished individuals showed signs of wasting, with 11.8% having a calf circumference <31 cm and 50% with a mid-arm circumference <21 cm ($p < 0.001$). Additionally, compromised activities of daily living, particularly bathing, were noted ($p < 0.001$). These findings underscore the urgent need for targeted nutritional interventions for Karachi's elderly.

Keywords: Malnutrition, mini nutritional assessment, cumulative illness rating scale, mid-arm circumference, activities of daily living.

1. INTRODUCTION

Malnutrition in the elderly can have a significant impact on their quality of life, leading to frailty, failure to thrive, and homeostatic balance failure syndrome [1]. Malnutrition is influenced by a myriad of determinants spanning dietary intake, health status, socioeconomic factors, age, psychosocial elements, environmental conditions, cultural and behavioral aspects, caregiver practices, substance abuse, and gender disparities [2]. Inadequate access to nutritious food, chronic illnesses, poverty, mental health issues, social isolation, environmental disruptions, cultural beliefs, and inappropriate feeding practices are among the key contributors to malnutrition [3]. These determinants interact in complex ways, impacting individuals across the lifespan and varying socio-demographic groups.

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Recognizing and addressing these factors is essential for developing targeted interventions and policies aimed at mitigating malnutrition and promoting optimal nutritional wellness in diverse populations.

Understanding the pattern of malnutrition among the elderly helps healthcare planners and policymakers allocate the meagre healthcare resources in Pakistan effectively [2]. By identifying areas with high rates of malnutrition, they can target interventions and support services where they are most needed. By quantifying the extent of malnutrition, policymakers could improve public health outcomes, enhance quality of life, reduce economic burden, and promote social equity in Pakistan [3].

2. METHODOLOGY

A cross-sectional study was conducted from January 2023 to December 2023, including 100 participants recruited *via* convenience sampling. Inclusion criteria required participants to be aged ≥65 years. Exclusion criteria included individuals receiving artificial nutrition, those with grade 4 comorbidities, severe disabilities, or those at high mortality risk as determined by the Cumulative Illness Rating Scale (CIRS). It should be noted that the non-randomized sampling approach may have introduced selection bias, potentially leading to an over-representation of individuals with easier access to healthcare services.

Participants underwent comprehensive clinical assessments performed by consultant family physicians specializing in elderly care. Standardized protocols were used to record anthropometric measurements—including Mid-Arm Circumference (MAC), Calf Circumference, and Body Mass Index (BMI). In addition, dietary habits, comorbid conditions, and food restrictions were evaluated through structured interviews.

The sample size was determined using WHO Open Epi, assuming a 95% confidence interval and a 5% margin of error, with Karachi's population of 14.9 million as the reference. Data were analyzed using SPSS version 20. Numerical variables (e.g., age, MAC, Calf Circumference, and BMI) were expressed as means ± standard deviations, while categorical variables (e.g., gender, education, comorbidities, Activities of Daily Living [ADLs], and Instrumental Activities of Daily Living [IADLs]) were summarized as frequencies and percentages. Chi-square tests were performed to assess associations, with a p-value <0.05 considered statistically significant. Confidence intervals were reported for major associations to enhance statistical precision and adhere to STROBE recommendations on reporting bias and rigor.

3. RESULTS

In our study, 5.6% of the elderly were classified as malnourished, while 30.6% were at risk of malnutrition. The mean age of participants was 69.65 ± 5.77 years. Notably, 10.5% of women were malnourished, whereas 35.3% of men were categorized as at risk. The average weight of participants was 64.97 ± 14.8 kg and the mean height was 164.56 ± 10.42 cm.

Malnutrition was found to be associated with comorbid conditions; for instance, 12.5% of hypertensive individuals were malnourished. In terms of daily functioning, only 2.9% of malnourished subjects were unable to bathe independently. Furthermore, poor dietary habits were common among the malnourished, with significantly lower consumption of protein and dairy products observed.

Table **1** presents the demographic and socio-cultural factors related to nutritional status, along with the corresponding chi-square statistics and p-values.

Table 1: Demographic and socio–cultural data related to nutritional status (according to MNA).

