



**International Journal of Biology, Pharmacy
and Allied Sciences (IJBPA)**
'A Bridge Between Laboratory and Reader'

www.ijbpas.com

A CROSS-SECTIONAL STUDY ON THE IMPACT OF MALNUTRITION IN THE ADULT POPULATION AND ITS OUTCOMES

CHINNI VP RAO^{*1}, SYED R¹, CHIRALA V¹, SYED NS¹, GONEPALLI S¹, GUNTURU
V¹, SREENU T² AND PUTTAGUNTA SB³

1: Department of Pharmacy Practice, Vignan Pharmacy College (Autonomous), Vadlamudi,
Guntur, Andhra Pradesh, India

2: Department of Pharmacology, Vignan Pharmacy College (Autonomous), Vadlamudi,
Guntur, Andhra Pradesh, India

3: Department of Pharmaceutics, Vignan Pharmacy College (Autonomous), Vadlamudi,
Guntur, Andhra Pradesh, India

***Corresponding Author: Dr. Chinni Venkata Prasada Rao: E Mail: saichinni2003@gmail.com**

Received 25th June 2025; Revised 6th Aug. 2025; Accepted 26th Oct. 2025; Available online 1st Aug. 2026

<https://doi.org/10.31032/IJBPA/2026/15.8.10219>

ABSTRACT

Background: A cross-sectional study was conducted over six months at Vignan Pharmacy College to evaluate the prevalence and consequences of malnutrition in the adult population. A total of 1,688 participants were enrolled, comprising 1,346 online and 342 offline respondents. The inclusion criteria were adults aged 18–30 years of either sex who were able to provide informed consent. Exclusion criteria included individuals with severe cognitive impairments preventing consent and those with terminal illnesses where nutritional status was not a significant prognostic factor.

Results: The study revealed that symptoms of malnutrition were highly prevalent among the participants. The most commonly reported issues were exhaustion (72.4%), weakness (65.1%), loss of appetite (45.3%), and unintentional weight loss (59.8%). Nutritional deficiencies were also widespread, with iron deficiency anemia being the most common (30.7%), followed by vitamin D deficiency (22.1%), protein-energy malnutrition (18.5%), and chronic fatigue syndrome (16.2%). Various treatment methods were employed to address malnutrition, including nutritional supplements (45.8%), dietary modifications (25.2%), and nutritional counselling (38.6%). Among these, supplementation emerged as the most effective intervention, with 68.4% of individuals who received supplements reporting significant improvement in their condition.

Conclusion: This study demonstrates that malnutrition is a notable health concern among adults aged 18–30. Fatigue, weakness, and key nutrient deficiencies especially iron and vitamin D were the most prevalent outcomes. While supplementation showed promising results, further research is required to evaluate the long-term effectiveness of treatment options and better understand the association between malnutrition and chronic illnesses.

Keywords: Undernutrition, overnutrition, micronutrient, macronutrient, chronic malnutrition

INTRODUCTION

The World Health Organization (WHO) defines malnutrition as an imbalance of vital nutrients, an excess or deficiency in nutritional intake, or poor nutrient utilization. Undernutrition, overweight, obesity, and noncommunicable diseases linked to diet make up the double burden of malnutrition. Underweight, stunting, wasting, and micronutrient deficits are the four main ways that undernutrition presents itself. A shortage of vitamins and minerals that are necessary for bodily processes like the synthesis of hormones, enzymes, and other materials required for growth and development is known as a micronutrient deficiency [1].

Causes of Micronutrient Malnutrition

- **Inadequate dietary intake:** Lack of access to nutrient-dense foods (fruits, vegetables, whole grains, dairy, etc.) or poor dietary diversity.
- **Increased nutritional needs:** Pregnancy, lactation, or periods of rapid growth (e.g., childhood) can increase the body's requirements for micronutrients.

- **Poor absorption:** Conditions like celiac disease, Crohn's disease, or gastrointestinal surgery can impair the absorption of vitamins and minerals.
- **Chronic illness:** Conditions such as diabetes, cancer, or chronic infections can increase the body's needs for micronutrients and interfere with their absorption or utilization [2].

Malnutrition Screening and Assessment in Adults

Nutritional Risk Screening 2002 (NRS-2002) for hospitalized patients, the Malnutrition Universal Screening Tool (MUST) for the community, and the first section of the Mini Nutritional Screening Tool are all widely advised by the European Society of Parenteral and Enteral Nutrition (ESPEN) for the older population (MNA-SF). Adult malnutrition is measured by evaluating both undernutrition and overnutrition since malnutrition includes a broad range of nutritional imbalances [3].

Treatment

WHO and UNICEF continue to recommend broad-spectrum oral

antibiotics for uncomplicated SAM, since the majority of SAM therapy is now provided in an outpatient setting. Although there is little evidence to support this, intravenous treatment followed by oral therapy-including a lengthy course of an aminoglycoside-is advised for complex SAM. The expense and logistical issues of empirical antimicrobial treatment, as well as the potential side effects, are of global concern, as is the rise in antibiotic resistance. Several epidemiological studies have reported high rates of non-susceptibility to first- and second-line therapies in children with SAM. The necessity of a regular course of oral antibiotics in children with uncomplicated SAM has also been questioned, with some clinics with limited resources opting not to prioritize their administration [[4]].

MATERIALS AND METHODS

Materials used

Subject or Individual Informed Consent Form, Data collection form/Google form.

Methodology

Source of data: Data were collected from the population in Vignan University, Vignan Pharmacy College & Vignan Lara in Vadlamudi.

Study Design: Cross Sectional Study

Study site: Vignan University, Vignan Pharmacy College, Vignan Lara in Vadlamudi and Online Platforms.

Study duration: The study was carried out for a period of 6 months (JUL 2024 – DEC 2025).

Sample Size: A total of 1688 volunteers who fulfilled the inclusion and exclusion criteria were selected for the study.

Study criteria

Inclusion criteria

Subjects who are willing to participate in the study, young population in Vignan University, Vignan Pharmacy College & Vignan Lara in Vadlamudi and subjects who understand the language, age above 18 Years, either sex.

Exclusion criteria

Age < 18years and who is not willing to participate in this study, Individuals with severe cognitive impairments that prevent informed consent, those with terminal illnesses where the prognosis is not significantly influenced by nutritional status.

Study procedure

The study was conducted through online and offline data after obtaining ethical clearance from the Institutional Ethical Committee. All the data under the inclusion criteria are included and assessed.

The data collection form designed by the need of subject demographic details and their physical examination and nutritional intake will be designed by using standard

textbooks, journals, and websites and by other relevant sources.

RESULTS & DISCUSSION

Depicts the information about the number of subjects answered each question from the given questionnaire and their total number of responses given for each option which indicates their score as per their response and along with the percentage of the responses occurred is mentioned in the given below

Table 1: Age Vs No of Subjects

Age	No. of subjects	Percentage	Mean $\pm$ SD
18-22	1051	78.08%	21.05 $\pm$ 2.39
23-27	265	19.68%	
28-32	30	2.22%	

Depicts the information regarding the distribution of study subjects within the age groups of 18 years to 32 years. Majority of the subjects were found within the age of 18 – 22 years 1051(78.08%), followed by 23 – 27 years 265(19.68%), 28 – 32 years 30(2.22%). According to the above data, the observed mean is approximately 21.05, the standard deviation is approximately 2.39, and the data is significant [[4]].

