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Hematology & Transfusion International Journal

Research Article

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Prevalence and associated factors of anemia among elderly patients at a tertiary hospital in Estern Ethiopia: a cross-sectional study

Abstract

Background: As anemia is a prevalent condition in geriatrics and old age and its frequency proportionately increases with age, leading to severe consequences; any magnitude of it is now recognized as a risk factor for any adverse outcomes: decreased quality-of-life, hospitalization, morbidity, and mortality. Despite its clinical importance, the problem is not widely recognized. Therefore, regular surveillance could provide evidence-based local data required for interventions. This study is aimed to assess the prevalence and associated factors of anemia among elderly patients in eastern Ethiopia.

Methods: From June 20 to July 30, 2022, a cross-sectional study centered in an institution was carried out, enrolling 381 elderly patients. Direct interviewing and review of medical records were used to gather socio-demographic and clinical data. Each participant provided a venous blood sample to determine total blood cell count and blood peripheral film examination; to identify hemoparasites and the morphological type of anemia. Using SPSS version 25, descriptive statistical analysis and bivariate and multivariate logistic regressions were used, and statistical significance was set at $p<0.05$.

Result: Anemia was seen in 40.4% of participants, mild, moderate, and severe anemia accounts for 71.1%, 23.1%, and 5.8%, respectively. Normocytic normochromic anemia was seen in 55.13% of cases, and microcytic hypochromic in 37.18%. The anemia was substantially correlated with being male [AOR=0.352 95% CI: 0.174, 0.708], having a lower socioeconomic status [AOR=0.041 95% CI: 0.011, 0.156], and eating meat less than once per week [AOR=0.301 95% CI: 0.114, 0.793].

Conclusion and recommendation: The prevalence of anemia among elderly patients in this area was found to be a severe public health problem. Mild anemia was the predominant type. Identified risk factors should be considered to prevent and control anemia, and screening for anemia among the elderly should be a part of their routine management.

Keywords: anemia, prevalence, elderly patients, associated factor, Jigjiga, eastern Ethiopia

Volume 12 Issue 1 - 2024

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Received: December 20, 2023 | **Published:** January 02, 2024

Introduction

Anemia is characterized by a decrease in hemoglobin concentration (Hgb), red blood cell count (RBC), and/or packed cell volume or hematocrit (PCV or HCT), and the resulting inability of the body to meet the oxygen demands of its tissue resulting hypoxia.[1] According to the World Health Organization (WHO), anemia in the elderly is defined as a Hgb concentration less than 12 g/dL (120 g/L) in women and less than 13 g/dL (130 g/L) in men.[2]

Aging has both medical and societal implications. It is associated with an increase in the incidence of chronic diseases, impairments, and functional reliance, and an increase in demand for medical, social, and caregiving services.[3,4] The root cause of elderly anemia is most likely multifactorial, and one answer could be realized at the hematopoietic stem cell level.[5] Anemia afflicted 1.62 billion people worldwide, with 164 million anemia cases reported among the elderly.[6] And its independent risk factor for increased morbidity, mortality, and decreased quality of life in elderly individuals.[7]

Anemia in the elderly is typically caused by a variety of clinical issues, such as nutritional deficiencies of iron deficiency (ID), vitamin B12 and/or folic acid (folate), occult and gross gastrointestinal (GI) bleeding, and malignancies, acute and chronic infections, and kidney disease, congestive heart failure (CHF).[8,9] Anemia contributed significantly to the burden of disease globally. It affects both industrialized and resource-limited nations, exerting an impact on socioeconomic progress in addition to human health and productivity.[10–13] Data from 45 research outputs of 85,409 study participants showed that the prevalence of anemia among the elderly was 17% (3-50%) in a comprehensive analysis done by Gaskell et al. in 2008. Overall, 47% (31-50%) in nursing homes, 40% (40-72%) in hospital admissions, and 12% (3-25%) of elderlies were anemic in studies based on community data, with the majority of patients having mild type anemia. This study found that anemia prevalence rose with age and was marginally more common in males than in women.[14] One of the main risk factors for older people living in the community is anemia, which is typically mild. Mild anemia is consistently linked to serious negative outcomes in older people, including a loss of physical ability,[15] decreased mobility,[16] cognitive decline,[17] an increase in falls,[18] an increase in hospitalization,[19,20] and mortality,[17,19] according to these observational data from community-based studies.

