Association of Body Mass Index and Anemia with Dietary Diversity of Nursing Students in Chitwan, Nepal

Sumitra Parajuli [1] **Sudha Sharma,** [2] **Kamala Regmi,** [1] **Tulasi Chaudhary,** [1] **Neelu Aryal,** [1] **Jiwan Kumar Poudyal** [3]

[1]Bharatpur Hospital Nursing College, [2]Department of Laboratory, Bharatpur Hospital, [3]Department of Public Health, Shree College of Technology, Bharatpur, Chitwan, Nepal.

ABSTRACT

Background

Adequate dietary diversity and nutritional status among nursing students are essential for a healthy lifestyle and strengthen their role as promoters of healthy eating. Therefore, the study aims to assess the association between Body Mass Index (BMI), anemia, and dietary diversity among nursing students in Chitwan.

Methods

A cross-sectional descriptive study was conducted among 238 bachelor-level nursing students of selected colleges in Chitwan using a census sampling method. Three 24-hour dietary recalls to assess dietary diversity using the Minimum Dietary Diversity for Women (MDD-W) tool, and anthropometric measurements using standard procedures. BMI was categorized using WHO Asian criteria, and hemoglobin was measured with a validated portable HemoCue® HB301device. Data were analyzed in SPSS version 22 using descriptive statistics, one-way ANOVA, and Pearson's correlation.

Results

The mean age of the students was 23.39±3.73 years. BMI increased significantly with age and was higher among married and BNS/BMS students, whereas hemoglobin levels did not vary across demographic variables. The mean Dietary Diversity Score was 6.20±1.4, with 82.8% achieving adequate dietary diversity. Overall, 46.6% had normal BMI, 35.2% were overweight/obese, 15.5% underweight, and 55.5% of students were anemic. BMI was weakly correlated with hemoglobin (r=0.158, p-value=0.015), whereas DDS showed no correlation with BMI or hemoglobin level.

Conclusions

The study revealed that a substantial proportion of nursing students have anemia and are underweight and overweight despite having adequate dietary diversity. BMI was associated with hemoglobin but not dietary diversity, highlighting the need for nutrition counseling and routine BMI and hemoglobin screening to identify at-risk students.

Keywords: anemia; body mass index; Chitwan; dietary diversity; nursing students.

INTRODUCTION

Nursing students are future healthcare professionals and key role models for promoting healthy behaviors in society. Nurses represent the largest proportion (67%) of the healthcare system workforce in Nepal.[1] Most nursing students are young adults (18 to 30 years), and it is a period characterized by dietary independence and susceptibility to adopting unhealthy food habits.[1,2] Optimal nutritional status and a healthy body weight are essential for overall health and well-being, and to improve educational performance. It is associated with the prevention and control of non-communicable and metabolic disorders. An individual's nutritional status is determined by adequate dietary intake.[3] Promotion of diverse diets helps to improve diet quality and micronutrient adequacy. As per the Food and Agriculture Organization (FAO), consuming fewer than five food groups per day, referred to as minimal dietary diversity, is linked to undernutrition and micronutrient deficiencies.[4] Body Mass Index (BMI) and the prevalence of anemia are key indicators of nutritional status. BMI is a simple, non-invasive, and widely used measure to assess adult body weight and related health risk. According to World Health Organization (WHO) Asia-Pacific guidelines, a BMI of $18.5-22.9 kg/m^2$ is classify as normal range of body weight.[5,6] Anemia, a micronutrient deficiency disorder characterized by low hemoglobin levels in blood. It remains a major public health concern because it causes fatigue, lethargy, reduces physical productivity, and poor work performance.[7] In Nepal, 34% of reproductive-age women are anemic, with the highest prevalence (45%) among women living in the Tarai area.[8] Similarly, studies have shown the coexistence of underweight and overweight/obesity among Nepalese adults.[5,9] Previous studies have found that unhealthy dietary choices hold significant health risks to nursing and healthcare students.[10–13] Therefore, this study aims to assess dietary diversity and its association with BMI and anemia among nursing students and provide insights for health promotion strategies.

METHODS

The study adopted a cross-sectional descriptive design to assess the association of Body Mass Index and anemia with minimal dietary diversity of nursing students at the selected nursing colleges in Chitwan. A census sampling technique was used, including all bachelor's level nursing students from the selected college enrolled in the study sample. The 238 sample was selected from the B.Sc. Nursing enrolled in the 1st to 4th academic years and BNS/BMS students from the 1st to 3rd academic years of 2025. Inclusion criteria were the absence of chronic disease, no requirement for dietary control and medical treatment, and willingness to participate in research. The study was conducted after obtaining ethical approval from the Institutional Review Committee of Bharatpur Hospital (Ref. No.: 081/82-081) and informed written consent from all participants. Anonymity was ensured by assigning a unique code number to each questionnaire instead of using participants' names.