Determinant		At Risk of Malnutrition (%)	Malnourished (%)	Normal Nutritional Status (%)	Chi-square	p-value
Gender	Female	26.3	10.5	63.2	6.09	0.047
	Male	35.3	0	64.7		
Marital Status	Married	31.4	5.7	62.9	1.74	0.621
	Single	0	0	100		
Living Status	Alone	0	0	100	3.59	0.202
	With Family	32.4	5.9	61.8		
Education	Illiterate	41.2	5.9	52.9	7.68	0.102
	High School	25	0	75		
	Graduation	18.2	9.1	72.7		

Table 1 Cont'd…

Determinant		At Risk of Malnutrition (%)	Malnourished (%)	Normal Nutritional Status (%)	Chi-square	p-value
Comorbidities	Diabetes	23.1	7.7	69.2	1.89	0.384
	Hypertension	18.8	12.5	68.8	11.7	0.002
	Osteoarthritis	35.7	7.1	57.1	1.4	0.564
Impact on Activities of Daily Living (ADLs)						
Bathing Independently		31.4	2.9	65.7	52.4	<0.001
Dressing Independently		30.6	5.6	63.9	–	–
Toileting Independently		31.4	5.7	62.9	1.74	0.621
Telephoning Independently		24.1	6.9	69	9.28	0.012
Operating Telephone (Dialling/Answering)		15.8	25	5.3	26.2	<0.001

Fig. (**1**) illustrates the causes of malnutrition among the elderly. The data show that 12.5% of malnourished individuals were taking more than three prescription drugs ($p = 0.042$), and nearly all of the malnourished participants experienced severe digestive problems ($p < 0.001$). Additionally, 33.3% of these individuals had suffered from some form of acute illness in the past three months ($p < 0.001$), while 16.7% were deliberately avoiding certain food items ($p = 0.047$). Interestingly, none of the malnourished individuals were receiving vitamin supplementation, although this finding did not reach conventional levels of statistical significance (chi-square = 5.6, $p = 0.062$).

Fig. (**2**) highlights the dietary habits among the healthy elderly population. It was observed that 77.8% of healthy individuals consumed three proper meals per day (chi-square = 35.15, $p < 0.001$), and 83.3% reported daily consumption of dairy products (chi-square = 19.7, $p < 0.001$). Furthermore, 65.6% consumed more than two servings of legumes or eggs weekly (chi-square = 2.8, $p = 0.291$), while 84.6% had meat, fish, or poultry daily (chi-square = 2.8, $p = 0.291$). Finally, a substantial 88.2% of the healthy elderly consumed at least two servings of fruits or vegetables per day (chi-square = 25.5, $p < 0.001$), underscoring a generally balanced dietary pattern in this group.