Table 2: Gender Vs No of subjects

Gender	No. of subjects	Percentage	Mean $\pm$ SD
Male	725	53.9%	0.539 $\pm$ 0.498
Female	620	46.1%	

Depicts the information regarding gender distribution among the study population, under which the participated male subjects were 725 (53.9%) and female subjects were

620 (46.1%). According to the above data, the observed mean is approximately 0.539, the standard deviation is approximately 0.498, and the data is significant [4].

Table 3: Individual no of responses for each question

Weight (in kgs)	No. of subjects	Percentage	Mean $\pm$ SD
25 -35	9	0.66%	62.06 $\pm$ 12.99
36-45	159	159(11.81%)	
46-55	413	413(30.68%)	
56-65	365	365(27.11%)	
66-75	243	243(18.05%)	
76-85	111	111(8.24%)	
86-95	32	32(2.37%)	
96-105	9	9(0.66%)	
106-116	5	5(0.37%)	

Depicts the information regarding the distribution of study subjects within the weight groups of 25 kgs to 116 kgs. Majority of the subjects were found within the weight groups of 46 - 55 (30.68%), followed by 25 -35 9(0.66%), 36-45 159(11.81%), 56-65 365(27.11%), 66-75 243(18.05%), 76-85 111(8.24%), 86-95 32(2.37%), 96-105 9(0.66%), 106-116 5(0.37%). According to the above data, the observed mean is approximately 62.06, the standard deviation is approximately 12.99, and the data is significant. [5]

Table 4: Individual no of responses for each question

Height (in CMS)	No. of subjects	Percentage	Mean $\pm$ SD
110-120	5	0.37%	133.9 $\pm$ 31.1
130-140	6	0.44%	
141-150	263	19.53%	
151-160	559	41.53%	
161-170	286	21.24%	
171-180	192	14.26%	
181-190	34	2.52%	

Depicts the information regarding the distribution of study subjects within the

height groups of 110 cms to 190 cms. Majority of the subjects were found within the height groups of 151-160 (41.53%), followed by 110-120 5(0.37%), 130-140 6(0.44%), 141-150 263(19.53%), 161-170 286(21.24%), 171-180 192(14.26%), 181-190 34(2.52%). According to the above data, the observed mean is approximately 133.9, the standard deviation is approximately 31.1, and the data is significant [6].

Table 5: Individual no of responses for each question

BMI Category	BMI Range	No. of Individuals	Mean $\pm$ SD
Severe Thinness	< 16	22(1.63%)	26.31 $\pm$ 9.53
Moderate Thinness	16 - 17	25(1.85%)	
Mild Thinness	17 - 18.5	97(7.20%)	
Normal	18.5 - 25	792(58.84%)	
Overweight	25 - 30	277(20.57%)	
Obese Class I	30 - 35	107(78.67%)	
Obese Class II	35 - 40	19(1.41%)	7(0.52%)
Obese Class III	> 40	7(0.52%)	

Depicts the information regarding the distribution of study subjects within the BMI ranges of less than 16 to greater than 40. Majority of the subjects were found within the BMI ranges of 30-35 (78.67%) with obese class I, followed by < 16. 22(1.63%) with severe thinness, 16-17.25(1.85%) with moderate thinness, 17-18.5 97(7.20%), 18.5-25 792(58.84%) with normal BMI, 25-30.277(20.57%) with Overweight, 35-40.19(1.41%) with Obese Class II, > 40. 7(0.52%) with Obese Class III. According to the above data, the observed mean is approximately 26.31, the

standard deviation is approximately 9.53 [7].

Table 6: Individual no of responses for each question

Have you experienced difficulty seeing in low light or at night?	No. of subjects	Percentage	Mean $\pm$ SD
Yes, frequently	221	16.4%	0.50 $\pm$ 0.76
Yes, occasionally	232	17.2%	
No	892	66.3%	

Depicts the information regarding the distribution of study subjects that have experienced difficulty seeing in low light or at night. The percentage of study subjects experiencing difficulty seeing in low light or night are Yes, frequently 221(16.4%); Yes, occasionally 232(17.2%); and the study subjects not experiencing difficulty in low light or night are No 892(66.3%). According to the above data, the observed mean is approximately 0.50, the standard deviation is approximately 0.76, and the data is significant [8].

Table 7: Individual no of responses for each question

Have you noticed any redness or dryness in your eyes?	No. of subjects	Percentage	Mean $\pm$ SD
Yes	358	26.6%	0.266 $\pm$ 0.0121
No	987	73.4%	

Depicts the information regarding the distribution of study subjects that have noticed any redness or dryness in your eyes. The percentage of study subjects who noticed any redness or dryness in their eyes is Yes 358 (26.6%), and study subjects who did not notice any redness or dryness in their eyes are No 987 (73.4%). According to the above data, the observed mean is

approximately 0.266, the standard deviation is approximately 0.0121, and the data is significant [9].

Table 8: Individual no of responses for each question

How would you describe your hair condition?	No. of subjects	Percentage	Mean±SD
Healthy	343	25.5%	1.54 ± 1.19
Thinning	375	27.9%	
Brittle	186	13.8%	
Falling out	441	32.8%	

Depicts the information regarding the distribution of study subjects that describe the hair condition. The percentage of study subjects who have Healthy hair condition are 343(25.5%), Thinning hair condition are 375(27.9%), Brittle hair condition are 186(13.8%) and majority of subjects experiencing Falling out hair condition are 441(32.8%). According to the above data, the observed mean is approximately 1.54, the standard deviation is approximately 1.19, and the data is significant [10].

Table 9: Individual no of responses for each question

Is your scalp:	No. of subjects	Percentage	Mean ± SD
Healthy	504	37.5%	1.01 ± 0.99
Dry	470	34.9%	
Flaky	222	16.5%	
Itchy	149	11.1%	

Depicts the information regarding the distribution of study subjects based on the condition of their scalp; 504 (37.5%) subjects describe their scalp as healthy, without any noticeable issues. 470 (34.9%) subjects describe their scalp as dry, which may be associated with flakiness or discomfort. 222 (16.5%) subjects experience flakiness on their scalp, potentially due to dandruff or other

conditions. 149 (11.1%) subjects report experiencing itching on their scalp, possibly due to dryness, irritation, or other scalp conditions. According to the above data, the observed mean is approximately 1.01, the standard deviation is approximately 0.99, and the data is significant [10].

Table 10: Individual no of responses for each question

Have you observed any areas of hyperpigmentation (dark spots) on your skin?	No. of subjects	Percentage	Mean ± SD
Yes	509	37.8%	0.378 ± 0.0132
No	836	62.2%	

Depicts the information regarding the distribution of study subjects based on whether they have observed any areas of hyperpigmentation (dark spots) on their skin. 509 (37.8%) subjects have observed hyperpigmentation on their skin, and 836 (62.2%) subjects have not observed any areas of hyperpigmentation (dark spots) on their skin. According to the above data, the observed mean is approximately 0.378, the standard deviation is approximately 0.0132, and the data is significant [11].

Table 11: Individual no of responses for each question

Have you noticed any areas of hypopigmentation (light spots) on your skin?	No. of subjects	Percentage	Mean ± SD
Yes	317	23.6%	0.236 ± 0.0116
No	1028	76.4%	

Depicts the information regarding the distribution of study subjects based on whether they have noticed any areas of hypopigmentation (light spots) on their

skin. 317 (23.6%) subjects have noticed areas of hypopigmentation (light spots) on their skin. 1028 (76.4%) subjects did not notice any areas of hypopigmentation (light spots) on their skin. According to the above data, the observed mean is approximately 0.236, the standard deviation is approximately 0.0116, and the data is significant [11].

