## Original Article

# Screening of Nutritional Deficiency Manifestations Among Egyptian Elderly: Cross-sectional study

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| ABSTRACT |
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| **Background**: Nutritional deficiencies are frequently not detected or misdiagnosed in old age as they could mimic the natural changes associated with aging |
| **Aim**: To screen the clinical manifestations of nutritional deficiencies among the elderly  . |
| Method: A cross-sectional study was conducted on 100 elderly participants with chronic diseases, aged 65 or more, chosen randomly from the outpatient clinic and inpatient at Menoufia university hospital, Egypt. Tools of the study: Demographic and clinical data; a checklist of symptoms and signs of common nutritional deficiency; and a subjective global assessment (SGA). |
| **Results**: the distribution of potential nutritional clinical manifestations among elderly revealed was variable ; skin rash (29%), easy bruising (41%), loss or thinning of hair (75%), spooning of nails (20%), impaired vision at night (37%), clouding and corneal dryness. |
| (57%), bleeding gums (56%), bone deformities (bowlegs, knocked knees, curved spine) (6%), bone tenderness (49%).  There were statistically significant difference between SGA and the following chronic diseases: (DM, hepatic, renal, and rheumatic) also significance associations between (skin rash in sun-exposed areas in hepatic diseases (p = 0.04), spooning of nails in renal disease (p = 0.06), Impaired night vision in cardiac and diabetic patients (p = 0.001), rheumatic diseases had more bone tenderness and diarrhea (p = 0.001) |
| **Conclusion**: The most common nutritional deficiency manifestations among elderly were; thinning or loss of hair, corneal drying or clouding, bleeding gum, easy bruising, and bone tenderness. SGA **based** nutritional status of elderly was (35%) well-nourished, (49%) mild to moderate, and (16%) severe malnutrition. |
| **KEY WORDS:** Nutritional deficiency, elderly, subjective global assessment. |

# Introduction

With around 8% of the world's population older than 65, life expectancy is increasing, and their number will double in approximately 30 years (1). The World Health Organization has declared healthy aging will be a top goal through 2030. For healthy aging, proper nutrition is key to future health and reduces the risk of chronic disease (2,3).

An overall state of poor nutrition, comprising both under and over-nutrition of macro- and micronutrients, is defined as malnutrition (4). Being underweight is more common in seniors who take two or more medications while being overweight is associated with the female gender (5). Malnutrition in older persons is a challenging health condition that results in greater use of medical services. It is associated with higher mortality and morbidity, deterioration in physical condition, and an overall worsening of quality of life (6,7).

Due to several age-related physiological and functional changes, including changes in energy expenditure, loss of appetite, swallowing and chewing problems, tooth loss, diminished hunger sensations, and diminished feeling of fullness, older adults are more prone to multiple nutritional deficiencies. Chronic illnesses and other variables like medicines that can induce nutritional malabsorption and changes in the motility of the digestive tract were among the many causes of malnutrition among the elderly (8,9).

An extensive range of malnutrition, from 3% in the community setting to 30% in rehabilitation centers, was found in a systematic review and meta-analysis study on the prevalence of nutritional deficiency in the elderly (10, 11). Another meta-analysis discovered considerable disparities between nations, with a higher frequency in women people over 80. (12), among individuals with one or more comorbidities and a greater incidence of nutritional deficiency in rural compared to urban areas (13).

During an Egyptian study, the elderly participant showed unsatisfactory nutritional status as more than one-third of the elderly (39.1%) were at risk of malnutrition, while about one-quarter (22.9%) were malnourished (14). In another population-based cross-sectional study, 35% of the rural Egyptian elderly were malnourished, and 38.4% were at risk of malnutrition (15).

**Significance:**

In old age, malnutrition increases the risk of general poor health and the occurrence of chronic diseases, such as cardiovascular disease, sarcopenia, osteoporosis, immune dysfunction, and delayed healing of wounds (16). Nutritional deficiency in the elderly continues to go underrecognized due to the natural processes associated with aging (17). A little research evaluated the clinical symptoms and signs of nutritional deficiencies in the elderly population (18).

At least two of six criteria are necessary for diagnoses of malnutrition according to the American Society for Parenteral and Enteral Nutrition and the Academy of Nutrition; low energy intake, decrease in muscle mass, loss of subcutaneous fat, weight loss, fluid accumulation, and decline in hand grip strength. (8). Accurate nutritional assessment is essential for proper diagnosis and intervention for the elderly.