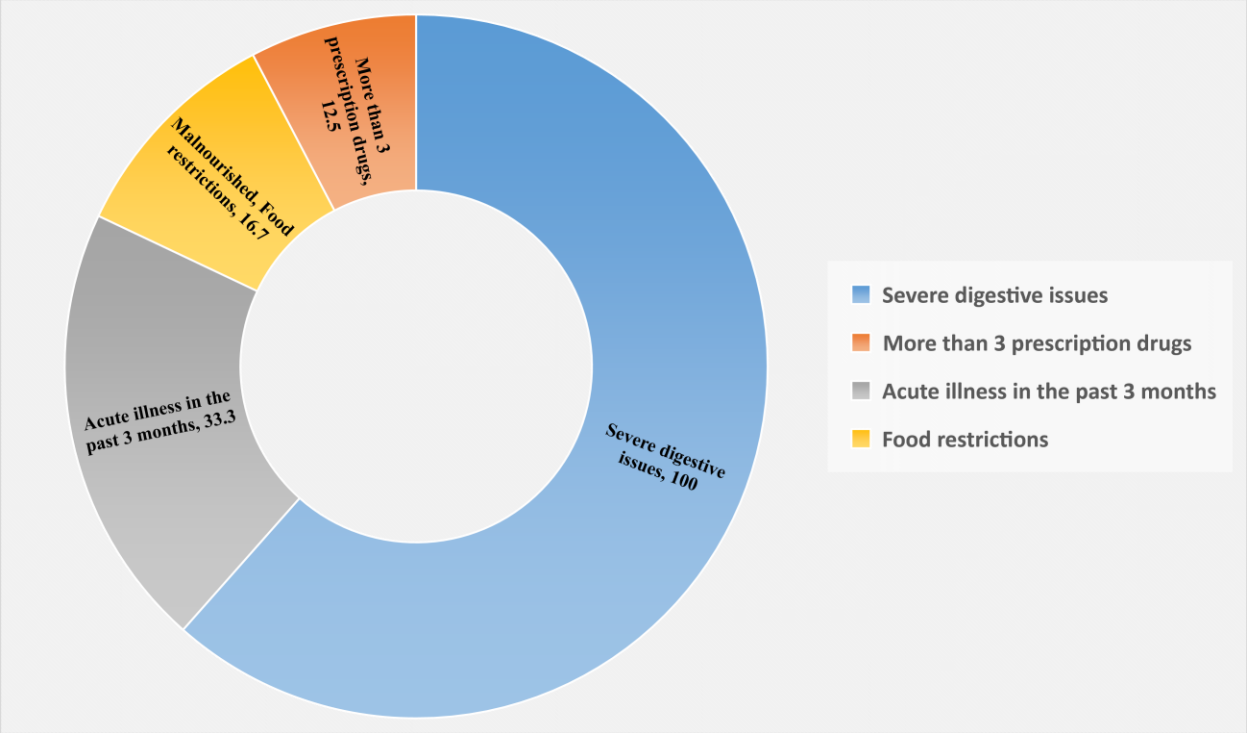

Figure 1: Causes of malnutrition in elderly.

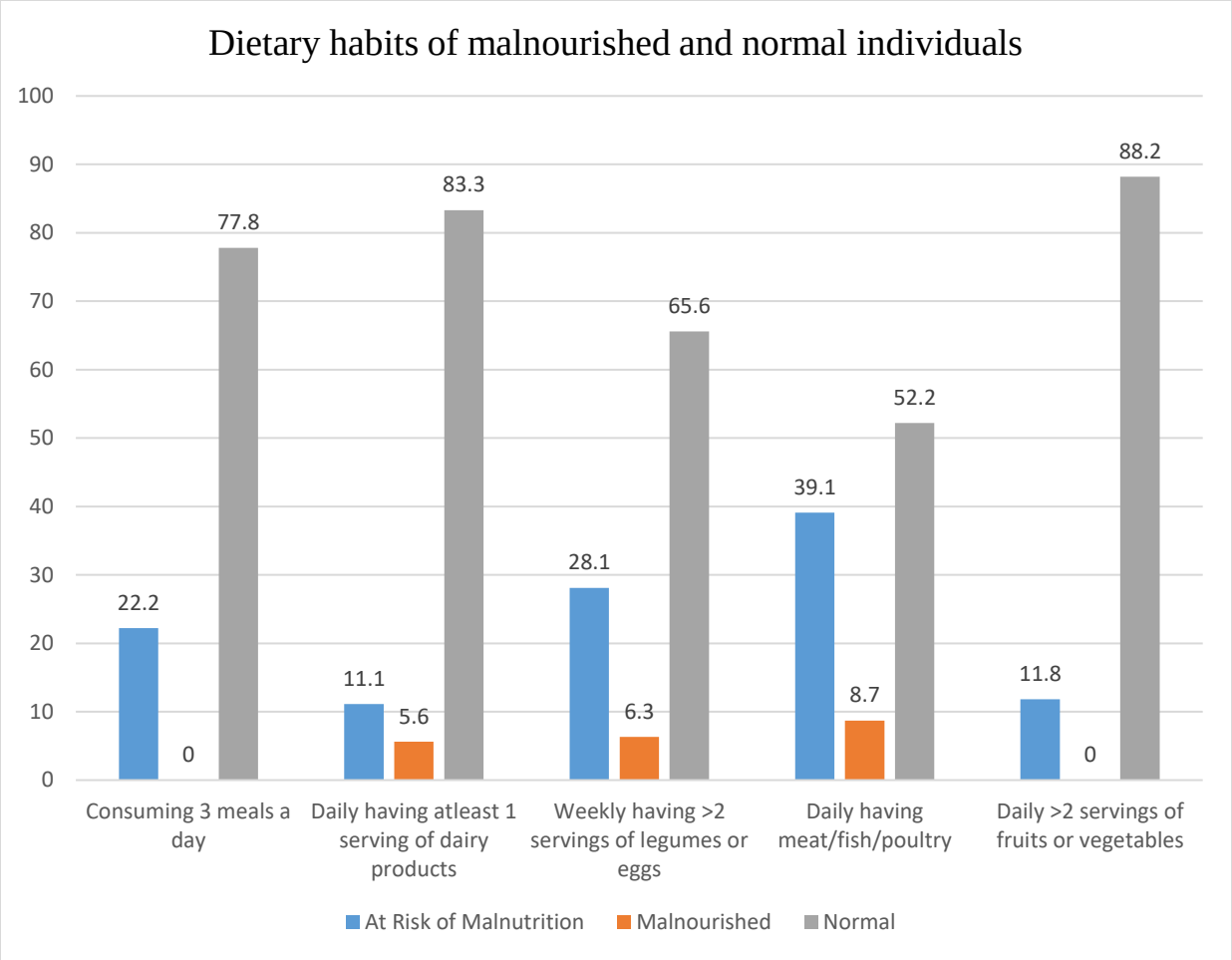

Figure 2: Comparison of diet consumed by malnourished, at risk of malnutrition and normal individuals.