Table 12: Individual no of responses for each question

Do you often notice a pale complexion on your face?	No. of subjects	Percentage	Mean $\pm$ SD
Yes	296	22%	0.220 $\pm$ 0.0113
No	1049	78%	

Depicts the information regarding the distribution of study subjects based on whether they often notice a pale complexion on their face; 296 (22%) of subjects frequently notice a pale complexion on their face. 1049 (78%) of subjects do not notice a pale complexion on their face. According to the above data, the observed mean is approximately 0.220, the standard deviation is approximately 0.0113, and the data is significant [12].

Table 13: Individual no of responses for each question

Have you had any rashes or lesions on your face?	No. of subjects	Percentage	Mean $\pm$ SD
Frequently	997	7.2%	1.72 $\pm$ 1.26
Occasionally	192	14.3%	
Rarely	490	36.4%	
Never	566	42.1%	

Depicts the information regarding the distribution of study subjects based on whether they have had any rashes or lesions on their face. 997 (7.2%) subjects

Frequently experienced rashes or lesions on their face regularly. 192 (14.3%) subjects Occasionally experienced rashes or lesions on their face from time to time. 490 (36.4%) subjects have rashes or lesions on their face infrequently. 566 (42.1%) subjects never experienced rashes or lesions on their face. According to the above data, the observed mean is approximately 1.72, the standard deviation is approximately 1.26, and the data is significant [13].

Table 14: Individual no of responses for each question

Do you experience soreness or pain in your mouth	No. of subjects	Percentage	Mean $\pm$ SD
Yes	297	22.1%	0.221 $\pm$ 0.0113
No	1048	77.9%	

Depicts the information regarding the distribution of study subjects based on whether they experience soreness or pain in their mouth; 297 (22.1%) subjects experienced soreness or pain in their mouth; 1048 (77.9%) subjects did not experience soreness or pain in their mouth. According to the above data, the observed mean is approximately 0.221, the standard deviation is approximately 0.0113, and the data is significant [14].

Table 15: Individual no of responses for each question

Are your lips:	No. of subjects	Percentage	Mean $\pm$ SD
Healthy	602	44.8%	2.27 $\pm$ 0.76
Dry	527	39.2%	
Cracked	197	14.6%	
Swollen	19	1.4%	

Depicts the information regarding the distribution of study subjects based on the

condition of their lips; 602 (44.8%) subjects report their lips as healthy, without any issues. 527 (39.2%) subjects described their lips as dry, possibly due to dehydration or environmental factors. 197 (14.6%) subjects whose lips are cracked, often due to dryness, chapping, or other factors. 19 (1.4%) subjects experience swelling in their lips, possibly due to inflammation or an allergic reaction. According to the above data, the observed mean is approximately 2.27, the standard deviation is approximately 0.76, and the data is significant [14].

Table 16: Individual no of responses for each question

Have you noticed any bleeding/swelling in gums?	No. of subjects	Percentage	Mean $\pm$ SD
Yes	249	18.5%	0.185
No	1096	81.5%	$\pm$ 0.0106

Depicts the information regarding the distribution of study subjects based on whether they have noticed any bleeding or swelling in their gums; 249 (18.5%) of patients who didn't notice any bleeding or edema in their gums reported bleeding or swelling. 1096 individuals (81.5%) reported no bleeding or swelling in their gums. According to the above data, the observed mean is approximately 0.185, the standard deviation is approximately 0.0106, and the data is significant [15].

Table 17: Individual no of responses for each question

How often do you feel muscle weakness?	No. of subjects	Percentage	Mean $\pm$ SD
Always	118	8.8%	0.777

Sometimes	809	60.1%	$\pm$ 0.591
Never	418	31.1%	

The data depicts the distribution of study subjects based on how frequently they suffer muscular weakness; 118 (8.8%) of these subjects experience muscle weakness on a consistent basis. 809 (60.1%) of the individuals experience muscle weakness on occasion or sporadically, while 418 (31.1%) do not experience muscle weakness. According to the above data, the observed mean is approximately 0.777, the standard deviation is approximately 0.591, and the data is significant [16].

Table 18: Individual no of responses for each question

Have you experienced joint pain in hands/legs?	No. of subjects	Percentage	Mean $\pm$ SD
Yes	582	43.3%	0.433 $\pm$
No	763	56.7%	0.0135

Depicts the information regarding the distribution of study subjects who experienced joint pain, hand pain, or leg pain. The percentage of study subjects who reported experiencing joint pain, hand pain, or leg pain is 582 (43.3%). And those who did not experience joint pain, hand pain, or leg pain are 763 (56.7%). According to the above data, the observed mean is approximately 0.433, the standard deviation is approximately 0.0135, and the data is significant [17].

Table 19: Individual no: of responses for each question

Do you have any abnormalities in your nails (e.g. discoloration, brittle, spoon shaped like)?	No. of subjects	Percentage	Mean $\pm$ SD
Yes	245	18.2%	0.182 $\pm$
No	1100	81.8%	0.0105

Depicts the information regarding the distribution of study subjects who experience any abnormalities in their nails (e.g., discoloration, brittleness, or a spoon-like shape), 245 (18.2%); the percentage or number of subjects who report having abnormalities in their nails, such as discoloration, brittleness, or a spoon-like shape, 1100 (81.8%) of subjects: those who do not report any abnormalities in their nails. According to the above data, the observed mean is approximately 0.182, the standard deviation is approximately 0.0105, and the data is significant [18].

Table 20: Individual no of responses for each question

How would you describe your toes?	No. of subjects	Percentage	Mean $\pm$ SD
Healthy	808	60.1%	2.28 $\pm$ 1.02
Cracked	242	18%	
Scaly	160	11.9%	
Both B & C	135	10%	

Depicts the information regarding the distribution of study subjects based on how they would describe their toes, whether the percentage or number of individuals who describe their toes as healthy are 808 (60.1%), subjects who report that their toes are cracked, possibly due to dryness or skin irritation, are 242 (18%). Subjects who describe their toes as having a scaly appearance, often associated with dry or flaking skin, are 160 (11.9%); subjects who report experiencing both cracked and scaly conditions on their toes are 135 (10%). According to the above data, the observed mean is approximately 2.28, the standard

deviation is approximately 1.02, and the data is significant [19].

Table 21: Individual no of responses for each question

Have you noticed any sores on your feet?	No. of subjects	Percentage	Mean $\pm$ SD
Yes	223	16.6%	0.166 $\pm$ 0.372
No	1122	83.4%	

Depicts the information regarding the distribution of study subjects who experienced or whether they noticed any sores on their feet; the percentage or number of individuals who noticed sores on their feet is 223 (16.6%), and the percentage or number of individuals who did not notice sores on their feet is 1122 (83.4%). According to the above data, the observed mean is approximately 0.166, the standard deviation is approximately 0.372, and the data is significant [20].

Table 22: Individual no of responses for each question

How often do you take a meal in a day?	No. of subjects	Percentage	Mean $\pm$ SD
1	110	8.2%	2.54 $\pm$ 0.834
2	562	41.8%	
3	543	40.4%	
4	102	7.6%	
5	28	2.1%	

Depicts the information regarding the distribution of study subjects How often do they take a meal in a day, 1 meal per day 110 (8.2%) of study subjects eat one meal a day. 2 meals per day 562 (41.8%) of study subjects consume two meals per day, 3 meals per day 543 (40.4%) of study subjects have three meals in a day, 4 meals per day. 102 (7.6%) of study subjects take four meals a day, 5 meals per day. 28

(2.1%) of study subjects eat five meals in a day. According to the above data, the observed mean is approximately 2.54, the standard deviation is approximately 0.834, and the data is significant [21].