**Aim of the study:** to assess nutritional deficiencies manifestations in older adults with chronic diseases based on symptoms and signs of nutritional deficiency

**Research questions:**

Q1. What is the nutritional status of older adults?

Q2. What are the most common nutritional deficiencies among older adults?

Q3. What are the symptoms and signs of nutritional deficiency in older adults?

**Subjects and method:**

 **Research Design:** an observational cross-sectional study.

**Setting and sample recruitment:** The current study was conducted at inpatient department and outpatient clinics of the Internal Medicine department at Menoufia University Hospital, Egypt, in the period between September 2021 and May 2022. A systematic random sample technique was used to recruit the study participants which included 100 elderly (aged 65 or more). The sample size was calculated according to the study objectives and design. Based on a review of past literature (SHI et al.,2015) found that the prevalence of malnutrition was 3.2% and the risk for malnutrition was 19.3%, according to BMI 7% of the older people were underweight, and the sample was calculated at power 80% and confidence level 95%, it was 100 participants.

**Inclusion criteria:** Patients had been enrolled in the study if they are Aged 65 years old or more according to the WHO definition of elderly. Both genders were included,

**Exclusion criteria:** Patients with a severe physical disability, patients with debilitating diseases.

**Tools for data collection:** All the participants were subjected to**:**

1.**demographic and socioeconomic data:** include age, sex, marital status, education, occupation, resident, income, and work type.

2.**Medical data include** history of chronic disease including history of diabetes, renal, hepatic, cardiac or rheumatic disease. Previous investigations related to nutritional status had been reported (Serum vitamin D, Ca (total and ionized), CBC, Lipid profile and PT, INR; if was done before and available with the patient.

3. **Symptoms and Signs of Nutritional Deficiency (in general needs more clarification** Common features of nutritional deficiency were assessed through physical examination; signs of nutritional deficiency; general appearance, body mass index BMI (< 18.5= Underweight, 18.5 to 24.9 = Healthy, 25.0 to 29.9 = Overweight, 30.0 to 39.9 = Obese, Over 40 = Extreme or high risk obesity), skin, hair/nail changes, spooning of nails, night blindness, mouth problems, edema, tetany **(carpopedal spasm )** , dysphagia, diarrhea, loss of appetite and patient reported weight loss (20).

4. **Subjective global assessment (SGA):** A screening tool developed by Baker et al., 1982, divides nutritional status into three

groups: well-nourished, moderately mal-nourished, and severely malnourished. History, weight, diet change, GI symptoms, functional capacity, and disease and physical examination were considered (21).

Using SGA takes only 10 minutes and can be done at the bedside. The tool can use to identify patients who could benefit from nutrition as well as to triage them (22). The SGA has been used with patients in various fields, including oncology and surgery. Despite its reliability and efficiency, it remains the most effective method of assessing nutrition (23, 21). The results of SGA are highly predictive of health outcomes related to nutritional status (24, 25).

### Ethical considerations

This study was conducted with the approval of The Research Ethics Committee, Faculty of Medicine, Menoufia University. Informed consent was obtained from the elderly patients after clarification of the study aim. Privacy of the participants was respected; data were kept confidential and utilized for study purposes only. There are no risks for the participants present in this study.

### Statistical analysis

Data were coded, entered, and analyzed using SPSS version 25 (the statistical software for social research; Armonk, NY: IBM Corp.). There were two distinct statistical analyses. The first is analytical statistics, including the Chi-square test ($\chi 2$) and multivariate analysis utilizing binary logistic regression, while the second is descriptive statistics, including number, percentage, mean, and standard deviation. Statistical significance was defined as a P-value < 0.05.

### Results

**Table (1):** showed the demographic data of the studied 100 elderly participants. Where their age ranged from 65 to 75 years, the age mean was (68.83±2.44) years and 53% of the participants were males, while 47% were females. According to BMI, there was (53%) of the participants were overweight, (19%) were obese, (17%) were normal, and only (11%) were underweight. As regards residence 56% of participants were living in rural areas and 44% were from the urban. As regards education 33% were illiterate, 40% low education, and 27% received high education. There was (48%) of the participants were married, (37%) were widow and (9%) were single while (6%) were divorced. As regards work types (57%) of the participants were pensioners, (21%) did light physical labor, (15%) did mental work, but (7%) did heavy physical work **(patient reported work overload)**. Regarding the income (76%) of the participants had enough income while (12%) had high income and also (12%) had low or non enough income. There was (83%) of participants lived with their families, and (17%) of them lived alone.