A semi-structured data collection tool was used for the study and consisted of three parts. The first part includes a socio-demographic and food frequency questionnaire, and the second part includes measurement of body weight, height, and Hemoglobin (Hb) level. The tool was developed in the English language based on an extensive review of relevant literature. A dietary diversity questionnaire was adopted from the Minimum Dietary Diversity for Women (MDD-W) indicator developed by FAO. The MDD-W is a proxy indicator that reflects the micronutrient adequacy of women's diet.[4] The dietary diversity questionnaire has ten different food groups such as, 1) Grains, white roots and tubers and plantains, 2) pulses (beans, peas, and lentils), 3) nuts and seeds, 4) dairy 5) meat, poultry and fish, 6) Eggs, 7) Dark green leafy vegetables, 8) vitamin A-rich fruits and vegetables, 9) other vegetables, and 10) other fruits. One point was given to each food group consumed over the past 24 hours. The sum score ranged from 0 to 10, and each participant's sum score ≥ 5 was assumed adequate dietary diversity. The tool was pretested in a similar setting, and necessary modifications were made before finalization.

The socio-demographic and dietary-related data were collected by using a self-administered questionnaire.

The dietary data were provided by students on three consecutive days of 24-hour dietary recalls, including two weekdays and one weekend day. The height and weight were measured in the classroom by two female researchers. Weight was measured once using a digital weighing scale, with students dressed in light clothing and no footwear. Height was measured while the student stood up without shoes, facing a wall-mounted measuring scale. The Body mass index (BMI) was calculated by dividing weight in kg by height in m^2. BMI was categorized into underweight ($<18.5kg/m^2$), normal weight ($18.5-22.9$ kg/m^2), Overweight/pre-obesity ($23-27.49kg/m^2$), and Obese ($\geq27.5kg/m^2$).[5,6]

Students' hemoglobin (Hb) levels were measured using a portable HemoCue® HB301device. It requires only a small drop of capillary blood and provides a quick and accurate Hb result. This device has stronger correlations (r=0.87) reported with a gold-standard hematology analyzer (reference hemoglobin) using venous blood.[14] The device was operated by trained laboratory staff at the data collection site. Among the non-pregnant women aged 15 years and above, a Hemoglobin level of $\geq12g/dl$ is considered non-anemic. Similarly, a Hb level of $11.0-11.9g/dl$ is mild, $8.0-10.9g/dl$ is moderate, and $<8.0 g/dl$ is classified as severe anemia.[8] All collected data were entered and analyzed in SPSS version 22. Descriptive statistics, including frequencies and percentages, and for inferential statistics, one way ANOVA test was applied to assess mean differences among variables, and a Pearson's correlation test was used to examine the association between categorical variables. The correlation, considered a p-value 0.05, is significant.

RESULTS

A total of 238 nursing students were included in this study. The average age was 23.39 ± 3.73 years. The key finding shows that BMI significantly differed by age, program of study, and marital status. BMI increases with age. BNS/BMS students have a higher BMI than B.Sc. Nursing and Married students have higher BMI, while the Hemoglobin level does not significantly vary with demographic variables.

Similarly, Mean DDS found significant differences by residence type, ethnicity, marital status, and dietary preference. DDS was found high among students residing in their own homes, belonging to the Brahmin/Chhetri, Married, and non-vegetarian group (Table 1).

The food consumption pattern of students on two weekdays and one weekend was found almost all students consumed the grain group across all days. Pulses, other vegetables, and fruits were also commonly consumed. Less than half of the students consumed meat, poultry, fish, and eggs, with meat consumption being notably higher (55.0%) on the weekend compared to weekdays. Meanwhile, nearly one-third of the students consumed vitamin A-rich fruits and vegetables, while less than half of the students consumed dark green leafy vegetables, nuts, and seeds. The overall mean DDS across three days was 6.20 ± 1.41, denoting a moderate level of dietary diversity among the students (Table 2).