Materials and methods

Study setting and population

A hospital-based cross-sectional study was conducted from 20 June to 30 July 2022 at the Jigjiga University Sheikh Hassan Yabare Referral Hospital in Eastern Ethiopia. Jigjiga is the capital of the Somali region and is located 630 kilometers east of Addis Ababa. At 1,934 meters above sea level, the city lies in the Fafan Zone, 60 kilometers (37 miles) west of the Somaliland border. According to the 2007 Census of the Central Bureau of Statistics of Ethiopia, the city has a total population of 277,560, of which 149,292 are male and 128,268 are female.[21,22] Sheikh Hassan Yabare Referral Hospital at Jigjiga University opened in January 2017 and has 342 beds, 13 intensive care units (of which 5 are currently in operation), 3 operating rooms, and a 24-hour emergency department. , clinical laboratories, and pharmacy services. Referral hospitals offer the following services: OPD (Out-patient) Medical Services (Adult and Pediatric), Surgical Services (Adult and Pediatric), OPD Gynecology and Obstetrics, delivery and maternity services, OPD Psychiatry, General Surgery, OPD Dermatology, 24 Hour Emergency Service (Adult and Pediatric), Inpatient Service, eye care, dental units, adult and pediatric critical care, neonatal emergency care, tuberculosis and HIV testing and treatment, ambulance services.[23]

Sample size determination and sampling technique

The sample size calculation assumed a 5% expected error margin, allowed for a 95% confidence interval to estimate a single population proportion,[24,25] and used a 54.5% prevalence rate of anemia in the elderly of a previous study conducted at the University Gondar, Northwest Ethiopia.[26]

By using the following formula:

n= (z/) 2□p (1-p)

d2

n = (1.96) ^2 x (0.545 (1-0.545)) = 381

(0.05) ^2

Therefore, the final minimum number of subjects for this study was 381. Elderly patients who met inclusion criteria during the study period were selected using a convenient sampling technique.

Data collection tools and methods

Socio-demographic and Related Data

Study participants' sociodemographic characteristics, economic status, and potential risk factors were collected through personal interviews using a pre-set questionnaire. Interviews were conducted by a registered clinical nurse fluent in the local language, and each participant's response to each question was recorded according to the questionnaire instructions. Clinical variables (History of diabetes (DM), chronic kidney disease (CKD), hypertension, malaria, HIV/AIDS, parasites, and other diseases) were identified through a review of clinical/medical records.[26]

Anthropometric measurement

Weight measurement: Before weighing the subject, the scale was placed on a firm flat surface, and the participant removed all coats, heavy sweaters, shoes, keys, and the contents of heavy bags. Again, participants were asked to stand in the center of the scale platform and distribute their weight evenly on both feet. A person's weight was calculated in units of 0.1 kilograms.[27–30]

Height measurement: Height was measured using a stature measuring scale (Infiniti Med Lab Pvt. Ltd., India). Participants stand upright on the bottom plate of the stadiometer with their backs to the vertical rear wall of the stadiometer. Bring the heels of your feet together so that both heels touch the bottom of the vertical board. The feet were turned slightly outward at a 60-degree angle. The buttocks, shoulder blades, and head are placed in contact with the vertical backboard. Participants' shoes and hats were removed during the height measurement, and the nearest 0.1 cm was used. BMI is calculated by dividing your weight (in kilograms) by your height (in meters) squared and divided into four categories. Underweight (BMI <18.5 kg/m2), normal weight (18.5-24.9 kg/m2), overweight (BMI 25-29.9 kg/m2), obese (BMI 30 kg/m2).[28,30,31]

Sample collection, processing, and analysis

Each study participant had four milliliters (4 ml) of venous blood drawn aseptically from the median cubital vein using a syringe and needle by trained laboratory technologists. The sample was then placed in a K3EDTA test tube for a hematological analyzer (Mindray® BC-5380, China) to determine the total blood cell count.[32] Adjusted Hgb concentration was used to characterize anemia after altitude correction.[33,34] Wright's stained blood films were inspected under a microscope to determine the red cell morphology.[35–37] The typical methods for collecting stool samples were used to acquire about 2 grams of a sample for parasite analysis. Intestinal parasites were evaluated using a direct wet mount after samples were fixed with 10% formalin.[38–40]

Operational definitions

Elderly:- individuals aged 60 years and above.[41]

Anemia:- is defined as a level of Hgb <13 g/dl for males and < 12 g/dl for women in an elderly population (33).