**Figure (1):** the participants were divided according to subjective global assessment (SGA) into (35%) well-nourished, (49%) mild to moderate malnutrition, and severe malnutrition was (16%)

**Table (2):** showed symptoms and signs of nutritional deficiency. According to symptoms and signs of skin there was (29%) had rash, (25%) had rash in sun-exposed areas suggesting deficiency of Niacin, and (41%) had easy bruising which may be a symptom of vitamin C or K deficiency. According to hair and nail symptoms and signs there were (75%) had thinning or loss of hair may be due to protein deficiency, (27%) had premature whitening of hair, and (25%) had spooning of nails. According to eyes' symptoms and signs (57%) had corneal kerato-malacia and (37%) had impaired night vision. According to symptoms and signs of mouth, (56%) had bleeding gums which indicate deficiency of vitamin C or riboflavin, and (9%) had cheilosis and glossitis. According to neurologic symptoms, there are

(14%) had paresthesia or numbness in a stocking-glove distribution, (21%) had cognitive and sensory deficits, (21%) had dementia which may due to deficiency of niacin, pyridoxine, vitamin $B_{12}$ also, and (7%) had attacks of tetany. Also, as a symptom of Calcium deficiency there is (6%) had bone deformities (e.g., bowlegs, knocked knees, curved spine), and also as a symptom of vitamin D deficiency with (49%) had bone tenderness as another symptom of vitamin D deficiency. According to GIT symptoms, (15%) had diarrhea.

**Table (3):** illustrated that Thirty nine percentage of the studied elderly patients had diabetes mellitus which increase among mild to moderate malnourished group, with statistical significant difference and (P=0.02), Rheumatic patients were represented by (17%) which was less among well-nourished, high statistical significant with mild to moderate malnourished status according to SGA (P=0.006), for hepatic patients (48%) there were statistical significant with nutrition status according to SGA (P=0.017), Renal diseases of participants were (13%) had statistical significant with nutrition status according to SGA (P=0.018). While according to hypertension there was (43%) of participants which had no statistical significant with nutrition status (p= 0.51). (13%) of participants represented by cardiac disease there was no statistically significance with nutrition status (p=0.235).

**Table (4):** showed association between laboratory data of vitamin D, Ca, and iron deficiency and its signs and symptoms. According to laboratory low vitamin D, only 9 participants had laboratory report showed low vitamin D, and 91 participants did not have one. For those 9 participants whom had the laboratory report, 6 of them had bone tenderness represented (66.7%) and 5 (55.6%) had bone deformity, from 91 participants who did not have laboratory data 43 (47.3%) had bone tenderness and just one

participant (1.1%) had bone deformity, there was statistically significant association between Laboratory low vitamin D and bone deformity (p<0.001), and there was no statistically significant association between Laboratory low vitamin D and bone tenderness

According to laboratory low Ca, 21 participants had laboratory report showed low Ca, and 79 participants did not have one. For those 21 participants whom had the laboratory report, 7 of them had tetany represented (33.3%) and 6 (28.6%) had bone deformity, according to 79 participants who did not have laboratory data no one had tetany or bone deformity, there was statistically significant association between Laboratory low Ca and both tetany and bone deformity (p<0.001)

According to laboratory low hemoglobin, 25 participants had laboratory report showed low iron, and 75 participants did not have one. For those 25 participants whom had the laboratory report, 15of them had spooning nail and 2 (8%) had cheilosis, from 75 participants who did not have laboratory data 10 did not have spooning nail and 7 (9.3%) participants had cheilosis, there was statistically significant association between Laboratory low Hb and spooning nail (p<0.001), and there was no statistically significant association between Laboratory low iron and cheilosis.

**Table (5):** showed regression relationship between nutritional deficiency signs and chronic diseases of patients. Multivariate analysis showed significant associations between skin rash in sun-exposed areas with hepatic diseases (p = 0.04), spooning of nails with renal disease (p = 0.06) and impaired night vision with cardiac disease (p = 0.04), diabetes mellitus with impaired night vision (p = 0.001), and with paresthesia (p = 0.01), rheumatic diseases with bone deformities (p = 0.01), bone tenderness (p = 0.00), and with diarrhea (p = 0.00).