Table 23: Individual no of responses for each question

How often do you eat a balanced diet?	No. of subjects	Percentage	Mean $\pm$ SD
Daily	318	23.6%	2.65 $\pm$ 0.94
Several times a week	364	27.1%	
Rarely	542	40.3%	
Never	121	9%	

Depicts the information regarding the distribution of study subjects eating a balanced diet. The majority of individuals (318, 23.6%) eat a balanced diet. 364 (27.1%) eat a balanced diet several times per week. 542 (40.3%) individuals rarely consume a balanced diet. And 121 (9%) individuals who never consume a balanced diet. According to the above data, the observed mean is approximately 2.65, the standard deviation is approximately 0.94, and the data is significant [21].

Table 24: Individual no of responses for each question

Do you take any dietary supplements?	No. of subjects	Percentage	Mean $\pm$ SD
Yes	194	14.3%	0.144 $\pm$ 0.351
No	1152	85.7%	

Depicts the information regarding the distribution of study subjects taking any dietary supplements. Yes, 193 (14.3%); No, 1152 (85.7%). According to the above data, the observed mean is approximately 0.144, the standard deviation is approximately 0.351, and the data is significant [23].

Table 25: Individual no of responses for each question

If YES, please mention the Dietary supplement (if NO, mention No)	No. of subjects	Percentage	Mean $\pm$ SD
Yes	226	16.79%	0.168 $\pm$ 0.373
No	1119	83.13%	

Depicts the information regarding the distribution of study subjects who have dietary supplements on a daily basis are **Yes** majority of individuals have Dietary supplement 226 (16.79%). **No** never consume Dietary supplements 1119 (83.13%). According to the above data, the observed mean is approximately 0.168, the standard deviation is approximately 0.373, and the data is significant [22].

Table 26: Individual no of responses for each question

How often do you experience fatigue or low energy?	No. of subjects	Percentage	Mean $\pm$ SD
Daily	140	0.4%	1.92 $\pm$ 0.954
Weekly	158	11.7%	
Occasionally	509	37.8%	
Rarely	539	40%	

Depicts the information regarding the distribution of study subjects experiencing fatigue or low energy. On a daily basis, 140 subjects (10.4%) felt exhaustion or poor energy. A weekly percentage of individuals who reported feeling exhausted or lacking energy was 158, or 11.7%. A total of 509 people (37.8%) reported feeling weary or having low energy sometimes. 538 people (40%) said they rarely felt tired or had low energy. According to the above data, the observed mean is approximately 1.92, the standard deviation is approximately 0.954, and the data is significant [23].

Table 27: Individual no of responses for each question

Have you sought medical advice for any of these symptoms?	No. of subjects	Percentage	Mean $\pm$ SD
Yes	306	22.8%	0.227 $\pm$ 0.419
No	1039	77.2%	

Depicts the information regarding the distribution of study subjects who sought medical advice for any of these symptoms among the study subjects. Those seeking medical attention were 306(22.8%) who did not seek medical advice for any of these symptoms; among the study subjects were 1039(77.2%). According to the above data, the observed mean is approximately 0.227, the standard deviation is approximately 0.419, and the data is significant [30].

Table 28: Gender Vs No of subjects

Gender	No. of subjects	Percentage	Mean $\pm$ SD
Male	87	25.43%	0.254 $\pm$ 0.436
Female	255	74.56%	

Depicts the information regarding gender distribution among the study population, under which the participated male subjects were 87(25.43%) and female subjects were 255(74.56%). According to the above data, the observed mean is approximately 0.254, the standard deviation is approximately 0.436, and the data is significant [4].

Table 29: Age Vs No of Subjects

Age	No. of subjects	Percentage	Mean $\pm$ SD
18-20	257	75.14%	20.03 $\pm$ 1.79
21-25	84	24.56%	
26-30	1	0.29%	

Depicts the information regarding the distribution of study subjects within the age groups of 18 years to 32 years. The majority of the subjects were found within the age of 18 – 20 years 257 (75.14%),

followed by 21 – 25 years 84(24.56%), 26-30 years 1(0.29%). According to the above data, the observed mean is approximately 0.254, the standard deviation is approximately 0.436, and the data is significant [4].

Table 30: BMI Categories

BMI	No. of subjects	Percentage	Mean $\pm$ SD
UNDER 18.5-This is described as underweight.	59	17.25%	2.21 $\pm$ 0.82
between 18.5 and 24.9 - This is described as the 'healthy range'.	184	53.08%	
between 25 and 29.9 - This is described as overweight	69	20.17%	
between 30 and 39.9- This is described as obesity	30	8.77%	
40 or over -This is described as severe obesity	0	0%	

Depicts the information regarding the distribution of study subjects in the Body Mass Index (BMI) categories among a total of 59 subjects 59(17.25%) fall into the underweight category BMI under 18.5, while the majority, 184 subjects (53.08%), are within the healthy range BMI between 18.5 and 24.9. Additionally, 69 subjects (20.17%) are classified as overweight BMI between 25 and 29.9, and 30 subjects (8.77%) fall under the obesity category BMI between 30 and 39.9. Notably, no subjects (0%) are classified as severely obese BMI 40 or over. According to the above data, the observed mean is approximately 2.21, the standard deviation

is approximately 0.82, and the data is significant [7].

Table 31: Individual physical examination data for cracked skin

Cracked Skin	No. of subjects	Percentage	Mean $\pm$ SD
Yes	9	2.36%	0.336 $\pm$ 0.933
No	297	87.13%	
Cracked	2	0.58%	
Hyperpigmentation	1	0.29%	
Pale	31	9.06%	
Rashes	1	0.29%	
Scaly	1	0.29%	

Depicts the information regarding the distribution of study subjects in the presence of cracked skin among a group of subjects, and their corresponding percentages. A total of 9 subjects (2.36%) reported having cracked skin (YES), while the majority, 297 subjects (87.13%), indicated that they did not experience cracked skin (NO). Additionally, there were 2 subjects (0.58%) who reported having cracked skin, 1 subject (0.29%) with hyperpigmentation, 31 subjects (9.06%) with pale skin, 1 subject (0.29%) with rashes, and 1 subject (0.29%) with scaly skin. According to the above data, the observed mean is approximately 0.336, the standard deviation is approximately 0.933, and the data is significant [11].

Table 32: Individual physical examination data for Dehydrated skin

Dehydrated Skin (Dry)	No. of subjects	Percentage	Mean $\pm$ SD
Yes	67	19.59%	0.196 $\pm$ 0.396
No	275	80.40%	

Depicts the information regarding the distribution of study subjects in the dehydration (dry skin) category. A total of

67 subjects (19.59%) reported experiencing dehydrated or dry skin while the majority, 275 subjects (80.40%), indicated that they did not experience dry skin. According to the above data, the observed mean is approximately 0.196, the standard deviation is approximately 0.396, and the data is significant [24].

Table 33: Individual physical examination data for Bitot spots

Bitot Test (Spots)	No. of subjects	Percentage	Mean $\pm$ SD
Yes	83	24.26%	0.243 $\pm$ 0.496
No	259	75.73%	

Depicts the information regarding the distribution of study subjects in presence of Bitot spots among a group, showing the number of individuals and their corresponding percentages for each response category. A total of 83 subjects (24.26%) reported having Bitot spots, while the majority, 259 subjects (75.73%), indicated that they did not have Bitot spots. According to the above data, the observed mean is approximately 0.243, the standard deviation is approximately 0.429, and the data is significant [8].