According to FAO, adequate dietary diversity is defined as >5 Dietary Diversity Score. Based on this definition, this study found that out of 238 students, the maximum (82.8%) of students consumed five or more food groups, which means intake of adequate micronutrients. Regarding BMI, nearly half of the participants (46.6%) were within the normal weight range. However, 15.5% were underweight, and a notable proportion of students were overweight (17.6%), and another 17.6% were Obese I category, meanwhile, 2.5% were Obese II. About anemia, less than half (44.5%) had normal Hemoglobin levels, whereas the remaining 55.5% had mild (29.4%) and moderate (26.1%) anemia (Table 3).

Nutritional status was significantly associated (p-value<0.05) with age, program of study, academic level, and marital status. Whereas, underweight prevalence was higher among 21-25years (20.2%), B.Sc Nursing (23.4%), fourth year (45.5%), and unmarried (18.3%) students, and overweight/obesity among 31years and above (90%), BNS/BMS (50.4%), married (63.8%), and Third year (45.0%) students. Similarly, more adequate dietary diversity was found among students aged 26-30 years (94.2%), married

Table 1. Association of socio-demographic variables with mean BMI, Hb, and DDS. (n=238)				
Variables	**Frequency (%)**	**Mean BMI**	**Mean Hb**	**Mean DDS(3 day)**
Age group (years)				
18-20	67(28.2)	21.10±2.94	11.81±1.28	6.03±1.56
21-25	109(45.8)	21.57±3.20	11.71±1.04	6.24±1.40
26-30	52(21.8)	23.89±3.63	11.82±1.21	6.19±1.13
31-38	10(4.2)	25.55±2.90	12.08±1.18	7.00±1.52
p-value		0.000*	0.756	0.243
Mean age(23.39±3.73)				
Reside nowadays				
Own home	106(44.5)	22.33±3.56	11.71±1.18	6.81±1.26
Rent a room	107(45.0)	22.00±3.28	11.76±1.17	5.85±1.30
Hostel	25(10.5)	21.66±3.71	12.13±0.88	5.13±1.29
p-value		0.618	0.265	0.000*
Program of study				
BNS/BMS	131(55.0)	23.18±3.63	11.77±1.10	6.24±1.30
B.sc Nursing	107(45.0)	20.81±2.70	11.78±1.22	6.16±1.53
p-value		0.000*	0.98	0.69
Academic level				
1st year	106(44.5)	22.30±3.56	12.00±1.12	6.16±1.52
2nd year	61(25.6)	21.84±3.39	11.58±1.23	6.17±1.46
3rd year	60(25.2)	22.52±3.38	11.59±1.09	6.22±1.13
4th year	11(4.6)	19.54±1.74	11.70±1.02	6.72±1.36
p-value		0.053	0.054	0.657
Ethnicity				
Brahmin/Chhetri	137(57.6)	21.68±3.14	11.73±1.20	6.40±1.37
Adibashi/Janajati	67(28.2)	22.95±4.06	11.77±1.10	5.92±1.41
Dalit	14(5.9)	22.78±2.99	12.18±1.14	6.52±0.91
Madheshi	15(6.3)	21.95±3.26	11.84±1.17	5.37±1.60
Muslim	5(2.1)	21.35±3.10	11.84±1.17	6.33±1.81
p-value		0.142	0.749	0.021*
Marital Status				
Single	191(80.3)	21.55±3.20	11.76±1.12	6.10±1.42
Married	47(19.7)	24.37±3.51	11.85±1.27	6.62±1.27
p-value		0.000*	0.61	0.024*
Dietary Preferences				
Vegetarian	22(9.2)	21.15±2.79	11.51±1.29	5.62±1.56
Non-vegetarian	216(90.8)	22.21±3.50	11.80±1.13	6.26±1.38
p-value		0.169	0.256	0.040*
Total Mean Values		22.11±3.45	11.78±1.15	6.20±1.41

Table 2. Food consumption pattern and mean dietary diversity score across three 24-hour dietary recall days. (n=238)			
Food Groups	Food Consumed in 3 days		
	Weekday 1 Frequency(%)	Weekday 2 Frequency(%)	Saturday (weekend) Frequency(%)
Grains, white roots and tubers	236(99.2)	237(99.6)	238(100)
Pulses (beans, peas, and lentils)	208(87.4)	200(84.0)	191(80.3)
Nuts and seeds	117(49.2)	111(46.6)	119(50.0)
Dairy	145(60.9)	134(56.3)	150 (63.0)
Meat, poultry, and fish	102(42.9)	74(31.1)	131(55.0)
Eggs	113(47.5)	94(39.5)	92(38.7)
Dark green leafy vegetables	126(52.9)	103(43.3)	98(41.2)
Vitamin A-rich fruits and vegetables	84(35.3)	61(25.6)	66(27.7)
Other vegetables	222(93.3)	219(92.0)	221(92.9)
Other fruits	181(76.1)	179(75.2)	181(76.1)
Mean DDS	6.45±1.70	5.93±1.70	6.25±1.74