**Discussion:**

The present study was conducted on elderly participants, where **their** ages ranged from 65 to 75 years and the age mean was (68.83±2.44) years, 53% of them were males, (56%) lived in downtown, (40%) had low education, (48%) married, (57%) pensioners, (76%) had enough income and (83%) lived with their families. Regarding BMI, 53% of the participants were overweight, (19%) were obese, (17%) were normal, and only (11%) were underweight, there was an agreement with **Estrella, C., et al,** (26), who studied 395 Mexican elderly participants and report that most of the participants were in overweight and obesity zone. While disagreed with the study of **Sheau k., et al, (27)**, in that (32%) of the participants were normal weight, This result can be interpreted as different in terms of the study population, culture, and nutritional habits. (table1)

The subjects of the study were divided according to subjective global assessment (SGA) of nutritional status into (35%) well-nourished, (49%) mild to moderate malnutrition, and severe malnutrition (16%), in a study by **Vasantha J., et al, (28),** the participants divided into (3%) well-nourished, (90.9%) mild to moderate malnutrition, and severe malnutrition was (6.06%), that result was in agreement with degree of nutrition status the present study as the most of participants were mild to moderate malnutrition. And in the study of **Chandrashish C., et al, (29),** the elderly participants according to SGA were (60.4%) well-nourished, (39.4%) mild to moderate malnutrition, and severe malnutrition was only (0.2%), which result did not agree with the present study, that also could be explained by racial factors and or nutritional habits.

The present study demonstrated variable percentages of nutritional deficiency symptoms and signs of elderly patients, according to symptoms and signs of skin, there was (29%) had skin rash which indicates a deficiency of multi-vitamins, zinc, or essential fatty acids, and regarding hair and nail symptoms and signs there were (75%) had hair changes may be due to protein deficiency, and (15%) had Spooning of nails may be due to deficiency of iron. As regard to eye symptoms and signs, (37%) had impaired night vision which indicates vitamin A deficiency, and according to symptoms and signs of mouth, (9%) had glossitis which may be due to deficiency of riboflavin also or niacin, pyridoxine, and iron. When comparing these results with results of previous research about nutritional deficiency manifestations in rheumatic diseases of different ages out of 284 rheumatic patients, there were (15.8%) had skin rash which indicates a malnutrition form, and According to hair and nail symptoms and signs there were (29.6%) had hair changes, and (9.2%) had Spooning of nails. These results were in disagreement with the present study. In the previous study (13.4%) had impaired night vision, and according to symptoms and signs of mouth, (16.9%) had glossitis **(30)**.

Assessment of neurologic nutritional symptoms and signs in this study, there are (14%) had paresthesia or numbness in a stocking-glove distribution, (21%) had cognitive impairment symptoms and sensory deficits, (21%) had dementia which may due to deficiency of niacin, pyridoxine, vitamin B12 also, and (7%) had Tetany which is a symptom of Ca and Mg deficiency. However, those results disagreed with the results of **Beran, R., et al, (31)**, as it showed that 88.9%, 82.5%, and 89.7% of participants had symptoms were pain, numbness, and paresthesia respectively.

Diarrhea is considered a symptom nutritional deficiency and a cause in the same time of malnutrition through a reduction in food intake, decrease in absorption, and

increase in the rate of catabolism of nutritional reserves. Regarding GIT symptoms in the present study, (15%) had diarrhea as a possible symptom of deficiency of Protein, niacin, folate, vitamin B12, or zinc. while was (12.7%) in the study of **Purty, A.et al, (32)**, (table2).

In the present study, the distribution of 100 participants regarding chronic diseases and SGA were distributed as follows; well-nourished elderly (n=36) according to SGA distributed as, (48.6%) had hypertension, (28.6%) were hepatic patients, (22%) had diabetes millets, (5.7%) were cardiac patients, (2.9%) had Rheumatic disease, and there was no well-nourished participant had renal disease. According to mild to moderate malnourished elderly (n=49), there were (59.2%) hepatic patients, (42.9%) had diabetes mellitus, (42.9%) had hypertension, (20.4%) had the rheumatic disease, (20.4%) had renal disease, and (18.4%) cardiac patients.

In the present study, **diabetic participants** (39%) had significant relation with **malnutrition** according to SGA (P=0.020). as represented (20.5%) were well nourished, (53.8%) of mild to moderate malnutrition, (25.6%) had severe malnutrition. However, in the study of **Chandrashish C., et al, (29)**, the distribution of 39 diabetic elderly participants (out of 100) according to SGA was (52%) was well nourished, (48%) of mild to moderate malnutrition, and no one had severe malnutrition. Almost the same result for mild to moderate but there was no agreement according to other types of SGA.