Table 34: Individual physical examination data for Bulged eyes

Bulged Eyes	No. of subjects	Percentage	Mean $\pm$ SD
Yes	40	11.69%	0.117 $\pm$ 0.322
No	302	88.30%	

Depicts the information regarding the distribution of study subjects in the presence of bulged eyes. A total of 40 subjects (11.69%) reported having bulged eyes, while the majority, 302 subjects

(88.30%), indicated that they did not have bulged eyes. According to the above data, the observed mean is approximately 0.117, the standard deviation is approximately 0.322, and the data is significant [9].

Table 35: Individual physical examination data for Dark circles

Dark Circles	No. of subjects	Percentage	Mean $\pm$ SD
Yes	147	42.98%	0.429 $\pm$ 0.495
No	195	57.01%	

Depicts the information regarding the distribution of study subjects in the presence of dark circles among a group of subjects, showing the number of individuals and their corresponding percentages for each response category. A total of 147 subjects (42.98%) reported having dark circles, while the majority, 195 subjects (57.01%), indicated that they did not have dark circles. According to the above data, the observed mean is approximately 0.429, the standard deviation is approximately 0.495, and the data is significant [9].

Table 36: Individual physical examination data for Sclera Colour

Sclera Colour	No. of subjects	Percentage	Mean $\pm$ SD
Yes	218	63.74%	1.43 $\pm$ 1.13
Mild	87	24.4%	
Moderate	114	33.33%	
Severe	17	4.97%	
No	124	36.25%	

Depicts the information regarding the distribution of study subjects in the presence of Sclera colour. A total of 218 subjects (63.74%) reported a noticeable sclera colour change with varying degrees

of severity: 87 subjects (24.4%) reported a mild change, 114 subjects (33.33%) reported a moderate change, and 17 subjects (4.97%) reported a severe change. Additionally, 124 subjects (36.25%) indicated that they did not observe any change in their sclera colour. According to the above data, the observed mean is approximately 1.43, the standard deviation is approximately 1.13, and the data is significant [25].

Table 37: Individual physical examination data for Face

Face	No. of subjects	Percentage	Mean $\pm$ SD
Fluffy Face	3	0.877%	0.57 $\pm$ 1.14
Hypopigmentation	20	5.84%	
Hyperpigmentation	48	14.03%	
No	269	78.65%	
Nerve Palsy	1	0.29%	
Severe Pimples	1	0.29%	

Depicts the information regarding the distribution of study subjects in the presence of Face. A total of 3 subjects (0.87%) reported having a fluffy face, while 20 subjects (5.84%) experienced hypopigmentation, and 48 subjects (14.03%) reported hyperpigmentation. The majority, 269 subjects (78.65%), indicated that they did not experience any facial conditions. Additionally, 1 subject (0.29%) reported nerve palsy, and 1 subject (0.29%) reported severe pimples. According to the above data, the observed mean is approximately 0.57, the standard deviation is approximately 1.14, and the data is significant [11].

Table 38: Individual physical examination data for Scooping face

Scooping Face	No. of subjects	Percentage	Mean $\pm$ SD
Yes	76	22.22%	171 $\pm$ 95
No	266	77.77%	

Depicts the information regarding the distribution of study subjects in the presence of Scooping face. A total of 76 subjects (22.22%) reported having a scooping face, while the majority, 266 subjects (77.77%), indicated that they did not have a scooping face. According to the above data, the observed mean is approximately 171, the standard deviation is approximately 95, and the data is significant [26].

Table 39: Individual physical examination data for Depressed eyes

Depressed Eyes	No. of subjects	Percentage	Mean $\pm$ SD
Yes	86	25.14%	0.251 $\pm$ 0.433
No	256	74.85%	

Depicts the information regarding the distribution of study subjects in the presence of Depressed eyes. A total of 86 subjects (25.14%) reported having depressed eyes, while the majority, 256 subjects (74.85%), indicated that they did not have depressed eyes. According to the above data, the observed mean is approximately 0.251, the standard deviation is approximately 0.433, and the data is significant [9].

Table 40: Individual physical examination data for Hair fall

Hair fall	No. of subjects	Percentage	Mean $\pm$ SD
Yes	202	59.06%	0.591 $\pm$ 0.492
No	140	40.93%	

Depicts the information regarding the distribution of study subjects in the presence of Hair fall. A total of 202 subjects (59.06%) reported experiencing hair fall, while 140 subjects (40.93%) indicated that they did not experience hair fall. According to the above data, the observed mean is approximately 0.591, the standard deviation is approximately 0.492, and the data is significant [10].

Table 41: Individual physical examination data for Dandruff

Dandruff	No. of subjects	Percentage	Mean $\pm$ SD
Yes	156	45.61%	0.456 $\pm$ 0.497
No	186	54.38%	

Depicts the information regarding the distribution of study subjects in the presence of Dandruff. A total of 156 subjects (45.61%) reported experiencing dandruff, while 186 subjects (54.38%) indicated that they did not experience dandruff. According to the above data, the observed mean is approximately 0.456, the standard deviation is approximately 0.497, and the data is significant [27].

Table 42: Individual physical examination data for White hair

White Hair	No. of subjects	Percentage	Mean $\pm$ SD
Yes	79	23.09%	0.231 $\pm$ 0.421
No	263	76.90%	

Depicts the information regarding the distribution of study subjects in the presence of White hair. A total of 79 subjects (23.09%) reported having white hair, while 263 subjects (76.90%) indicated that they did not have white hair. According

to the above data, the observed mean is approximately 0.231, the standard deviation is approximately 0.421, and the data is significant [10].

Table 43: Individual physical examination data for Nails

Nails	No. of subjects	Percentage	Mean $\pm$ SD
Normal	245	71.63%	0.651 $\pm$ 1.35
White spots	43	12.57%	
Pale	16	4.67%	
Flaky	27	7.89%	
Black colour nails	1	0.29%	
Brittle	1	0.29%	
Clubbing	5	1.46%	
Criss cross fingers	4	1.16%	

Depicts the information regarding the distribution of study subjects in the presence of Nails. A total of 245 subjects (71.63%) reported having normal nails, while 43 subjects (12.57%) indicated the presence of white spots, 16 subjects (4.67%) reported having pale nails, and 27 subjects (7.89%) experienced flaky nails. Additionally, 1 subject (0.29%) reported having black colour nails, 1 subject (0.29%) reported brittle nails, 5 subjects (1.46%) reported clubbing, and 4 subjects (1.16%) reported crisscross fingers. According to the above data, the observed mean is approximately 0.651, the standard deviation is approximately 1.35, and the data is significant [18].

Table 44: Individual physical examination data for Spooning Nails

Spooning Nails	No. of subjects	Percentage	Mean $\pm$ SD
Yes	38	11.11%	5.56 $\pm$ 15.6
No	304	88.88%	

Depicts the information regarding the distribution of study subjects in the presence of spooning nails 38(11.11%) reported having spooning nails, 304(88.88%) indicated that they did not have spooning nails [18].

Table 45: Individual physical examination data for Tongue colour

Tongue colour	No of subjects	Percentage	Mean $\pm$ SD
Normal	192	56.14%	22.7 $\pm$ 21.7
Mild	59	17.25%	
Moderate	76	22.22%	
Severe	1	0.29%	
Sores	14	4.09%	

Depicts the information regarding the distribution of study subjects within the tongue colour ranges from normal, mild, moderate, severe and sores. Majority of the subjects were found with normal 192(56.14%), followed by mild 59(17.25%), moderate 76(22.22%), severe 1(0.29%) and sores 14(4.09%). According to the above data, the observed mean is approximately 22.7, the standard deviation is approximately 21.7, and the data is significant [28].