4. DISCUSSION

Malnutrition is defined by the World Health Organization as "deficiencies or excesses in nutrient intake, imbalance of essential nutrients or impaired nutrient utilization." This multifaceted condition results in numerous adverse effects for individuals and healthcare systems alike. Individuals suffering from malnutrition are at an elevated risk of frailty, possess weakened immune systems, and experience increased mortality rates. Additionally, malnutrition leads to heightened physical dependency, which further burdens healthcare services and imposes significant financial strain on affected individuals. The financial challenges often exacerbate the condition, as those facing economic hardship may struggle to access adequate nutrition, thereby placing them at a higher risk of redeveloping malnutrition.

In our study, analysis of the results revealed that 5.6% of the elderly population was malnourished, while 30.6% were at risk of malnutrition. When compared to previous studies conducted in Pakistan—specifically those in Karachi in 2024 and 2015, and Islamabad in 2015—the prevalence of malnutrition in those studies was reported as 9.4%, 14%, and 8%, respectively, with the risk of malnutrition being 42.4%, 43.3%, and 38.2% [4-6]. When we compared our findings with international studies from India [7], Nepal [8], Sri Lanka [9], Vietnam [10], Malaysia [11], China [12], and Saudi Arabia [13], it was observed that the prevalence of malnutrition in our sample was lower than in most of these studies, except for the one conducted in Saudi Arabia, which reported a prevalence of 5.3%. Similarly, with regard to the risk of malnutrition, only the Malaysian study reported a lower risk at 23.5%. Notably, comparisons with neighboring countries revealed substantial differences; for instance, the Pakistani studies and the Chinese study reported malnutrition and risk values of 17.9% and 60.1%, respectively, whereas the Indian study reported a prevalence of 17.9% with 58.8% at risk. It is important to

note that the larger populations of India and China could affect the distribution and availability of food resources, thereby influencing these nutritional indices.

Gender appears to play a significant role in the development of malnutrition. In our study, a majority of women were more malnourished, with 10.5% of women being malnourished, whereas 35.3% of men were at risk compared to 26.3% of women. These findings are consistent with other studies [4, 8, 10, 11] and with a systematic review conducted in 2020 that analyzed 45 studies [14]. The higher risk among men may be attributed to factors such as a greater likelihood of food insecurity due to financial dependency on their spouses, exposure to domestic violence, and lower muscle density—all of which can affect anthropometric measurements like mid-arm and calf circumferences. Moreover, the educational level may also influence nutritional status; individuals with lower levels of education might lack accurate information on healthy dietary practices, or they might face challenges in securing well-paying employment, which in turn affects their access to nutritious food [4]. Although marital status has been shown to play a role in reducing the risk of malnutrition, our findings suggest that the presence of a supportive family unit and a robust social environment is perhaps even more critical. Such settings enhance accountability regarding daily nutritional intake and reduce physical dependency in tasks like meal preparation, thereby mitigating food insecurity and, consequently, the risk of malnutrition [9, 12, 15, 16]. However, due to our small sample size, we were unable to draw definitive conclusions regarding the influence of marital status or living arrangements.

Living conditions are also crucial in the development of malnutrition. Studies indicate that elderly individuals residing in nursing homes or care facilities have a higher risk of malnutrition, with reported prevalence and risk values of 13.5% and 37%, respectively, compared to community-dwelling individuals, who demonstrate prevalence and risk values of 7.3% and 23.5% in Malaysia [11]. Similarly, research conducted in China among nursing home residents revealed malnutrition and risk levels of 10.5% and 37.4%, respectively [15]. Although care facilities typically provide three meals a day—which is generally associated with a lower risk of malnutrition (22.8% at risk compared to 77.8% with normal nutritional status)—the meals provided may not meet all the specific nutrient requirements of each resident. In contrast, meals prepared at home may be more tailored to individual needs. Additionally, living in rural areas has been consistently associated with a higher risk of malnutrition. For instance, rural areas reported malnutrition and risk values of 10.0% and 30.2%, compared to 6.3% and 21.1% in urban areas [11], which may be due to disparities in food availability and quality.