In the present study, hypertension among participants was (43%), which had no statistical significance with nutrition**al** status according to SGA. as represented (39.5%) were well nourished, (48.8%) of mild to moderate malnutrition, (11.6%) had severe malnutrition. On the other hand, in the study of **Chandrashish C., et al, (29)**,

the distribution of 140 hypertensive elderly participants according to SGA was (59%) was well nourished, (41%) of mild to moderate malnutrition, and no one had severe malnutrition. the result for mild to moderate was near to the present study but there was no agreement according to other types of SGA, the difference in the study sampling could explain this difference.

In our study, participants with renal disorders (13%) had statistical significant with **malnutrition** according to SGA (P=0.018). as represented (by 76.9%) of mild to moderate malnutrition, (23.1%) had severe malnutrition, and there was no one had well-nourished according to SGA score. But in the study by I**van R., et al, (33)**, the distribution of a total number of 52 patients with renal diseases according to SGA was (53.9%) mild to moderate malnutrition, (11.5%) had severe malnutrition, and (34.6%) had well nourished. While in the study of **Chandrashish C., et al, (29)**, the distribution of 31 renal diseases **( out of 500)** elderly participants according to SGA was (48%) were well nourished, (52%) had mild to moderate malnutrition, and the result was extremely different with the result of the present study, the difference in the study sampling could explain this difference

Cardiac patients, who were (13%) had no statistical significance with nutrition status according to SGA (P=0.235). as represented (69.2%) of mild to moderate malnutrition, (15.4%) had severe malnutrition, and 15.4 of patients are well-nourished. However Yamauti AK., et al study conducted on 160 cardiac elderly patients showed that malnutrition prevalence is 51.9% by SGA.

According to laboratory low vitamin D, only 9 participants had laboratory reports showing low vitamin D below 20 ng/mL. Of those 9 participants who had the laboratory report, 6 of them had bone tenderness

represented (66.7%), from 91 participants who did not have laboratory data 43 (47.3%) had bone tenderness, and there was no statistically significant association between Laboratory low vitamin D and bone tenderness. But it was different in the study of **Heidari, B., et al, (35)**, in patients with non-specific bone tenderness there was a significantly positive association between low vitamin D and bone tenderness (P=0.0001), Differences in environment , climate  and lifestyle could account for these differences.

Another symptom of low vitamin D is a bone deformity, For those 9 participants who had the laboratory report, 5 (55.6%) had a bone deformity ( **muscle weakness that could cause slight bow legs)** , and from 91 participants who did not have laboratory data just one participant (1.1%) had a bone deformity, there was a statistically significant association between Laboratory low vitamin D and bone deformity (p<0.001).

According to laboratory low Ca, 21 participants had laboratory reports showing low Ca, and 79 participants did not have one. Of those 21 participants who had the laboratory report, 7 of them had tetany represented (33.3%), according to 79 participants who did not have laboratory data no one had tetany, there was a statistically significant association between Laboratory low Ca and both tetany and bone deformity (p<0.001). this result was in agreement with a previous study , which had statistically significant (p<0.001) according to tetany in 284 rheumatic patients **(table4).**

The present study showed statistically significant associations between skin rash in sun-exposed areas with hepatic diseases (p = 0.04), and in the study of **Bansal, S., et al, (36)**, also the skin rash in sun-exposed areas was significantly higher in hepatic disease (49.1%). In patients with diabetes mellitus, there was impaired night vision (p = 0.001), and paresthesia (p = 0.01), which was in agreement with **Beran, R., et al, (31)**, as the

paresthesia was the most presented symptom in the diabetic elderly population.  For patients with rheumatic diseases, the statistically significant was with bone deformities (p = 0.01). In a previous study of nutritional deficiency of rheumatic patients, they had significant associations with skin rash (p=0.016) and tetany (p<0.001) **(30).**

**Limitations**

Various nutrient deficiencies may share common presentation features with other medical diseases and might cause confusion in interpretation. As regard lab. Of vit. D & calcium number of patients is small to correlate wisely with physical findings. Multivariant analysis is needed to detect which different chronic disease is most close to score of malnutrition among elderly.

**Conclusion**

Thinning or loss of hair, corneal dryness and clouding, Bleeding gum, Easy bruising and Bone tenderness ate the most common nutritional deficiency manifestations among elderly **(100 participants)**. Assessment of participants' nutritional status revealed that (35%) of them were well-nourished, (49%) had mild to moderate malnutrition, and was (16% had severe malnutrition. Malnutrition was more prevalent in the elderly with diabetes, hepatic, renal, or rheumatic disease than elderly with HTN or cardiac disease. Skin rash in sun-exposed areas was more prevalent hepatic diseases, Spooning of nails was prevalent in renal disease, Impaired night vision was significant in cardiac disease, night vision and paresthesia were more among diabetics,  bone deformities, bone tenderness were more in elderly with rheumatic disorder .

