بسم الله الرحمن الرحيم

University of Dongola
Faculty of Medicine
Department of Community Medicine

Title:

Prevalence of Obesity among Primary School Children in Jertude Village, Dongola Locality, Northern State, Sudan, 2026

Submitted by:
Rayan Mubarak Taha Suhail
Sitana AbdelAkame AbdelArahime Idres

Supervised by:
Professor Mohamed Osman Abdelaziz

2026

TABLE OF CONTENTS

1. Introduction 3
- 1.1 Background 3
- 1.2 Problem Statement 3
- 1.3 Justification 4
- 1.4 Research Question 5
- 1.5 Objectives 5
  - 1.5.1 General Objective 5
  - 1.5.2 Specific Objectives 5

2. Literature Review 6

3. Materials and Methods 8
- 3.1 Study Design 8
- 3.2 Study Area 8
- 3.3 Study Period 8
- 3.4 Study Population 8
- 3.5 Sample Size and Sampling Technique 8
  - 3.5.1 Sample Size Determination 8
  - 3.5.2 Sampling Technique 9
- 3.6 Methods of Data Collection 10
  - 3.6.1 Anthropometric Measurements 10
  - 3.6.2 Operational Definitions 11
- 3.7 Study Variables 11
- 3.8 Data Quality Control 12
- 3.9 Data Analysis 12

4. Ethical Considerations 13

5. Research Plan 13

6. Timeline 14

7. Estimated Budget 15

8. References 16

9. Annexes 17
- Annex 1: Data Collection Form 17
- Annex 2: Parent/Guardian Informed Consent Form 19

1. Introduction

1.1 Background

Childhood obesity is an increasing public-health problem worldwide. It is associated with long-term complications and reduced quality of life. Obese children are more likely to become obese adults [1].

For children aged 5–19 years, the World Health Organization (WHO) recommends using body mass index (BMI) for age and sex to assess nutritional status. Overweight is defined as BMI-for-age above +1 standard deviation (SD), while obesity is defined as BMI-for-age above +2 SD from the WHO growth reference. BMI is calculated as weight in kilograms divided by height in metres squared [2].

A systematic review and meta-analysis of African primary-school children estimated the prevalence of obesity at 6.1% according to WHO criteria. However, the prevalence may differ according to geographical location, socioeconomic status, dietary habits, physical activity, environment, and access to recreational facilities [3].

Childhood obesity is increasingly reported in African countries, including Sudan. A study among primary-school children in urban Sudan reported that 14.8% were overweight and 10.5% were obese [4]. The study also found an association between obesity and hypertension. Another Sudanese study among schoolchildren aged 10–18 years in Khartoum State reported a combined overweight/obesity prevalence of 20.5% [5].

There is limited information about obesity among primary-school-age children in the rural villages of Northern Sudan, including Jertude Village. Therefore, this study aims to determine the prevalence of obesity among these children.

1.2 Problem Statement

Childhood obesity is an emerging public health problem that may coexist with under-nutrition in low- and middle-income countries. Evidence from Sudan has shown considerable levels of overweight and obesity among schoolchildren. In an urban Sudanese study, 14.8% of children were overweight and 10.5% were obese; obesity was also strongly associated with hypertension [4].

Studies conducted in Northern Sudan have reported the coexistence of under-nutrition and excess weight among school-aged children. In Argo City, overweight, obesity, underweight, and stunting were all reported among primary schoolchildren [6]. Similarly, a study conducted among secondary-school students in Dongola City reported prevalence rates of 15.7% for overweight and 5.2% for obesity [7]. Evidence from other African countries also indicates that overweight and obesity are common among primary schoolchildren, with higher levels generally reported in urban and private-school populations [3, 8].

However, most available studies in Sudan have been conducted in urban areas, while rural populations in Northern Sudan remain inadequately documented. The absence of local data from Jertude Village makes it difficult for health workers, teachers, parents, and local authorities to determine the magnitude of childhood obesity and to develop appropriate prevention and health-promotion activities. Early identification of childhood obesity is important because obesity may be associated with hypertension during childhood [4] and may contribute to future cardiovascular and metabolic complications. Therefore, assessing the prevalence of overweight and obesity among schoolchildren in Jertude Village is necessary to provide local evidence and support the development of appropriate school- and community-based interventions.

1.3 Justification

Childhood obesity has become a growing public health concern worldwide, with the WHO reporting a marked rise in its prevalence over recent decades [1]. Sudan is undergoing a nutrition transition characterized by changing dietary patterns and reduced physical activity, yet available data come mainly from urban centers such as Khartoum [4, 5]. Rural communities in Northern Sudan remain poorly studied, and no prevalence data are available for Jertude Village. Primary school age is a critical period for establishing lifelong eating and activity habits, and obesity at this stage tends to persist into adulthood, increasing the risk of type 2 diabetes and cardiovascular disease [1].

The study is expected to:

- Provide baseline data on the prevalence of obesity among primary school

children in Jertude Village.

- Address the gap in research on childhood obesity in rural Northern Sudan.
- Inform school health programs and local health planning, and serve as a reference for future studies.

1.4 Research Question

What is the prevalence of obesity among primary-school-age children in Jertude Village, Northern Sudan?

1.5 Objectives

1.5.1 General Objective

To study the prevalence of obesity among primary-school-age children in Jertude Village, Northern Sudan.

1.5.2 Specific Objectives

1. To measure the weight and height of primary-school-age children in Jertude Village.
2. To calculate BMI-for-age using the WHO growth reference standards.
3. To determine the prevalence of obesity among study participants.

2. Literature Review

Summaries of similar published studies are presented below.