A mild anemia:- Hgb level between 10-11.9 g/dl of Non-pregnant women (15 years of age and above), whereas Men (15 years of age and above) is 10-12.9g/dl (33).

A moderate anemia:- Hgb level between 7-9.9 g/d (33).

A severe anemia:- Hgb level between 7 g/dl (33).

Alcohol abuse: [42]

For men, consuming more than 4 drinks on any day or more than 14 drinks per week

For women, consuming more than 3 drinks on any day or more than 7 drinks per week

Data quality assurance and quality control

All quality assurance phases were performed to ensure data quality. The English questionnaire was translated into the national language, Ahu Somali. Data collectors and supervisors were trained during her two days on research objectives, information confidentiality, and data collection processes. Standard operating procedures were strictly followed for complete blood count, anthropometry, stool examination, blood smear preparation, and staining. Check the expiry date before using laboratory reagents. Daily quality control with 3-step QC materials for automated hematology analyzers.

Data processing, analysis, and interpretation

All data integrity was checked and coded. Data entry was performed using Epi Data version 4.6 (EpiData Association, Odense, Denmark) and exported to SPSS version 25 (IBM® SPSS®, IBM

Corp., Armonk, NY, USA) for analysis. Descriptive statistics were used to describe study variables. Both bivariate (candidate variable selection; p<0.25) and multivariate binary logistic regressions were computed to identify relevant factors. Multicollinearity was checked using the variance inflation coefficient test (VIF) and all candidate variables were included in the final model for multivariate analysis. The goodness of fit of the model was tested using the Hosmer-Lemeshow goodness of fit test. Adjusted odds ratios (AOR) with corresponding 95% confidence intervals (CI) were used to show the strength of association and variables with p-values <0.05 were considered statistically significant.[24,43,44]

Results

Socio-demographic characteristics of study participants

A total of 381 elderly patients participated in this study; 59.1% (225) were females; most of the elderly 61.4% (174) belong to the age group 60 to 69 years (66.8 ± 7.2 years). Urban residents of the study participants were 63% (240) and 84.3% (325) of the study participants were married. More than half of the study participants 56.2% (214) were illiterate, and 38.3% (146) of the study participants were housewives/retired. Regarding the families' monthly income, which was based on a survey done in Ethiopia,[45] it showed that 33.1% (126) of the study participants earned less than 1000 Ethiopian Birr per month, 37.5% (143) earned between 1001 and 1999 ETB, and 29.4%(112) were earning more than 2000 ETB (Table 1).

Table 1 Socio-demographic characteristics of study participants among elderly patients attending JUSHYRH; June 20- July 30, 2022; Somali Regional State, eastern Ethiopia

Variable	Categories	Frequency	Percent (%)
Age of patients	60-69	234	61.4
	70-79	100	26.2
	>80	47	12.3
Sex	Male	156	40.9
	Female	225	59.1
Place residence	Rural	141	37
	Urban	240	63
Marital status	Single	6	1.6
	Married	321	84
	Widowed	48	12.6
	divorced	6	2
Educational level	Illiterate	214	56.2
	primary school	92	24.1
	Secondary	13	3.4
	College and above	62	16.3
Occupational status	Farmer	66	17.3
	Daily laborer	55	14.4
	Private employer	43	11.3
	Governmental employer	71	18.6
	Housewife/retired	146	38.3
Monthly income in ETB*	<1000 ETB	126	33.1
	1001-1999 ETB	143	37.5
	>2000 ETB	112	29.4

***ETB:** Ethiopian Birr

Behavioral characteristics and nutritional status of study participants

Study participants who had vegetables and meat less than once a week had 65.4% (249) and 54.1% (206), respectively, while those who consumed vegetables and meat at least once a week or more had 34.6% (132) and 45.9% (175). Furthermore, alcohol intake, cigarette smoking, and coffee/tea consumption with a meal were 1.6% (6), 7.9% (30), and 6.8% (26) respectively. In terms of nutritional status, 24.4% (93), 59.1% (225), and 15.5% (59), respectively, were underweight, normal weight, and overweight (Table 2).

