بسم الله الرحمن الرحيم

Dongola University

Faculity of Medicine and Health Science

Department of Community Medicine

Research proposal

Title:

Prevalence and Risk Factors of Anemia among Female Students at University of Dongola, Northern State, Sudan, 2026

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1. Introduction

1.1 Background

Anemia is defined by the World Health Organization (WHO) as a condition in which the number of red blood cells or their oxygen-carrying capacity is insufficient to meet the body's physiological needs, and is operationally identified by a hemoglobin (Hb) concentration below the age-, sex-, and physiological-status-specific cut-off values. Anemia remains one of the most widespread public health problems worldwide, affecting an estimated one-third of the global population, with the highest burden concentrated in low- and middle-income countries (4).

Iron deficiency is the single most common nutritional cause of anemia globally, accounting for approximately half of all anemia cases, and is termed iron deficiency anemia (IDA) when it progresses to a measurable drop in hemoglobin (4). Women of reproductive age, including female university students, constitute a particularly vulnerable group because of recurring iron losses through menstruation combined with dietary patterns that are frequently deficient in bioavailable iron and enhancers of iron absorption such as vitamin C, alongside frequent consumption of inhibitors such as tea and coffee (1,5).

University life introduces additional risk factors for anemia and IDA among female students, including irregular meal patterns, skipping breakfast, reliance on low-iron convenience foods, restrictive dieting for body-image reasons, heavy or prolonged menstrual bleeding, and limited awareness of iron-rich dietary sources (1,2,6). Anemia in this age group has been linked to fatigue, reduced concentration, impaired academic performance, and lowered immunity, which makes it a relevant concern not only clinically but also academically and socially (4).

Regional studies from neighboring Arab countries have documented a wide range of anemia and IDA prevalence among female university students — for example 12.5% among female students in Tabuk, Saudi Arabia, 38.3% among female medical students at Imam Abdulrahman Bin Faisal University, and 67.35% among female students at Jazan University (1,2,3) — reflecting substantial variation according to dietary habits, socioeconomic status, and geographic context (5,6). Within Sudan, the limited available evidence also points to a considerable burden: a national household survey found an overall anemia prevalence of 35.6% among Sudanese women of reproductive age (7), and a university-based hematological study at Sudan University of Science and Technology found that the mean hemoglobin level among apparently healthy female students (11.2 g/dL) was significantly lower than among their male counterparts (12.9 g/dL), with individual female values ranging as low as 8 g/dL (8). However, published evidence on anemia among female university students

in Sudan remains limited, and no study was identified that specifically assessed the prevalence and risk factors of anemia among female students at the University of Dongola or in Northern State.

1.2 Problem Statement

Anemia, and iron deficiency anemia in particular, is widely recognized as a significant health burden among female university students in the Middle East and North Africa region, with reported prevalence figures ranging from about 12% to over 60% depending on the population studied and the diagnostic criteria applied (1,2,3). Female students are considered a high-risk group due to menstrual blood loss, unbalanced dietary intake, and demanding academic schedules that often lead to irregular eating habits.

Despite this well-documented regional burden (1,2,3), and preliminary local evidence suggesting a comparable problem among Sudanese women and university students in general (7,8), no local data currently exist on the prevalence of anemia or its risk factors among female students at the University of Dongola, Northern State, Sudan. Without such data, the extent of the problem in this specific student population is unknown, and it is not possible for university health services or public health authorities to plan appropriate screening, nutritional education, or intervention programs, as has been recommended in comparable settings (1,3). This research proposal is therefore designed to address this gap by estimating the prevalence of symptoms and self-reported history suggestive of anemia, with particular attention to iron deficiency anemia, and by identifying its associated socio-demographic, dietary, and gynecological risk factors among this population.

1.3 Research Question

Main research question: Among female students at the University of Dongola, Northern State, Sudan, what is the prevalence of symptoms and self-reported history suggestive of anemia, and which socio-demographic, dietary, and gynecological factors are associated with it?

1.4 Hypothesis

Null hypothesis (H_0): There is no statistically significant association between the socio-demographic, dietary, and gynecological factors studied and a symptom profile suggestive of anemia among female students at the University of Dongola.