**Recommendations**

We recommend that: Implementing and disseminating an educational program for elderly people about essential nutrition for healthy aging. Conduct large-scale studies and multicenter ones to evaluate the role of (SGA) in elderly people. Collecting

laboratory data from all participants and comparing these data with the clinical one to help in the early prediction and treatment of nutrition defections. Use the new modified (SGA) score and its sub-specialty according to the chronic disease. A distinctive history and clinical examination may prompt health professionals to consider nutritional causes and help differentiate a nutrient deficiency from other medical conditions, making it important to recognize nutritional disorders so that appropriate treatment can reverse symptoms and prevent irreversible sequel.

**Abbreviations**

Ca, Calcium, Vit D, Vitamin D, CBC, A complete blood count; PT, Prothrombin Time, INR, DM: Diabetes Miletus, HTN: Hypertension, RhP: Rheumatic patient, HP: Hepatic patient, RP: Renal patient, CP: Cardiac patient.

**Conflict of Interest**

No conflict of interest, the researchers had, and no external funds for the study.

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**Table 1: Demographic data for participant's elderly.**

| Variable | Frequency | Percent |
|---|---|---|
| **Age (year)** | | |
| Min.-Max. | 65-75 | |
| Mean ±SD | 68.83±2.44 | |
| **Gender** | | |
| Male | 53 | 53.0 |
| Female | 47 | 47.0 |
| **BMI** | | |
| Underweight | 11 | 11.0 |
| Normal | 17 | 17.0 |
| Overweight | 53 | 53.0 |
| Obese | 19 | 19.0 |
| **Residence** | | |
| Urban | 44 | 44.0 |
| Downtown | 56 | 56.0 |
| **Education** | | |
| Illiteracy | 33 | 33.0 |
| Lower education | 40 | 40.0 |
| Higher education | 27 | 27.0 |
| **Marital status** | | |
| Married | 48 | 48.0 |
| Divorced | 6 | 6.0 |
| Widow | 37 | 37.0 |
| Single | 9 | 9.0 |
| **Work type** | | |
| Heavy physical labor | 7 | 7.0 |
| Light physical labor | 21 | 21.0 |
| Mental labor | 15 | 15.0 |
| Pensioner | 57 | 57.0 |
| **Income** | | |
| Enough | 76 | 76.0 |
| Not enough | 12 | 12.0 |
| High ( more than enough) | 12 | 12.0 |
| **Living** | | |
| Alone | 17 | 17.0 |
| With family | 83 | 83.0 |

**Figure 1: Distribution of participants according to subjective global assessment (SGA).**
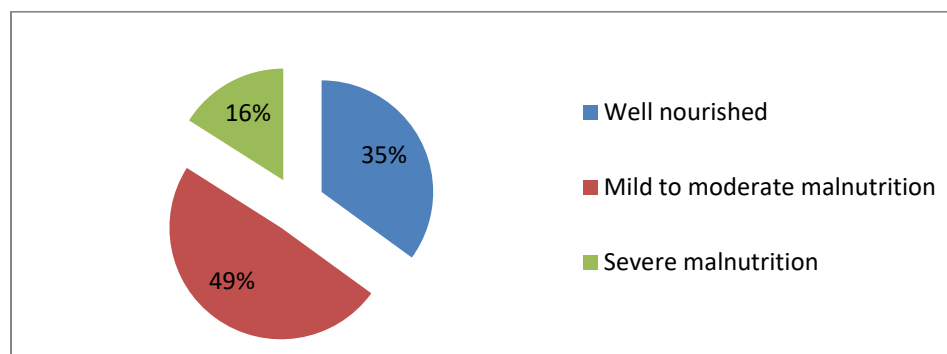
**Table 2: Frequency of Symptoms and signs of nutritional deficiency among elderly.**