Table 3. Dietary Diversity, Body Mass Index, and Anemia among students. (n=238)	
Variables	Frequency (%)
Dietary Diversity	
Adequate DD (≥5 groups)	197(82.8)
Not adequate DD (<5 groups)	41(17.2)
BMI (kg/m²)	
<18.5 (Underweight)	37(15.5)
18.5 -22.9 (Normal weight)	111(46.6)
23.0-24.9 (Overweight)	42(17.6)
25.0-29.9 (Obese I)	42(17.6)
≥30 (Obese II)	6(2.5)
Anemia∗	
≥12g/dl (normal)	106(44.5)
11.0-11.9g/dl (Mild anemia)	70(29.4)
8-10.9g/dl (Moderate anemia)	62(26.1)

∗*Hemoglobin level in non-pregnant women 15 years and above.*

(93.6%), Dalit ethnicity (100%), and residing in their own homes compared to those living in hostels (44.0%) or rented rooms (22.4%) (Table 4).

The study revealed a significant positive correlation between BMI and Hemoglobin level (r=0.158, p-value=0.015), indicating that students with higher BMI tended to have slightly higher hemoglobin levels. However, no significant correlation was observed between BMI and dietary diversity score (r=0.093, p-value=0.151), or between dietary diversity score and hemoglobin level (r=0.001, p-value=0.985) (Table 5).

DISCUSSION

This study assessed the nutritional status and dietary diversity among nursing students. The study findings demonstrate that out of 238 nursing students, most (82.8%) of them consume five or more food groups from the ten food groups. The FAO recommends consuming more than five food groups for an adequate dietary diversity score.[4] The study found the mean dietary diversity score was 6.20±1.41, which means students' intake of adequate micronutrients on average. However, a limited intake of vitamin A rich fruits and vegetables and eggs, and only one-third intake of micronutrient-rich foods such as dark green leafy vegetables, nuts, and seeds is concerning. Inadequate intake of these food groups may contribute to the observed prevalence of anemia (55.5%), although moderate dietary diversity. A similar finding was reported in a study in China, suggesting that despite people with high DDS, Vitamin A was seriously inadequate.[15] This may be attributed to the fact that most students prefer consuming easily available junk food. A study in Nepal found that 79.9% medical and nursing students had an inadequate fruit/vegetable intake habit.[10] Mean DDS was low among students

Table 4. Association of socio-demographic variables with nutritional status and dietary diversity. (n=238)

Variables	Nutritional status n(%)			p-value	Dietary Diversity n(%)		p-value
	Under-weight 37(15.5)	Normal 111(46.6)	Overweight and Obese 90(37.8)		Adequate (<5score) 197(82.8)	Inadequate (≥5score) 41(17.2)	
Age in Years							
18-20	12(17.9)	39(58.2)	16(23.9)	0.000*#	50(74.6)	17(25.4)	0.028*#
21-25	22(20.2)	53(48.6)	34(31.2)		90(82.6)	19(17.4)	
26-30	3(5.8)	18(34.6)	31(59.6)		49(94.2)	3(5.8)	
31-38	0(0.0)	1(10.0)	9(90.0)		8(80.0)	2(20.0)	
Program of study							
BNS/BMS	12(9.2)	53(40.5)	66(50.4)	0.000*	116(88.5)	15(11.5)	0.009*
B.Sc.Nursing	25(23.4)	58(54.2)	24(22.4)		81(75.7)	26(24.3)	
Academic level							
1st year	12(11.3)	53(50.0)	41(38.7)	0.023*#	21(19.8)	85(80.2)	0.464
2nd year	12(19.7)	27(44.3)	22(36.1)		12(19.7)	49(80.3)	
3rd year	8(13.3)	25(41.7)	27(45.0)		7(11.7)	53(88.3)	
4th year	5(45.5)	6(54.5)	0(0.0)		1(9.1)	10(90.9)	
Marital Status							
Single	35(18.3)	96(50.3)	60(31.4)	0.000*	153(80.1)	38(19.9)	0.028*
Married	2(4.3)	15(31.9)	30(63.8)		44(93.6)	3(6.4)	
Place to reside							
Own home	16(15.1)	46(43.4)	44(41.5)	0.554	100(94.3)	6(5.7)	0.000*
Rent a room	15(14.0)	55(51.4)	37(34.6)		83(77.6)	24(22.4)	
Hostel	6(24.0)	10(40.0)	9(36.0)		14(56.0)	11(44.0)	
Ethnicity							
Brahmin/ Chhetri	23(16.8)	69(50.4)	45(32.8)	0.553	119(86.9)	18(13.1)	0.008*#
Adibashi/ Janajati	10(14.9)	25(37.3)	32(47.8)		52(77.6)	15(22.4)	
Dalit	1(7.1)	6(42.9)	7(50.0)		14(100.0)	0(0.0)	
Madheshi	2(13.3)	9(60.0)	4(26.7)		9(60.0)	6(40.0)	
Muslim	1(20.0)	2(40.0)	2(40.0)		3(60.0)	2(40.0)	