Alternative hypothesis (H_1): There is a statistically significant association between one or more of these factors (for example infrequent intake of red meat and iron-rich foods, frequent tea/coffee consumption, skipping breakfast, and heavy or prolonged menstrual bleeding) and a symptom profile suggestive of anemia among female students at the University of Dongola

1.5 Rationale

The diagnosis of anemia is primarily based on laboratory measurement of hemoglobin concentration, while the identification of iron deficiency requires

assessment of iron status, particularly serum ferritin. Such laboratory-based assessment was used in the Tabuk, Jazan, and Imam Abdulrahman Bin Faisal University studies referenced above (1,2,3). However, direct measurement of hemoglobin and iron status requires blood sampling, laboratory reagents, trained personnel, and additional financial resources. These requirements are not feasible within the available resources and time frame of this undergraduate research project, particularly given the large and geographically dispersed target population of female students across the University of Dongola

Given these financial, logistical, and time constraints, this study will use a structured, self-administered questionnaire adapted from tools used in comparable regional studies (1,2,3). The questionnaire will collect information on self-reported previous diagnosis of anemia, current or previous iron supplementation, family history, symptoms and clinical features that may be associated with anemia, including persistent fatigue, dizziness, shortness of breath on exertion, pallor, hair loss, brittle nails, pica, and heavy or prolonged menstrual bleeding. It will also assess dietary and other relevant risk factors that may influence iron status.

Because these self-reported symptoms and risk factors are not sufficiently specific to establish a laboratory-confirmed diagnosis of anemia or iron deficiency anemia, the study will not classify participants as having confirmed anemia or IDA. Instead, participants will be categorized according to a predefined questionnaire-based profile suggestive of increased likelihood of anemia, based on the combination of relevant symptoms, history, and risk factors.

This questionnaire-based approach provides a feasible and low-cost method for assessing the probable burden and associated risk factors of anemia-related symptoms among female students at the University of Dongola within the available study period and budget. Although it cannot replace laboratory-based diagnosis or provide a biochemically confirmed prevalence of anemia or IDA, it can provide valuable local baseline information regarding symptoms, previous anemia history, dietary and menstrual risk factors, and the proportion of students requiring further clinical or laboratory assessment. The findings may therefore help inform the University health unit about the need for future laboratory-based screening and targeted nutritional interventions.

1.6 Objectives

General Objective

To assess the prevalence of symptoms and self-reported history suggestive of anemia — with particular attention to iron deficiency anemia — and to identify its associated risk factors among female students at the University of Dongola,

Northern State, Sudan, 2026.

Specific Objectives

- To determine the proportion of female students at University of Dongola with a symptom profile and/or self-reported history suggestive of anemia.
- To describe the socio-demographic characteristics (age, faculty, academic level, residence, marital status, socioeconomic status) of the study participants.
- To assess dietary habits and iron-intake patterns (meal regularity, intake of red meat/iron-rich foods, vitamin C intake, tea/coffee consumption) among the participants.
- To assess menstrual and gynecological characteristics (age of menarche, cycle length, duration and heaviness of menstrual flow) associated with iron deficiency anemia.
- To assess the level of awareness and knowledge of participants regarding anemia, its causes, and iron deficiency anemia.
- To identify the socio-demographic, dietary, and gynecological factors significantly associated with a symptom profile suggestive of anemia.

2. Literature Review — Summary of Three Related Published Studies:

The following three studies were selected because they closely match the topic, target population (female university students), and regional context of the present proposal, and their questionnaires were used as the main reference in designing the data-collection tool for this study.

2.1 Study 1 — University of Tabuk, Saudi Arabia (Alzaheb & Al-Amer, 2017) [1]

This cross-sectional study recruited 200 apparently healthy female university students aged 19–25 years at the University of Tabuk, Saudi Arabia, between February and June 2016. Data on socio-demographics, dietary habits, health history, anthropometry, and hematological/biochemical iron indices were collected through a structured interview questionnaire together with venous blood sampling. The overall prevalence of iron deficiency anemia (IDA) was 12.5%. Multivariate logistic regression identified inadequate dietary iron and vitamin C intake, infrequent consumption of red meat (≤2 times/week), frequent tea consumption (≥2 times/week), and a past personal history of IDA as significant independent risk factors. The authors recommended targeted nutritional education to improve iron-rich food consumption and awareness of factors that enhance or inhibit iron absorption.

2.2 Study 2 — Imam Abdulrahman Bin Faisal University, Saudi Arabia (AlSheikh, 2018) [2]

This cross-sectional study examined 120 female medical students selected by randomized sampling. Hemoglobin and serum ferritin levels were measured to classify IDA according to WHO criteria, and a structured questionnaire covering socio-demographic data, gynecological/obstetric history (age of menarche, cycle length, duration of menstruation, presence of clots, history of heavy bleeding), and dietary habits (breakfast intake, meat, vegetables, vitamin C, and drug use) was administered. The study found a considerably higher IDA prevalence of 38.3%, though no statistically significant association was found between IDA and the background, gynecological, and dietary variables examined in that particular sample. This study's three-domain questionnaire structure (socio-demographic, gynecological/obstetric, and dietary) was used as a direct model for the tool designed for the present proposal.