Psychological factors, particularly depression, are also linked to malnutrition. Depression has been associated with an increased prevalence of malnutrition, with studies showing rates of 12.0% for malnourished patients with depression compared to 8.1% in those without, and risks of 47.0% versus 36.5%, respectively [17, 18]. Furthermore, an Iranian study demonstrated that lower Mini Nutritional Assessment (MNA) scores were correlated with higher levels of depression; malnourished or at-risk individuals had a mean Geriatric Depression Scale (GDS) score of 13.31 ± 7.71, compared to 6.70 ± 5.24 in well-nourished individuals [19]. These observations can be explained by the tendency of depressed individuals to exhibit diminished appetite and irregular meal patterns, which can lead to nutritional deficiencies. Additionally, a 2023 systematic review of 24 studies found that dementia, which often coexists with malnutrition, had a pooled prevalence of 26.98% for malnourished individuals with dementia and 79.66% for those at risk [20]. Dementia, as a syndrome characterized by chronic progressive degeneration of brain tissue, impairs memory, thinking, and decision-making, and can lead to altered food intake patterns even in the early stages. In advanced dementia, patients may lose the ability to recognize hunger and thirst cues and may struggle with feeding themselves due to spatial dysfunction, thereby directly contributing to malnutrition [20].

Comorbidities such as hypertension, diabetes, and osteoarthritis were also found to be associated with malnutrition. In our study, hypertensive patients exhibited the highest incidence of malnutrition (12.5%) but the lowest risk (18.8%), whereas patients with osteoarthritis showed the lowest prevalence of malnutrition (7.1%) but the highest risk (35.7%). This suggests that hypertensive individuals may be more prone to progressing from risk to overt malnutrition, possibly due to dietary restrictions and the effects of medications. In contrast, osteoarthritic patients may be more successful in managing their nutritional status despite being at higher risk. The relationship between malnutrition and hypertension is further supported by evidence suggesting that while malnutrition may reduce the prevalence of obesity, its outcomes are worsened when hypertension is present. This may be partly due to the dietary management requirements of hypertensive patients and the side effects of medications such as diuretics and beta blockers (e.g., metoprolol), which can lead to increased urination, electrolyte imbalances, and reduced appetite [21].

Physical activity, and by extension, physical dependency, has a bidirectional relationship with nutrition. This relationship is particularly evident in conditions such as osteoarthritis and sarcopenia. Osteoarthritis, defined by the CDC as the breakdown of cartilage and subsequent changes in the underlying bone, limits mobility and can lead to increased physical dependency on others. Similarly, sarcopenia—a progressive loss of muscle mass and strength—can result from both inadequate protein intake and reduced caloric consumption [22]. This muscle degradation can, in turn, worsen physical dependency, as diminished muscle strength reduces the capacity for physical activity. An important distinction between osteoarthritis and sarcopenia is the development of sarcopenic dysphagia, where the loss of muscle mass affects the muscles involved in swallowing, such as the tongue and genio-hyoid muscle [23, 24]. A Vietnamese study utilizing the EAT-10 tool found that 24.6% of participants were at risk for dysphagia, and this subgroup demonstrated a higher prevalence and risk of malnutrition compared to those without dysphagia [25]. Additionally, a study in China reported that 85% of participants who were completely physically dependent exhibited poor nutritional status [12]. The challenges in performing daily tasks, such as purchasing groceries or cooking due to limited mobility, further exacerbate the risk of malnutrition. Moreover, physical dependency often leads to social isolation, which has been linked to depression—a factor already noted as contributing to malnutrition [12, 18]. These interconnected factors suggest the existence of a vicious cycle in which malnutrition leads to physical dependency, and physical dependency, in turn, exacerbates malnutrition.

Maldigestion, malabsorption, and oral health issues are additional contributors to malnutrition in the elderly. According to Schiller (2020), "Maldigestion is the term used to describe impaired hydrolysis of nutrients within the gut lumen, and malabsorption describes impaired absorption across the mucosa" [26]. These conditions are frequently secondary to pre-existing disorders such as diabetes, enteropathies, or bacterial overgrowth. Maldigestion may manifest in various forms, including duodenal bile acid deficiency, bacterial overgrowth, and lactase deficiency. Duodenal bile acid inadequacy, for instance, can lead to steatorrhea due to the accumulation of undigested fats, which may result from bile duct blockages or impaired bile acid reabsorption. Bacterial overgrowth can alter gut motility and cause diarrhea, while lactase deficiency hampers the breakdown of lactose, the primary disaccharide in milk, rendering dairy products less accessible. This inaccessibility may lead to dietary restrictions that reduce overall vitamin and mineral intake, further contributing to gastrointestinal disturbances and dehydration.