Table 46: Individual physical examination data for Lips

Lips	No. of subjects	Percentage	Mean $\pm$ SD
Normal	278	81.28%	5.63 $\pm$ 13.57
Cracked	57	16.66%	
Pigmented	2	0.58%	
Dry	4	1.16%	
Pale	1	0.29%	

Depicts the information regarding the distribution of study subjects within the lips physical examination ranges from normal, cracked, pigmented, dry, pale. Majority of the subjects were found to be normal

278(81.28%), followed by cracked 57(16.66%), pigmented 2(0.58%), dry 4(1.16%) and pale 1(0.29%). According to the above data, the observed mean is approximately 5.63, the standard deviation is approximately 13.57, and the data is significant [14].

Table 47: Individual physical examination data for Thyroid gland physical examination

Thyroid gland physical examination	No. of subjects	Percentage	Mean $\pm$ SD
Normal	140	40.9%	17.98 $\pm$ 17.25
Mild	161	47.07%	
Moderate	38	11.11%	
Severe	3	0.87%	

Depicts the information regarding the distribution of study subjects within the thyroid gland physical examination ranges from normal, mild, moderate, severe. Majority of the subjects were found with mild thyroid 140(47.07%), followed by normal 161(40.9%), moderate 38(11.11%), and severe 3(0.87%). According to the above data, the observed mean is approximately 17.98, the standard deviation is approximately 17.25, and the data is significant [29].

Table 48: Individual physical examination data for Pedal edema

Pedal Edema	No. of subjects	Percentage	Mean $\pm$ SD
Normal	174	50.8%	14.2 $\pm$ 15.8
Mild	142	41.5%	
Moderate	26	7.6%	
Severe	0	0%	

Depicts the information regarding the distribution of study subjects within the pedal edema ranges from normal, mild, moderate, severe. The majority of the

subjects were found with normal edema of 174(50.8%), followed by mild 142(41.5%), moderate 26(7.6%), and severe 0(0%). According to the above data, the observed mean is approximately 14.2, the standard deviation is approximately 15.8, and the data is significant [30].

Table 49: Individual physical examination data for Dorsal hand (Assessing -Interosseous Muscle loss)

Dorsal Hand (Assessing - Interosseous Muscle loss)	No. of subjects	Percentage	Mean $\pm$ SD
Normal	125	36.5%	20.5 $\pm$ 18.1
Mild	156	45.6%	
Moderate	59	17.2%	
Severe	2	0.5%	

Depicts the information regarding the distribution of study subjects within the dorsal hand ranges from normal, mild, moderate, severe. The majority of the subjects were found with mild muscle loss 125(45.6%), followed by normal 156(36.5%), moderate 59(17.2%), and severe 2(0.5%). According to the above data, the observed mean is approximately 20.5, the standard deviation is approximately 18.1, and the data is significant [31].

Table 50: Individual physical examination data for Upper arm (muscle wasting)

Upper arm (muscle wasting)	No. of subjects	Percentage	Mean $\pm$ SD
Normal	308	90%	2.78 $\pm$ 8.37
Mild	30	8.7%	
Moderate	4	1.1%	
Severe	0	0%	

Depicts the information regarding the distribution of study subjects within the upper arm muscle wasting ranges from

normal, mild, moderate, severe. The majority of the subjects were found with normal muscle wasting of 308(90%), followed by mild 30(8.7%), moderate 4(4%), and severe 0(0%). According to the above data, the observed mean is approximately 2.78, the standard deviation is approximately 8.37, and the data is significant [32].

Table 51: Individual physical examination data for Shoulder (observing shape)

Shoulder (observing shape)	No. of subjects	Percentage	Mean $\pm$ SD
Normal	268	78.3%	6.6 $\pm$ 13.4
Mild	59	17.2%	
Moderate	14	4.0%	
Severe	1	0.2%	

Depicts the information regarding the distribution of study subjects within the shoulder shape ranges from normal, mild, moderate, severe. Majority of the subjects were found with normal shape of 268(78.3%), followed by mild 59(17.2%), moderate 14(4.0%), and severe 1(0.2%). According to the above data, the observed mean is approximately 6.6, the standard deviation is approximately 13.4, and the data is significant [33].

Table 52: Individual physical examination data for Clavicle (depth of muscle loss)

Clavicle (depth of muscle loss)	No. of subjects	Percentage	Mean $\pm$ SD
Normal	152	44.4%	18.7 $\pm$ 18.9
Mild	127	37.1%	
Moderate	61	17.8%	
Severe	2	0.5%	

Depicts the information regarding the distribution of study subjects within the clavicle ranges from normal, mild, moderate, severe. Majority of the subjects

were found with normal muscle loss of 152(44.4%), followed by mild 127(37.1%), moderate 61(17.8%), and severe 2(0.5%). According to the above data, the observed mean is approximately 18.7, the standard deviation is approximately 18.9, and the data is significant [34].

Table 53: Individual physical examination data for grip strength Grip strength (refilling capacity)

Grip Strength (refilling capacity)	No of subjects	Percentage	Mean $\pm$ SD
Normal	166	48.5%	1.64 $\pm$ 0.703
Mild	137	40%	
Moderate	36	10.5%	
Severe	3	0.8%	

Depicts the information regarding the distribution of study subjects within the grip strength ranges from normal, mild, moderate, severe. Majority of the subjects were found with normal refilling capacity of 166(48.5%), followed by mild 137(40%), moderate 36(10.5%), and severe 3(0.8%). According to the above data, the observed mean is approximately 83.8, the standard deviation is approximately 17.6, and the data is significant [35].

CONCLUSION

The purpose of this study was to evaluate the effects of starvation on the adult population and the consequences that follow. The study found that chronic illnesses such as diabetes, respiratory disorders, and cardiovascular diseases were far more common among people who were malnourished. Compared to adults

who were well-nourished, malnourished adults were more likely to suffer from negative health outcomes, highlighting the vital role that proper nutrition plays in preserving general health. Research indicates that malnutrition significantly impairs quality of life, with low levels of physical, mental, and social well-being reported by those who are malnourished. This emphasizes how critical it is to treat malnutrition to enhance the functional ability and overall quality of life of those who are impacted. A total of 1688(1346 subjects of online and 342 subjects of offline) subjects were included in our study. Among them Common symptoms including weakness (65.1%) and exhaustion (72.4%) were noted by the participants. Many also reported feeling less hungry (45.3%) and losing weight (59.8%). Iron deficiency anemia was the most prevalent nutrient deficiency, accounting for 30.7% of cases, followed by vitamin D (22.1%) and protein- energy malnutrition (18.5%) and chronic fatigue syndrome (16.2%) were associated with malnutrition. Supplements (45.8%), dietary modifications (25.2%), and nutritional counselling (38.6%) were used to treat malnutrition. The most successful treatment was supplementation, as 68.4% of individuals reported feeling better after taking it. This study reveals that malnutrition is a significant concern in the

adult population, with fatigue, weakness, and various nutritional deficiencies being the most common outcomes. Iron deficiency anemia and vitamin D deficiency were particularly prevalent. Further research is necessary to explore the long-term effectiveness of treatments and the complex relationship between malnutrition and chronic diseases.