2.3 Study 3 — Jazan University, Saudi Arabia (Hamali et al., 2020) [3]

This cross-sectional study assessed anemia and iron deficiency among 134 apparently healthy students (85 males and 49 females) at the Faculty of Applied Medical Sciences, Jazan University, using a validated socio-demographic and health questionnaire combined with complete blood count, serum iron, and serum ferritin testing. Anemia (hemoglobin <12 g/dL) was found in 67.35% of female students. Among the female students with anemia, 26.54% had low serum iron and serum ferritin, indicating iron deficiency. The authors emphasized the need for larger-scale screening across university populations and highlighted irregular meals and low dietary iron intake as potential contributing factors. These findings support including detailed dietary and meal-pattern questions in the present study's questionnaire.3.

Materials and Methods

3.1 Study Design

A descriptive, cross-sectional, questionnaire-based study.

3.2 Study Area

The study will be conducted at the University of Dongola, Northern State, Sudan, across the different faculties in which female students are enrolled.

3.3 Study Population

All female undergraduate students currently enrolled at the University of Dongola during the academic year 2026 constitute the study population.

Inclusion criteria: Female students currently registered at University of Dongola who are willing to give informed consent and complete the questionnaire.

Exclusion criteria: Pregnant students, students with a known chronic hematological, renal, or other medical condition that may affect hemoglobin or iron status, and

students who decline to provide informed consent or submit an incomplete questionnaire.

3.4 Sample Size and Sampling Technique

The sample size will be calculated using the single-population proportion formula:

$n = Z^2p(1-p) / d^2$

Where Z = 1.96 (95% confidence level), p = 0.40 (assumed prevalence of symptoms suggestive of anemia), and d = 0.05 (margin of error). The calculated minimum sample size is approximately 369 participants. After adding 10% to account for incomplete or non-returned questionnaires, the final target sample size will be approximately 406 female students.

A stratified random sampling technique will be used, with the university faculties treated as strata. The number of participants selected from each faculty will be proportional to the number of registered female students in that faculty. Students within each faculty will then be selected using simple random sampling from available class or registration lists.

3.5 Methods of Data Collection

Data will be collected using a structured, self-administered questionnaire adapted from questionnaires used in the reference studies described in the Literature Review (1,2,3). The questionnaire will be translated into Arabic and reviewed to ensure clarity and cultural appropriateness. It will be administered electronically using an online form distributed through WhatsApp and university student groups. Where internet access is limited, the same questionnaire may be administered through a phone-based interview.

The questionnaire will consist of the following sections:

Section A: Informed consent.

Section B: Socio-demographic data: age, faculty, academic year, residence, marital status, and monthly family income.

Section C: Dietary habits: breakfast regularity; frequency of red meat and liver intake; consumption of green leafy vegetables and vitamin-C-rich fruits; tea and coffee consumption; and use of iron or vitamin supplements.

Section D: Menstrual and gynecological history: age at menarche, menstrual cycle regularity and length, duration and heaviness of menstrual flow, and presence of blood clots.

Section E: History of anemia: previous diagnosis of anemia by a healthcare

professional, family history of anemia, and current use of iron supplements.

Section F: Symptoms commonly associated with anemia: fatigue or easy tiredness, pallor of the skin or inner eyelids, dizziness or fainting, palpitations, shortness of breath on exertion, hair loss, brittle or spoon-shaped nails, and pica such as craving ice, soil, or paper.

Section G: Knowledge and awareness of anemia and iron deficiency.

3.6 Study Variables

Outcome (dependent) variable:

A binary variable, 'symptom profile suggestive of anemia' (symptom profile suggestive of anemia versus not suggestive), derived from a pre-defined scoring of the direct-history and symptom-checklist items (Sections E and F of the questionnaire).

Independent (exposure) variables:

- Socio-demographic factors: age, faculty, academic year, residence, marital status, family income.
- Dietary factors: breakfast regularity, red meat/iron-rich food intake, vitamin C intake, tea/coffee frequency, supplement use.
- Gynecological factors: age of menarche, cycle length/regularity, duration and heaviness of menstrual flow.
- Knowledge/awareness of anemia and iron deficiency.

3.7 Data Analysis

Completed questionnaires will be checked for completeness, coded, and entered into IBM SPSS Statistics for analysis. Descriptive statistics (frequencies, percentages, means, and standard deviations) will be used to summarize socio-demographic characteristics and describe the prevalence of the symptom profile suggestive of anemia. The Chi-square test will be used to examine associations between categorical independent variables and the outcome variable, and binary logistic regression will be applied to identify independent risk factors, with odds ratios and 95% confidence intervals reported. A p-value < 0.05 will be considered statistically significant.