| Type of nutritional Deficiency | Area/System | Symptom or Sign | Frequency | Percent |
|---|---|---|---|---|
| Many vitamins, zinc essential fatty acids | Skin | Rash | 29 | 29% |
| Niacin (pellagra) | | Rash in sun-exposed areas | 25 | 25% |
| Vitamin C or K | | Easy bruising | 41 | 41% |
| Protein | Hair and nails | Thinning or loss of hair | 75 | 75% |
| Selenium | | Premature whitening of hair | 27 | 27% |
| Iron | | Spooning (up curling) of nails | 20 | 20% |
| Vitamin A | Eyes | Impaired night vision | 37 | 37% |
| Vitamin A | | Corneal keratomalacia (corneal drying and clouding) | 57 | 57% |
| Riboflavin, niacin, pyridoxine, iron | Mouth | Cheilosis and glossitis | 9 | 9% |
| Vitamin C, riboflavin | | Bleeding gums | 56 | 56% |
| Thiamin (beriberi) | Neurologic | Paresthesia or numbness in stocking-glove distribution | 14 | 14% |
| Ca, Mg | | Tetany | 7 | 7% |
| Thiamin, niacin, pyridoxine, vitamin $B_{12}$ | | Cognitive impairment **or** sensory deficits | 21 | 21% |
| Thiamin, niacin, vitamin $B_{12}$ | | Dementia symptoms | 23 | 23% |
| Vitamin D, Ca | Musculoskeletal | Bone deformities (e.g., bowlegs, knocked knees, curved spine) | 6 | 6% |
| Vitamin D | | Bone tenderness | 49 | 49% |
| Protein, niacin, folate, vitamin $B_{12}$ Zinc | Gastrointestinal | Diarrhea | 15 | 15% |

**Table (3): Chronic diseases and nutritional status according to SGA.**

| Chronic diseases | | Nutritional status | | | Total | X$^2$ | P-value |
|---|---|---|---|---|---|---|---|
| | | Well nour-ished (no=35) | Mild to moderate malnutrition (no=49) | Severe malnutri-tion (no=16) | | | |
| Diabetes Miletus | N | 8 | 21 | 10 | 39 | 7.854 | 0.020* |
| | % | 22.9% | 42.9% | 62.5% | 39.0% | | |
| Hypertension | N | 17 | 21 | 5 | 43 | 1.345 | 0.510 |
| | % | 48.6% | 42.9% | 31.3% | 43.0% | | |
| Rheumatic patient | N | 1 | 10 | 6 | 17 | 10.13 | 0.006* |
| | % | 2.9% | 20.4% | 37.5% | 17.0% | | |
| Hepatic patient | N | 10 | 29 | 9 | 48 | 8.185 | 0.017* |
| | % | 28.6% | 59.2% | 56.3% | 48.0% | | |
| Renal patient | N | 0 | 10 | 3 | 13 | 8.075 | 0.018* |
| | % | 0.0% | 20.4% | 18.8% | 13.0% | | |
| Cardiac patient | N | 2 | 9 | 2 | 13 | 2.894 | 0.235 |
| | % | 5.7% | 18.4% | 12.5% | 13.0% | | |

A P-value of < 0.05 was considered statistically significant &<0.001 for highly significant

**Table (4): Association between laboratory data of vitamin D, Ca, and iron deficiency and its signs and symptoms.**

| Lab low vit D | | Present (n=9) | | Lab not present (n=91) | | Total | | $X^2$ | P-value |
|---|---|---|---|---|---|---|---|---|---|
| | | N | % | N | % | N | % | | |
| **Bone tenderness** | Present | 6 | 66.7% | 43 | 47.3% | 49 | 49.0% | 1.235 | 0.266 |
| | Absent | 3 | 33.3% | 48 | 52.7% | 51 | 51.0% | | |
| **Bone deformity** | Present | 5 | 55.6% | 1 | 1.1% | 6 | 6.0% | 43.06 | <0.001** |
| | Absent | 4 | 44.4% | 90 | 98.9% | 94 | 94.0% | | |
| **Lab low Ca** | | Present (n=21) | | Lab not present (n=79) | | Total | | $X^2$ | P-value |
| | | N | % | N | % | N | % | | |
| **Tetany** | Present | 7 | 33.3% | 0 | 0.0% | 7 | 7.0% | 28.03 | <0.001** |
| | Absent | 14 | 66.7% | 79 | 100.0% | 93 | 93.0% | | |
| **Bone deformity** | Present | 6 | 28.6% | 0 | 0.0% | 6 | 6.0% | 24.01 | <0.001** |
| | Absent | 15 | 71.4% | 79 | 100.0% | 94 | 94.0% | | |
| **Lab low Hb** | | Present (n=25) | | Lab not present (n=75) | | Total | | $X^2$ | P-value |
| | | N | % | N | % | N | % | | |
| **Spooning nail** | Present | 15 | 60.0% | 5 | 5.0% | 20 | 20.0% | 100 | <0.001** |
| | Absent | 10 | 40.0% | 70 | 95.0% | 80 | 80.0% | | |
| **Cheilosis** | Present | 2 | 8.0% | 7 | 9.3% | 9 | 9.0% | 0.041 | 0.843 |
| | Absent | 23 | 92.0% | 68 | 90.7% | 91 | 91.0% | | |