ABBREVIATIONS

WHO: world health organisation; WFA: weight for age; WFH: weight for height; HFA: height for age; BMI: body mass index; SAM: severe acute malnutrition; MUST: malnutrition universal screening test; NRI: nutritional risk index; WHR: waist-to-hip ratio

ACKNOWLEDGEMENT

We gratefully acknowledge our guide, Dr. Ch Vara Prasada Rao Professor, Department of Pharmacy Practice, Vignan Pharmacy College, Mr. Sreenu Thalla Associate Professor, Department of Pharmacology, Vignan Pharmacy College and Dr. P. Srinivasa Babu, Principal of Vignan Pharmacy College, Vadlamudi for ultimate support.

Authors' contributions

Dr. Ch Vara Prasada Rao and Sreenu Thalla contributed to the idea of the study and work proposal and supervision; Syed Reshma and Chirala Vasanthi collected the patient data, consent for the study, and documentation regarding physical

examinations; and Syed Nanne Shariff, Gonepalli Sravani and Gunturu Varsha were the contributors for analyzing, interpreting, and writing the manuscript.

“All authors read and approved the manuscript.”

Funding

Nil

Availability of data and materials

All data generated or analysed during this study are included in this published article.

Ethics approval and consent to participate

Written informed consent was signed by all study participants.

Consent for publication

Not applicable

Competing interests

The authors declare that they have no competing interests

Author Details

*1Department of Pharmacy Practice, Vignan Pharmacy College (Autonomous), Vadlamudi, Guntur, Andhra Pradesh, India.

2Department of Pharmacology, Vignan Pharmacy College (Autonomous), Vadlamudi, Guntur, Andhra Pradesh, India.

3Department of Pharmaceutics, Vignan Pharmacy College (Autonomous), Vadlamudi, Guntur, Andhra Pradesh, India.

REFERENCE

[1] Definition-

<https://www.who.int/health-topics/malnutrition> 25.01.2025

[2] Micronutrient

malnutrition Stunting, Wasting, and Micronutrient Deficiency Disorders - Disease Control Priorities in Developing Countries - NCBI Bookshelf <https://www.ncbi.nlm.nih.gov/books/NBK11761/> 01.02.2025

[3] Serón-Arbeloa C, Labarta-Monzón L, Puzo-Foncillas J, Mallor-Bonet T, Lafita-López A, Bueno-Vidales N, Montoro-Huguet M. Malnutrition Screening and Assessment. *Nutrients*. 2022 Jun 9;14(12):2392. <https://doi.org/10.3390/nu14122392> 03.02.2025

[4] Williams, P.C. and Berkley, J.A., 2018. Guidelines for the treatment of severe acute malnutrition: a systematic review of the evidence for antimicrobial therapy. *Paediatrics and international child health*, 38(sup1), pp.S32-S49 <https://doi.org/10.1080/20469047.2017.1409453>

[5] Mwene-Batu, P., Wells, J., Maheshe, G., Hermans, M.P., Kalumuna, E., Ngaboyeka, G., Chimanuka, C., Owino, V.O., Macq, J., Lukula, M. and Dramaix, M., 2021. Body composition of adults with a history of severe acute malnutrition during childhood using the deuterium

- dilution method in eastern DR Congo: the Lwiro Cohort Study. *The American journal of clinical nutrition*, 114(6), pp.2052-2059. DOI: [10.1093/ajcn/nqab293](https://doi.org/10.1093/ajcn/nqab293)
- [6] Serón-Arbeloa, C., Labarta-Monzón, L., Puzo-Foncillas, J., Mallor-Bonet, T., Lafita-López, A., Bueno-Vidales, N. and Montoro-Huguet, M., 2022. Malnutrition screening and assessment. *Nutrients*, 14(12), p.2392. DOI: [10.3390/nu14122392](https://doi.org/10.3390/nu14122392)
- [7] Al Rahmad, A.H., Miko, A., Labatjo, R., Fajriansyah, F., Fitri, Y. and Suryana, S., 2020. Malnutrition prevalence among toddlers based on family characteristics: A cross-sectional study in the rural and urban areas of Aceh, Indonesia. *Sri Lanka Journal of Child Health*, 49(3). DOI: [10.4038/sljch.v49i3.9145](https://doi.org/10.4038/sljch.v49i3.9145).
- [8] Ter Beek, L., Bolhuis, M.S., Jager-Wittenaar, H., Brijan, R.X., Sturkenboom, M.G., Kerstjens, H.A., De Lange, W.C., Tiberi, S., Van Der Werf, T.S., Alffenaar, J.W.C. and Akkerman, O.W., 2021. Malnutrition assessment methods in adult patients with tuberculosis: a systematic review. *BMJ open*, 11(12), p.e049777. DOI: [10.1136/bmjopen-2021-049777](https://doi.org/10.1136/bmjopen-2021-049777)
- [9] Bantihun, A., Gonete, K.A., Getie, A.A. and Atnafu, A., 2020. Child Night Blindness and Bitot's Spots Are Public Health Problems in Lay Armachiho District, Central Gondar Zone, Northwest Ethiopia, 2019: A Community-Based Cross-Sectional Study. *International Journal of Pediatrics*, 2020(1), p.5095620. DOI: [10.1155/2020/5095620](https://doi.org/10.1155/2020/5095620)
- [10] Cong, Y., Zhang, Y., Han, Y., Wu, Y., Wang, D. and Zhang, B., 2024. Recommendations for nutritional supplements for dry eye disease: current advances. *Frontiers in Pharmacology*, 15, p.1388787. DOI: [10.3389/fphar.2024.1388787](https://doi.org/10.3389/fphar.2024.1388787)
- [11] McKenzie, C.A., Wakamatsu, K., Hanchard, N.A., Forrester, T. and Ito, S., 2007. Childhood malnutrition is associated with a reduction in the total melanin content of scalp hair. *British journal of nutrition*, 98(1), pp.159-164. DOI: [10.1017/S0007114507694458](https://doi.org/10.1017/S0007114507694458)
- [12] Burg, G. and Bergner, T., 1989. Pigmentary disorders associated with nutritional deficiency states. *Clinics in Dermatology*, 7(2), pp.36-43. DOI: [10.1016/0738-081x\(89\)90055-2](https://doi.org/10.1016/0738-081x(89)90055-2)