4. Ethical Clearance

Ethical approval will be obtained from the Research Ethics Committee of the Faculty of Medicine, University of Dongola, prior to data collection. Written or electronic informed consent will be obtained from each participant after explaining the purpose, procedures, confidentiality measures, and voluntary nature of participation.

Participants will be informed that they may withdraw at any stage without any academic or personal consequence. No blood samples or invasive procedures will be performed as part of this study. Any participant whose responses strongly suggest anemia will be advised, at the end of the questionnaire, to seek further medical evaluation and hemoglobin testing at a health facility.

5. Research Plan and Time-line

The study will be conducted over a total period of 15 weeks, from proposal/ethical approval through to final report submission, as detailed in the table below.

Task to be performed	September		October				November					Jan
Proposal submission												
Proposal presentation												
Data collection												
Data analysis												
Writing results & discussion												
Writing final report												
Electronic submission to Dept. of Community Medicine												
Research defense												

6. Budget Breakdown

The budget is limited to printing/stationery costs and data analysis support, as summarized below. Figures should be completed according to actual local costs at the time of the study.

Item	Quantity	Unit Cost (SDG)	Total Cost (SDG)
Printing of proposal	1copies	12,000	12,000
Photocopying / stationery (data collection sheets, pens, files,)and internet	1 set	150,000	150,000
Data entry & statistical analysis (SPSS license/service, statistician support)	1 service	200,000	200,000
Printing final report .	5 copies	150,000	150,000
Total			512,000

References

1. Alzaheb RA, Al-Amer O. The prevalence of iron deficiency anemia and its associated risk factors among a sample of female university students in Tabuk,

Saudi Arabia. Clin Med Insights Womens Health. 2017;10:1179562X17745088.

2. AlSheikh MH. Prevalence and risk factors of iron-deficiency anemia in Saudi female medical students. Saudi J Health Sci. 2018;7(3):148–152.
3. Hamali HA, Mobarki AA, Saboor M, Alfeel A, Madkhali AM, Akhter MS, Dobie G. Prevalence of anemia among Jazan University students. Int J Gen Med. 2020;13:765–770.
4. World Health Organization. Worldwide prevalence of anaemia 1993–2005: WHO global database on anaemia. Geneva: WHO; 2008.
5. Alswailem AM, Alahmad SM, Alshehri MA. The prevalence of iron deficiency anemia and its associated risk factors among a sample of females in Riyadh, Saudi Arabia. Egypt J Hosp Med. 2018;72(6):4625–4629.
6. Almasmoum HA, Iqbal MS, Aljaadi A, Ghafouri K, Qasem AH, Azhar W, et al. Prevalence of undiagnosed iron deficiency anemia and associated factors among female undergraduate medical students in Makkah, Saudi Arabia. Cureus. 2023;15(12):e50046.
7. Elmardi KA, Adam I, Malik EM, Abdelrahim TA, Elhag MS, Ibrahim AA, Babiker MA, Elhassan AH, Kafy HT, Elshafie AT, Nawai LM, Abdin MS, Kremers S. Prevalence and determinants of anaemia in women of reproductive age in Sudan: analysis of a cross-sectional household survey. BMC Public Health. 2020;20:1141.
8. Shaweeish NHE, Masood FAM. Measurement of hemoglobin and packed cell volume among apparently healthy students at Sudan University of Science and Technology [BSc thesis]. Khartoum: Sudan University of Science and Technology; 2014.

Annex: Draft Data Collection Questionnaire (Summary Outline)

The questionnaire will consist of seven sections covering informed consent, socio-demographic characteristics, dietary habits, menstrual and gynecological history, history of anemia, symptoms commonly associated with anemia, and knowledge and awareness of anemia and iron deficiency.

Section A — Informed Consent

Brief information about the study, confidentiality, voluntary participation, and consent to participate.

Section B — Socio-demographic Data

Age, faculty/college, academic year/level, residence, marital status, and approximate monthly family income.

Section C — Dietary Habits

Breakfast regularity, frequency of red meat/liver and green leafy vegetable intake, vitamin-C-rich fruit intake, tea/coffee consumption, and use of iron or multivitamin supplements.

Section D — Menstrual/Gynecological History

Age at menarche, menstrual cycle regularity, duration of menstrual bleeding, and heaviness of menstrual flow.

Section E — Direct History of Anemia

Previous diagnosis of anemia by a doctor, family history of anemia, and current treatment for anemia.

Section F — Symptoms Commonly Associated with Anemia

Fatigue or weakness, pallor, dizziness or fainting, palpitations, shortness of breath with activity, hair loss, nail changes, and pica.

Section G — Knowledge and Awareness

Previous awareness of anemia/iron deficiency anemia, knowledge of dietary sources of iron, and awareness of the effect of tea and coffee on iron absorption.