Table 2 Behavioral characteristics and nutritional status of study participants among elderly patients attending JUSHYRH; June 20- July 30, 2022; Somali regional, eastern Ethiopia

Variable	Category	Frequency	Percent (%)
Consumption vegetable	Less than once a week	249	65.4
	at least once a week or more	132	34.6
Consumption of meat	Less than once a week	206	54.1
	at least once a week or more	175	45.9
Drinking coffee or tea with a meal	Yes	26	6.8
	No	355	93
Smoking Cigarette	Yes	30	7.9
	No	351	92
Amount of smoking cigarette	<10	29	7.6
	20-Nov	1	0
Alcohol consumption per week	14 drinks per week (men)	5	1.3
	7 drinks per week (women)	1	0.3
	Malnutrition	4	1
BMI*	Underweight	93	24.4
	Normal	225	59.1
	Overweight	59	15.5

***BMI:** Body Mass Index

Clinical and other related characteristics of study participants

Intestinal parasites were detected in the stools of 22.8% (87) of the elderly patients, of which 7.1% (27) were Giardia lamblia, 12.1% (46) were E. histolytica, and 2.4% (9) were Hookworms. The proportion of chronic renal disease, and malaria infection among the study participants was 3.4% and 1.3% (5) were diabetes mellitus. Rather, 3.1% (12) had a systolic blood pressure of ≥140mmHg, and a diastolic blood pressure of ≥ 90mmHg (Table 3).

Prevalence, severity, and types of anemia

The mean hemoglobin value of elderly patients was 12.6±SD 2.2 g/dl, ranging from 5 to 17.20 g/dl. The overall prevalence of anemia was 40.4% (154/381 95% CI: 0.55- 0.65) and high prevalence was

detected in the males 81/154(21.3%) and age group of 70-79 years, 64/154 (16.8%) followed by age 60-69, 56/154 (14.7%) and >80 years, 34/154 (8.9%). Among those who were anemic, 109 (71.15%) had mild, 36(23.1 %) had moderate anemia, and nine cases of severe anemia were also identified. Regarding types of anemia, the examined blood film showed 85 (55.13%) microcytic hypochromic, 57 (37.18%) normocytic normochromic, and 12 (7.69%) macrocytic normochromic cells.

Factors associated with anemia

All variables having a $p \leq 0.25$ on binary analysis were added to the multiple logistic regression models to identify those that were independent risk factors of anemia since confounding variables might exist. In multivariate analysis, sex (male) (AOR= 0.352 95% CI: 0.174, 0.708), lower monthly income (AOR= 0.041 95% CI: 0.011, 0.156), and habit consumption of meat less than once a week (AOR= 0.301 95% CI: 0.114, 0.793) remained as independent predictors of anemia in the final model of multivariate analysis ($p<0.05$) (Table 4).

Table 3 clinical characteristics of the study participant among elderly patients attending JUSHYRH; June 20- July 30, 2022; Somali regional, eastern Ethiopia

Variables	Category	Frequency	Percent (%)
Intestinal parasite	**Yes**	**87**	**22.8**
	No	294	77.2
	E. histolytica	46	12.1
Type of parasite	*G. lamblia*	27	7.1
	H. worms	9	2.4
	A. lumbricoides	5	1.3
Hypertension	Yes	12	3
	No	369	96.9
Diabetes Mellitus	Yes	5	1
	No	375	98.7
Chronic kidney disease	Yes	13	3
	No	368	96.6
Cancer	Yes	2	0.5
	No	379	99.5
Malaria	Yes	13	3.4
	No	367	96.6
	Total	381	100

Table 4 Multivariate logistic regressions of selected factors associated with anemia among elderly patients at JUSHYRH, June 20- July 30, 2022; Somali region, eastern Ethiopia