p-value<0.05 considered statistically significant; # significant in Fisher's Exact Test.

Table 5. Correlation between average Dietary Diversity Score, BMI, and Hemoglobin level.

Variables	Average Dietary Diversity Score	BMI	Hb level
Average Dietary Diversity Score	1	0.093	0.001
BMI		1	0.158*
Hb level			1

Correlation is significant at the 0.05 level (2-tailed).

residing in the hostel, and the low frequency of meat, poultry, and egg consumption during weekdays and its increase during weekends indicates dietary inconsistency. Similarly, meals are not diversified in a nursing college, Ghana.[16]

WHO Asia-Pacific classifies BMI 18.5-22.9kg/m^2 as the normal range.[6] The study reveals that less than half (46.6%) of students had a normal weight, and a co-existence of under-nutrition (15.5%), and nearly one-third were overweight/obese. This finding differs from the previous studies reported that 15.4% of nursing students were underweight[9], and among Nepalese

adults, Rawal et al. revealed 17.27% underweight, 51.58% normal weight, and 31.16% overweight or obese.[5] This difference might be due to age and sex variation of the study sample. This study had a noticeable prevalence of obesity may be attributed to the widespread consumption of carbohydrate-rich foods compared to vegetables and fruits. The study found a significant difference in mean BMI by age, program of study, and marital status. BMI was increased with age, consistent with previous evidence indicating that body fat accumulation and sedentary behavior generally rise as individuals grow older.[17] Married students had higher BMI, which might be linked to lifestyle changes and altered dietary habits after marriage. Especially in low and middle-income countries, women were obese than men due to pregnancy-related weight gain and lower physical activity levels.[18]

Regarding anemia prevalence, less than half (44.5%) of the students had no anemia, while 55.5% were mildly to moderately anemic in this study. It contradicts the study by Timilsina et al., which reported that 37.8% of undergraduate health science students were anemic.[19] The study found no significant differences in mean hemoglobin levels across demographic variables. The study found no statistically significant correlation between the dietary diversity score and either BMI or hemoglobin level; however, a significant positive correlation was observed between BMI

and hemoglobin level, denoting that students with higher BMI had slightly higher hemoglobin levels. Similar results by Timilsina et al., were reported that undergraduate students with higher BMI had higher hemoglobin values.[19]

CONCLUSIONS

The study concluded that most bachelor-level nursing students in Chitwan maintained adequate dietary diversity, a considerable proportion exhibited an imbalanced nutritional status, including underweight, overweight/obesity, and anemia. There is a significant association between BMI and hemoglobin levels. However, no significant correlation was observed between dietary diversity and either BMI or hemoglobin levels. These findings emphasize the need to establish a routine dietary counseling and screening for BMI and hemoglobin levels to identify and support students at nutritional risk.

REFERENCES

1. Prasai R. The Status Quo of Nursing in Nepal: Challenges, Opportunities and Future Prospects. Int J Multidiscip Res Arts, Sci Technol [Internet]. 2025 Mar 13 [cited 2025 Jun 10];3(3):01–14. [LINK] [DOI]

2. Tavolacci MP, Delay J, Grigioni S, Déchelotte P, Ladner J. Changes and specificities in health behaviors among healthcare students over an 8-year period. PLoS One [Internet]. 2018 Mar 1 [cited 2025 Jun 10];13(3):e0194188. [LINK] [DOI]

3. National Institutes of Health. Maintain a Healthy Weight [Internet]. Aim for a Healthy Weight. 2015 [cited 2025 Jun 9]. [LINK]