- [13] Hoffman, K., 2015. When vitamin and Nutritional deficiencies cause skin and nail changes. *Podiatry Today*, 28(1), pp.56-62.
- [14] Lee, B.Y., Hogan, D.J., Ursine, S., Yanamandra, K. and Bocchini, J.A., 2006. Personal observation of skin disorders in malnutrition. *Clinics in dermatology*, 24(3), pp.222-227. DOI: [10.1016/j.clindermatol.2005.11.002](https://doi.org/10.1016/j.clindermatol.2005.11.002)
- [15] Sheetal, A., Hiremath, V.K., Patil, A.G., Sajjansetty, S. and Kumar, S.R., 2013. Malnutrition and its oral outcome—a review. *Journal of clinical and diagnostic research: JCDR*, 7(1), p.178. DOI: [10.7860/JCDR/2012/5104.2702](https://doi.org/10.7860/JCDR/2012/5104.2702)
- [16] Algra, Y., Haverkort, E., Kok, W., Etten-Jamaludin, F.V., Schoot, L.V., Hollaar, V., Naumann, E., Schueren, M.D.V.D. and Jerković-Ćosić, K., 2021. The association between malnutrition and oral health in older people: a systematic review. *Nutrients*, 13(10), p.3584. DOI: [10.3390/nu13103584](https://doi.org/10.3390/nu13103584)
- [17] Landi, F., Camprubi-Robles, M., Bear, D.E., Cederholm, T., Malafarina, V., Welch, A.A. and Cruz-Jentoft, A.J., 2019. Muscle loss: The new malnutrition challenge in clinical practice. *Clinical nutrition*, 38(5), pp.2113-2120. DOI: [10.1016/j.clnu.2018.11.021](https://doi.org/10.1016/j.clnu.2018.11.021)
- [18] Elma, Ö., Brain, K. and Dong, H.J., 2022. The importance of nutrition as a lifestyle factor in chronic pain management: a narrative review. *Journal of clinical medicine*, 11(19), p.5950. DOI: [10.3390/jcm11195950](https://doi.org/10.3390/jcm11195950)
- [19] Seshadri, D. and De, D., 2012. Nails in nutritional deficiencies. *Indian Journal of Dermatology, Venereology and Leprology*, 78, p.237. DOI: [10.4103/0378-6323.95437](https://doi.org/10.4103/0378-6323.95437)
- [20] Pitney, T., Muir, J. and Sun, C., 2020. Trouble afoot: A review of common skin conditions of the feet and nails. *Australian Journal of General Practice*, 49(5), pp.257-260. DOI: [10.31128/AJGP-11-19-5163](https://doi.org/10.31128/AJGP-11-19-5163)
- [21] Lauwers, P., Hendriks, J.M., Van Bouwel, S., Verrijken, A., Van Dessel, K., Van Gils, C., Peiffer, F., Yogeswaran, K., De Block, C. and Dirinck, E., 2021. Malnutrition according to the 2018 GLIM criteria is highly prevalent in people with a diabetic foot ulcer but does not affect outcome. *Clinical nutrition*

- ESPEN*, 43, pp.335-341. DOI: [10.1016/j.clnesp.2021.03.029](https://doi.org/10.1016/j.clnesp.2021.03.029)
- [22] Ntentie, F.R., Angie Mbong, M.A., Tonou Tchuenté, B.R., Biyegue Nyangono, C.F., Wandji Nguedjo, M., Bissal, C., Souavourbe, P., Avom-Me Mbida, F. and Enyong Oben, J., 2022. Malnutrition, eating habits, food consumption, and risk factors of malnutrition among students at the University of Maroua, Cameroon. *Journal of Nutrition and Metabolism*, 2022(1), p.1431743. DOI: [10.1155/2022/1431743](https://doi.org/10.1155/2022/1431743)
- [23] Samadi, M., Zeinali, F., Habibi, N. and Ghotbodini-Mohammadi, S., 2016. Intake of dietary supplements and malnutrition in patients in intensive care unit. *International journal of preventive medicine*, 7(1), p.90. DOI: [10.4103/2008-7802.186224](https://doi.org/10.4103/2008-7802.186224)
- [24] Azzolino, D., Marzetti, E., Proietti, M., Calvani, R., de Souto Barreto, P., Rolland, Y. and Cesari, M., 2021. Lack of energy is associated with malnutrition in nursing home residents: Results from the INCUR study. *Journal of the American Geriatrics Society*, 69(11), pp.3242-3248. DOI: [10.1111/jgs.17393](https://doi.org/10.1111/jgs.17393)
- [25] Alou, M.T., Golden, M.H., Million, M. and Raoult, D., 2021. Difference between kwashiorkor and marasmus: Comparative meta-analysis of pathogenic characteristics and implications for treatment. *Microbial pathogenesis*, 150, p.104702. DOI: [10.1016/j.micpath.2020.104702](https://doi.org/10.1016/j.micpath.2020.104702)
- [26] Serhan, H.A., Alma'aitah, H.W., Irshaidat, S., Ameer, M.A., Asghar, M.S. and Tahir, M.J., 2022. Ophthalmic manifestations of nutritional deficiencies: a mini review. *Journal of family medicine and primary care*, 11(10), pp.5899-5901. DOI: [10.4103/jfmpe.jfmpe.790.22](https://doi.org/10.4103/jfmpe.jfmpe.790.22)
- [27] Tay, W., Quek, R., Kaur, B., Lim, J. and Henry, C.J., 2022. Use of facial morphology to determine nutritional status in older adults: opportunities and challenges. *JMIR Public Health and Surveillance*, 8(7), p.e33478. DOI: [10.2196/33478](https://doi.org/10.2196/33478)
- [28] Park, S.E., Williams, M., Crew, A.B. and Hsiao, J.L., 2024. Cutaneous Signs of Nutritional Deficiencies. *Current Geriatrics Reports*, 13(4), pp.189-199. doi: [10.1016/j.ijwd.2021.09.003](https://doi.org/10.1016/j.ijwd.2021.09.003)

- [29] Chang, K.V., Wu, W.T., Chen, L.R., Wang, H.I., Wang, T.G. and Han, D.S., 2021. Suboptimal tongue pressure is associated with risk of malnutrition in community-dwelling older individuals. *Nutrients*, 13(6), p.1821. DOI: [10.3390/nu13061821](https://doi.org/10.3390/nu13061821)
- [30] Brahmabhatt, S.R., Brahmabhatt, R.M., Eastman, C.J. and Boyages, S.C., 2001. Thyroid ultrasonography consistently identifies goiter in adults over the age of 30 years despite a diminished response with aging of the thyroid gland to the effects of goitrogenesis. *The Scientific World Journal*, 1(2), pp.243-253. DOI: [10.1100/tsw.2001.55](https://doi.org/10.1100/tsw.2001.55)
- [31] Franklin, R.R., Dikassa, L.N. and Bertrand, W.E., 1984. The impact of oedema on anthropometric measurements in nutritional surveys: a case study from Zaire. *Bulletin of the World Health Organization*, 62(1), p.145. doi: [10.1007/BF02749045](https://doi.org/10.1007/BF02749045).
- [32] Malone, A. and Hamilton, C., 2013. The Academy of Nutrition and Dietetics/the American Society for Parenteral and Enteral Nutrition consensus malnutrition characteristics: application in practice. *Nutrition in Clinical Practice*, 28(6), pp.639-650. DOI: [10.1177/0884533613508435](https://doi.org/10.1177/0884533613508435)
- [33] Lengelé, L., Bruyère, O., Beaudart, C., Reginster, J.Y. and Locquet, M., 2021. Impact of malnutrition status on muscle parameter changes over a 5-year follow-up of community-dwelling older adults from the SarcoPhAge cohort. *Nutrients*, 13(2), p.407. DOI: [10.3390/nu13020407](https://doi.org/10.3390/nu13020407)
- [34] van den Hoorn, W., Fabre, A., Nardese, G., Su, E.Y.S., Cutbush, K., Gupta, A. and Kerr, G., 2025. The Future of Clinical Active Shoulder Range of Motion Assessment, Best Practice, and Its Challenges: Narrative Review. *Sensors*, 25(3), p.667. DOI: [10.3390/s25030667](https://doi.org/10.3390/s25030667)
- [35] Kirolos, A., Harawa, P.P., Chimowa, T., Divala, O., Freyne, B., Jones, A.G., Lelijveld, N., Lissauer, S., Maleta, K., Gladstone, M.J. and Kerac, M., 2024. Long-term outcomes after severe childhood malnutrition in adolescents in Malawi (LOSCM): a prospective observational cohort study. *The Lancet Child & Adolescent Health*, 8(4), pp.280-289. DOI: [10.1016/S2352-4642\(23\)00339-5](https://doi.org/10.1016/S2352-4642(23)00339-5)