Variables	Category	Anemic patients N (%)	Non-anemic patients N (%)	COR [95%CI]	AOR* (95%CI)
Age of study participant	60-69	56(14.7)	178(46.7)	Ref(1)	
	70-79	64(16.8)	36(9.4)	8.313 (4.102, 16.84)	0.720(0.216, 2.403)
	>80	34(8.9)	13(3.4)	1.471 (0.689, 3.140)	0.471(0.164, 1.353)
Gender	Male	81 (21.3)	75(19.7)	0.445(0.292, 0.677)	0.352 (0.174, 0.708)
	Female	73(19.2)	152(39.9)	Ref(1)	.
Place of residence	Rural	88(23.1)	53(13.9)	0.228(0.147, 0.356)	1.057 (0.429, 2.608)
	urban	66(17.3)	174(45.7)	Ref(1)	
Educational status	Illiterate	129(33.9)	85(22.3)	0.058(0.022, 0.150)	0.768 (0.115. 5.110)
	primary school	18(4.7)	74(19.4)	0.361(0.126, 1.030)	1.273 (0.208, 7.781)
	secondary	2(0.5)	11(2.9)	0.482(0.083, 2.811)	0.779 (0.080, 7.591)
	College/ above	5(1.3)	57(15.0)	Ref(1)	
Occupational status	farmer	35(9.2)	31(8.1)	0.379(0.083, 1.728)	1.221 (0.412, 3.620)
	daily laborer	11(2.9)	44(11.5)	0.588(0.121, 2.862)	1.844 (0.505, 6.738)
	private employer	6(1.6)	37(9.7)	0.240(0.034, 1.713)	0.813 (0.165, 4.007)
	governmental employer	6(1.6)	65(17.1)	0.318(0.038, 2.679)	1.057 (0.190, 5.894)
	housewife/retired	96(25.2)	50(13.1)	Ref(1)	
Monthly income	<1000 ETB	109(28.6)	17(4.5)	0.009(0.003, 0.023)	0.041 (0.011, 0.156)
	1001-1999 ETB	39(10.2)	104(27.3)	0.151(0.061, 0.372)	0.267(0.071, 1.004)
	>2000 ETB	6(1.6)	106(27.8)	Ref(1)	
Body Mass Index	Underweight	73(19.2)	20(5.2)	0.049(0.049, 0.021)	2.152(0.651, 7.115)
	Normal	68(17.8)	157(41.2)	0.416(0.193, 0.893)	0.934(0.334, 2.610)
	Overweight	9(2.4)	60(13.1)	Ref(1)	Ref(1)
A habit of consumption of meat	Less than once a week	138(36.2)	68(17.8)	0.050(0.027, 0.089)	3.139(1.183, 8.328)
	At least once a week or more	16(4.2)	159(41.7)	Ref(1)	.
A habit of consumption of fruit & vegetable	Less than once a week	129(33.9)	120(30.1)	0.217(0.132, 0.359)	0.546(0.221, 1.350)
	At least once a week or more	29(7.6)	107(28.1)	Ref(1)	

CI, confidence interval; COR, crude OR odd ratio; AOR, adjusted OR

Discussion

In this study, the total prevalence of anemia among elderly individuals was 40.4% (154/381; 95% CI 0.69-0.91). According to WHO guidelines, our data revealed a serious public health issue among these patients (33). In addition, the rates of mild, moderate, and severe anemia were 71.15% (109/154), 23.1% (36/154), and 5.81% (9/154), respectively. Age, gender, low monthly income, and less than once per week meat consumption are all risk factors for anemia in older people. This prevalence is close to that obtained by Pautas et al. in France, who discovered that 44.7% of elderly patients were anemic.[46] This conclusion, however, was higher than studies conducted in the United States (13.6%),[47] Austria (21.1%),[48] and Egypt (17.5%).[49] This could be attributed to the differences in study participants' lifestyles, sample size, and differing maximum age limits used. Furthermore, in our study, inadequate iron intake and consumption of animal products may have a long-term influence.

Furthermore, our study anemia prevalence was lower than, reports of studies done in Tanzania (79.5%) by Chamba et al.,[50] France (53%) by Petrosyan et al.,[51] India (68.7%) by Pathania et al.,[52] Turkey (54.9%) by Sahin et al.,[53] and Ethiopia (54.5%) by Melku et al.[26] The difference might be due to comorbidity of disease and difference in the study subjects, since the elderly of this study who sought medical intervention in the outpatient department, as opposed to the study subjects in the other studies were institutionalized in long-term care facilities, and the study subjects, and the use of different study design than the current study. Our findings were also lower than those reported by Dunn et al.[54] 77% Mary Potter Hospices in New Zealand. This disparity can be related to the study participants' unique characteristics, as Dunn et al. included older patients brought to the hospital for palliative care and a higher number of hematological malignancy patients.