4. FAO, 360 FHI. Minimum Dietary Diversity for Women: A Guide for Measurement [Internet]. 2016. [LINK]

5. Rawal LB, Kanda K, Mahumud RA, Joshi D, Mehata S, Shrestha N, et al. Prevalence of underweight, overweight and obesity and their associated risk factors in Nepalese adults: Data from a Nationwide Survey, 2016. PLoS One [Internet]. 2018 Nov 1 [cited 2025 Jun 9];13(11):e0205912. [LINK] [DOI]

6. WHO WPR. The Asia – Pacific perspective: redefining obesity and its treatment [Internet]. 2000. [LINK]

7. Chaparro CM, Suchdev PS. Anemia epidemiology, pathophysiology, and etiology in low- and middle-income countries. Ann N Y Acad Sci [Internet]. 2019 Aug 22 [cited 2025 Jun 9];1450(1):15–31. [LINK] [DOI]

8. Ministry of Health and Population. Nepal Demographic and Health Survey 2022 Key Indicators Report [Internet]. 2022. [LINK]

9. Paudel S, Poudel A, Arjyal A. Analysis of Health Promoting Lifestyle Behaviors among Nursing Students from a College of a Health Sciences Academy in Kathmandu, Nepal. Middle East J Nurs [Internet]. 2019 Nov [cited 2025 Sep 16];13(3):3–10. [LINK] [Full-Text]

10. Nepal S, Atreya A, Adhikari K, Acharya B, Menezes RG, Sapkota LP. Health risk behaviors among medical and nursing students of Lumbini Medical College, Nepal: A cross-sectional study. Heal Sci Reports [Internet]. 2024 Oct 1 [cited 2025 Jun 10];7(10):e70140. [LINK] [DOI]

11. Van den Berg VL, Abera BMM, Nel M, Walsh CM. Nutritional status of undergraduate healthcare students at the University of the Free State. South African Fam Pract [Internet]. 2013 [cited 2025 Oct 13];55(5):445–52. [LINK] [DOI]

12. Hadaye R, Pathak B, Lavangare S. Nutritional status of the student nurses of a tertiary health-care center – A mixed-method study. J Fam Med Prim Care [Internet]. 2019 [cited 2025 Jun 10];8(3):1028. [LINK] [DOI]

13. Darakai H, Noonil N, Aekwarangkoon S. Nutritional Status and Food Consumption of Nursing Students in Southern Nursing College Network. Sci Technol Soc Sci Procedia [Internet]. 2024 May 30 [cited 2025 Jun 10];2024(4):ICMH02–ICMH02. [LINK]

14. Young MF, Raines K, Jameel F, Sidi M, Oliveira-Streiff S, Nwajei P, et al. Non-invasive hemoglobin measurement devices require refinement to match diagnostic performance with their high level of usability and acceptability. PLoS One [Internet]. 2021 Jul 1 [cited 2025 Nov 7];16(7):e0254629. [LINK] [DOI]

15. Zhang Q, Chen X, Liu Z, Varma DS, Wan R, Zhao S. Diet diversity and nutritional status among adults in southwest China. PLoS One [Internet]. 2017 Feb 1 [cited 2025 Jun 19];12(2):e0172406. [LINK] [DOI]

16. Iddrisu S, Anthony W. Nutritional status and nutrient intake adequacy of Students of Nursing and Midwifery Training College, Bole, Ghana. F1000Research [Internet]. 2025 May 19 [cited 2025 Jun 18];14:499. [LINK] [DOI]

17. Oh CM, Bang JI, Lee SY, Lee JK, Chai JW, Oh SW. An Analysis of Age-Related Body Composition Changes and Metabolic Patterns in Korean Adults Using FDG-PET/CT Health Screening Data. Diabetes Metab J [Internet]. 2024 Jan 1 [cited 2025 Oct 15];49(1):92–104. [LINK]

18. Ford ND, Patel SA, Narayan KMV. Obesity in Low- and Middle-Income Countries : Burden , Drivers , and Emerging Challenges. Annu Rev Public Heal [Internet]. 2017;38:145–64. [LINK]

19. Timilsina S, Yadav RL, Bhusal P, Khatri N, Islam MN. Status of Anemia among Undergraduate Students of a Medical College of Central Nepal. J Coll Med Sci [Internet]. 2020 Jun 30 [cited 2025 Oct 17];16(2):103–6. [LINK] [DOI]