Inflammatory bowel diseases such as Crohn's disease and ulcerative colitis are also known to cause malabsorption due to chronic inflammation, with Crohn's disease exerting a more significant impact on nutrient absorption. Additionally, celiac disease—a genetically inherited autoimmune condition triggered by gluten consumption—can damage intestinal villi, resulting in malabsorption and severe dietary restrictions, particularly given the higher cost of gluten-free alternatives.

Oral health is another critical factor in the development of malnutrition. Studies have shown that poor masticatory performance, tooth loss, and other oral health problems (e.g., ulcers and bleeding gums) are associated with underweight status. In one study, 31.47% of participants who had lost teeth were found to be underweight [27]. The inability to chew solid food restricts not only the types of food that can be consumed but also the frequency of meals, thereby reducing overall nutritional intake—a finding that is in line with our observation that 16.7% of participants intentionally avoided certain food items.

The use of multiple prescription drugs, or polypharmacy, is another significant factor associated with malnutrition. In our study, 12.5% of malnourished participants were taking more than three prescription medications. Although specific details on the types of drugs were not recorded, medications known to potentially cause malabsorption—such as methotrexate, azathioprine, colchicine, and angiotensin II receptor blockers like olmesartan, which can cause histological changes similar to those observed in celiac disease—are of particular concern [26]. Moreover, xerostomia, a common side effect of diabetes medications, can further hinder food consumption. A 2022 systematic review of seven papers reported a statistically significant link between polypharmacy and the risk of malnutrition; however, a causal relationship could not be firmly established due to the limitations inherent in the reviewed studies [28]. This association may partly result from the overuse and overtreatment of conditions such as gastroesophageal reflux disease (GERD), the use of antithrombotic agents, lipid-modifying agents, and medications for constipation—often administered beyond their effective dosages—leading to side effects rather than therapeutic benefits. The consequent alteration in drug bioavailability can exacerbate these side effects, further impairing nutritional status and underscoring the need for improved communication between physicians and patients regarding medication protocols.

Limitations of this study include its cross-sectional design, which does not allow for the establishment of

causal relationships, and a relatively small sample size limited to a single catchment area. This geographic and demographic constraint may have prevented the detection of other factors influencing nutritional status. Additionally, the paucity of literature on geriatric malnutrition in Pakistan necessitated the use of studies from other Asian countries for comparison, which may not fully reflect the local context.

5. CONCLUSION

In conclusion, our study highlights the complex and multifactorial nature of malnutrition among the elderly, where social, economic, psychological, and physiological factors interweave to drive its development and persistence. Addressing this critical issue requires comprehensive strategies, including improved dietary education, enhanced healthcare services, and policies that expand access to nutritional food while addressing broader social determinants of health. Given the substantial proportion of the elderly at risk, it is imperative that local authorities take immediate action through extensive screening and welfare programs to reduce the burden of malnutrition, thereby enhancing quality of life and alleviating strain on healthcare systems.

LIMITAION AND FUTURE DIRECTIONS

This study's reliance on self-reported data and its cross-sectional design may limit the generalizability of its findings. Additionally, the non-random sampling approach poses challenges in applying these results broadly. Future research should adopt longitudinal designs to explore the relationship between dementia knowledge and mental health over time. Qualitative studies could also provide a deeper understanding of students' experiences and challenges.

The study suggests incorporating dementia education in medical curricula, particularly in pre-clinical years, to prepare students for elderly patient care. Establishing mental health services and integrating geriatrics and mental health awareness will improve students' readiness for non-pharmacological interventions.

ETHICAL APPROVAL

Ethics review committee of Ziauddin University Pakistan approved this study with ERC code is 6690223RAFM.

PATIENT'S CONSENT

Verbal and written consent was taken from all patients in this study.

CONFLICT OF INTEREST

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AUTHOR CONTRIBUTIONS

RA and FJ were involved in the conception, data acquisition, analysis and interpretation as well as manuscript writing and proof reading.

TA and SMU were involved in manuscript writing and proof reading.

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