The most common kind of anemia (54.8%) was normocytic-normochromic anemia, as determined by RBC morphology. The cause could be chronic infection, chronic inflammatory diseases, and an increase in hepcidin levels.[55,56] This conclusion is consistent with the findings of other investigations conducted on elderly patients in Ecuador (87.4%),[57] France (82.1%),[51] Iran (75.17%),[58] and Gondar, Northwest Ethiopia (85.3%).[26] Furthermore, hypochromic-microcytic anemia (37.4%) is the second most common kind of anemia in our study. This could be due to the long-term effects of reduced iron consumption, decreased iron absorption, chronic blood loss, GI bleeding, and elevated circulating hepcidin concentrations.[59] This conclusion is consistent with research from Ecuador (7.6%),[57] France (9.5%),[51] Iran (20.29%),[58] and northwest Ethiopia (9.20%).[26]

Mild anemia, on the other hand, was the most common type of anemia in the current study, accounting for 71.1%. This could be explained by the fact that our study was conducted in a hospital; our population already had relatively advanced conditions that necessitated admission. However, it is probable that a considerable fraction of the elderly population already exists. When they develop diseases that necessitate medical attention, their anemia will deteriorate and they will appear with moderate or severe anemia. The findings were consistent with those of studies conducted on old patients in France (61.1%),[51] India (47.4%),[52] and Ethiopia (56.9%).[26]

In terms of gender differences, males had a higher prevalence of anemia than females in the current study (AOR 0.352 95% CI 0.174, 0.708). This was similar to previous research undertaken in Ecuador, Egypt, and Russia.[14,49,60] The large disparity in anemia prevalence rates between men and women can be related to a significant reduction in free and accessible testosterone concentration in males after middle age. This has a deleterious impact on the bone marrow's improved metabolic processes. As testosterone levels diminish with age, so does the rate of erythropoiesis, predisposing men to an increased risk of anemia.[61,62] When compared to those with a high family income, the elderly with a low family income had a 0.267 (AOR= 0.267) risk of being anemic. Bryce et al.,[63] Cuba and Dominican Republic (socioeconomic status and meat intake), and Bikbov et al.,[60] Russia (socioeconomic status), found that elderly from low family income were more likely to be anemic than those from high family income.

When compared to the consumer, the risk of anemia was 3.139 (AOR= 3.139) times greater among the elderly who did not consume meat. This is congruent with studies undertaken in Cuba and the Dominican Republic (socioeconomic status and meat consumption) by Bryce et al.,[63] and Iran (meat consumption) by Afag et al.[58] It was discovered that the elderly who consume animal products fewer than once a week are more likely to be anemic. This revealed that a lack of access to animal products rich in micronutrients (iron, vitamin B12, folate, and vitamin) and iron absorption enhancers may be the primary cause of anemia.

In this study, those who consumed meat at least once a week or more showed a lower risk of anemia than those who consumed it less frequently or less than once a week. There is evidence that limiting meat and other animal products increases your risk of acquiring nutritional deficiencies.[64,65] Furthermore, the risk of vitamin B12, iron, and other mineral deficiencies is common in vegetarians, predisposing them to a higher risk of nutritional deficiency anemia.[66] Along with severe undernutrition, which is a major public health issue in many African countries due to poverty and a lack of access to critical social services.[67]

Conclusion

The overall prevalence of anemia among elderly patients is critical for public health. The majority of older individuals had moderate anemia. More than half of the elderly individuals had Normocytic normochromic anemia, with the other forms being Microcytic hypochromic anemia and fewer Macrocytic normochromic anemia. Sex, poor socioeconomic position, and less than once-a-week meat consumption were factors contributing to the prevalence of anemia in these individuals. Thus, geriatric nutrition knowledge, the function of a balanced diet, and the implications of anemia among the elderly needed to be adopted. Screening for anemia in the elderly should be part of their usual care, as should the examination of iron markers such as serum ferritin and serum transferrin and the evaluation of serum folate and serum Vit-B12.

Acknowledgments

We would like to thank Jigjiga University and Jimma University for being involved in this research. Our gratitude also extends to data collectors for their time and effort in gathering data, as well as study participants for their participation in this study. We are also grateful to everyone who helped with the completion of this research.

Conflicts of interest

The author(s) declare that there are no potential conflicts of interest for this research work, authorship, and/or publication of the article.

Funding

None.

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