Hb: hemoglobin, Ca: calcium

A P-value of < 0.05 was considered statistically significant &<0.001 for highly significant

**Number of participants with available lab. Is small**

**Table (5): Regression of the relationship between nutritional deficiency signs ( & symptoms) and chronic diseases of patients.**

| Symptom or Sign | Chronic disease | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | DM | | HTN | | Rheumatic | | Hepatic | | Renal | | Cardiac | |
| | B | P | B | P | β | P | β | P | β | P | β | P |
| Rash | 0.54 | 0.22 | 0.52 | 0.20 | 0.47 | 0.28 | 0.75 | 0.54 | 1.07 | 0.93 | 0.70 | 0.69 |
| Rash in sun-exposed areas | 0.69 | 0.49 | 1.52 | 0.42 | 0.28 | 0.12 | **2.86** | **0.04*** | 1.47 | 0.62 | 0.47 | 0.39 |
| Easy bruising | 1.23 | 0.64 | 1.39 | 0.47 | 0.70 | 0.52 | 1.33 | 0.50 | 1.41 | 0.58 | 0.70 | 0.60 |
| Thinning or loss of hair | 0.69 | 0.45 | 1.64 | 0.35 | 0.75 | 0.64 | 1.60 | 0.33 | 0.95 | 0.94 | 1.69 | 0.56 |
| Premature whitening or **greying** of hair | 0.85 | 0.75 | 1.17 | 0.75 | 0.49 | 0.31 | 1.92 | 0.17 | 0.55 | 0.48 | 0.42 | 0.32 |
| Spooning of nails | 1.01 | 0.98 | 1.58 | 0.38 | 2.33 | 0.15 | 1.61 | 0.34 | **3.57** | **0.06*** | 0.42 | 0.33 |
| Impaired night vision | **0.40** | **0.06*** | 0.60 | 0.30 | 1.03 | 0.96 | 0.75 | 0.52 | 1.17 | 0.52 | **4.30** | **0.04*** |
| Corneal keratomalacia **(cloudy and soft cornea)** | 1.03 | 0.95 | 0.58 | 0.22 | 0.69 | 0.50 | 1.67 | 0.23 | 1.23 | 0.75 | 0.82 | 0.77 |
| Cheilosis and glossitis | 1.37 | 0.68 | 1.29 | 0.74 | 0.56 | 0.61 | 1.30 | 0.71 | 0.00 | 1.00 | 1.58 | 0.64 |
| Bleeding gums | 0.76 | 0.53 | 1.41 | 0.45 | 0.84 | 0.76 | 1.26 | 0.57 | 1.51 | 0.51 | 0.59 | 0.43 |
| Paresthesia | **6.57** | **0.01*** | 0.61 | 0.51 | 0.68 | 0.66 | 0.81 | 0.73 | 1.50 | 0.62 | 2.91 | 0.23 |
| **Tetany ??** | 0.86 | 0.91 | 1.26 | 0.85 | 00.0 | 1.00 | 0.79 | 0.85 | 0.46 | 0.61 | 00.0 | 1.00 |
| **Cognitive ??** and sensory deficits | 2.02 | 0.19 | 0.61 | 0.41 | 0.30 | 0.42 | 0.59 | 0.32 | 0.48 | 0.39 | 2.87 | 0.17 |
| **Dementia ??** | 1.88 | 0.22 | 0.52 | 0.26 | 0.91 | 0.88 | 1.20 | 0.71 | 0.49 | 0.39 | 2.81 | 0.17 |
| Bone deformities | 1.38 | 0.55 | 1.08 | 0.90 | **5.39** | **0.01*** | 0.75 | 0.59 | 0.47 | 0.38 | 0.21 | 0.19 |
| Bone tenderness | 1.28 | 0.83 | 0.39 | 0.47 | **40.5** | **0.00**** | 0.75 | 0.80 | 0.00 | 1.00 | 0.00 | 1.00 |
| Diarrhea | 1.67 | 0.58 | 0.56 | 0.56 | **30.2** | **0.00**** | 2.22 | 0.39 | 0.44 | 0.54 | 0.00 | 1.00 |

**DM:** Diabetes Miletus, **HTN:** Hypertension,
**P:** P-value **\*:** P-value≤0.05 **\*\*:** P-value≤0.001