Study 1: African Primary-School Children (Systematic Review and Meta-Analysis)

A systematic review and meta-analysis pooling data on African primary-school children estimated the overall prevalence of obesity at 6.1% using WHO criteria. The review found that prevalence varied considerably by geographical location, socioeconomic status, dietary habits, physical activity, environment, and access to recreational facilities, highlighting the importance of context-specific local studies [3].

Study 2: Kilimanjaro, Tanzania

A cross-sectional study was conducted among 1,170 primary-school children aged 9–11 years from 20 schools in Kilimanjaro. The study used multistage sampling, questionnaires on diet and physical activity, and anthropometric measurements. The overall prevalence of overweight and obesity was 15%, consisting of 9% overweight and 6% obesity. Overweight and obesity were more common in urban areas and private schools, while access to school playgrounds was associated with lower risk [8].

Study 3: Dongola City, Northern Sudan

A cross-sectional, school-based study was conducted among 695 secondary-school adolescents in Dongola City, Northern State, Sudan, in November 2019. Weight and height were measured and nutritional status was classified using the WHO growth reference. The study found that 15.7% of adolescents were overweight and 5.2% were obese, while 12.2% were underweight. A family history of obesity and residence in an urban area were significantly associated with a higher risk of overweight and obesity. The authors recommended strengthening school health programmes and conducting further studies covering both rural and urban schools in the Northern State [7].

Study 4: Argo City, Northern Sudan

A cross-sectional study was conducted among 1,223 primary-school children aged 6–14 years in Argo City, Northern State, Sudan. Anthropometric measurements were taken for all participants. The study found that only 1.5% of children were obese and 6.2% were overweight, while underweight (4.6%) and stunting (3.8%) were also present,

reflecting a double burden of malnutrition. The authors recommended establishing intervention measures to address both overweight and under-nutrition among primary-school children in the Northern State [6].

Study 5: Khartoum State, Sudan (Schoolchildren Aged 10–18 Years)

A school-based study among 1,138 schoolchildren aged 10–18 years in Khartoum State, Sudan, measured weight and height and classified nutritional status using WHO BMI-for-age percentiles. The prevalence of obesity was just over 9%, overweight 10.8%, and combined overweight/obesity 20.5%. The combined prevalence rose markedly with socioeconomic class, from 3.1% in the lower class to 27.3% in the middle class and 56.8% in the higher class, pointing to an emerging problem among children of better-off families [5].

Study 6: Khartoum, Sudan (Primary Schoolchildren)

A study among primary schoolchildren aged 6–12 years in urban Khartoum, Sudan, classified children using BMI-for-age percentile cut-offs (85 th and 95th percentiles) and found that 14.8% were overweight and 10.5% were obese. Obesity, but not a family history of hypertension, was associated with hypertension: 31.2% of obese children were hypertensive, compared with 17.8% of overweight children and 5.3% of children with a normal BMI [4].

3. Materials and Methods

3.1 Study Design

A school-based observational cross-sectional study will be conducted among primary-school-age children in Jertude Village, Northern Sudan, to determine the prevalence of obesity.

3.2 Study Area

The study will be conducted in Jertude Village, located in Dongola Locality, East Nile Administrative Unit, Northern State, Sudan. The village is situated approximately 24–30 kilometres from Dongola town and is served by primary schools that provide education to children of primary-school age, as well as by basic community facilities, including educational and health services. The study will include eligible children attending the selected primary schools in the village.

3.3 Study Period

The study will be conducted over a three-month period from September to November 2026.

3.4 Study Population

The study population will consist of primary-school-age children aged 5–12 years who live in Jertude Village and attend the selected primary schools in Jertude. Children will be eligible to participate if they are enrolled in the selected schools, fall within the specified age group, and have written informed consent from a parent or guardian. Children who are seriously ill at the time of data collection, unable to stand for accurate height measurement, or whose parents/guardians do not provide consent will not be included.

3.5 Sample Size and Sampling Technique

3.5.1 Sample Size Determination

Since the total number of primary-school-age children in Jertude Village is unknown, the sample size will be calculated using the single population proportion formula for an

unknown population:

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

Where:

n = required sample size

Z = standard normal value at 95% confidence level, equal to 1.96

p = estimated prevalence of obesity among primary-school-age children

1 − p = proportion of children without obesity

d = margin of error, equal to 0.05

As no previous study has determined the prevalence of obesity among primary-school-age children in Jertude Village, the prevalence is assumed to be 50% (p = 0.5). This proportion is used when the actual prevalence is unknown because it produces the maximum required sample size.

$$n = [(1.96)^2 \times 0.5 \times (1 - 0.5)] / (0.05)^2$$

$$n = (3.8416 \times 0.5 \times 0.5) / 0.0025$$

$$n = 0.9604 / 0.0025$$

$$n = 384.16$$

Therefore, the minimum calculated sample size will be 384 children.

To compensate for possible non-response or incomplete questionnaires, 10% will be added to the calculated sample size:

$$n = 384 + (384 \times 0.10)$$

$$n = 384 + 38.4$$

$$n = 422.4$$

Therefore, the final sample size will be rounded up to 423 primary-school-age children.

The formula used estimates the minimum sample required for a specified confidence level and margin of error when the target population is unknown or treated as large.

3.5.2 Sampling Technique

The sample size for each selected school will be calculated using proportional

allocation as follows:

$$ni = (Ni / N) \times n$$

Where:

ni = required sample size from each selected school

Ni = total number of eligible children in each selected school

N = total number of eligible children in all selected schools

n = total calculated sample size, equal to 423 children

3.6 Methods of Data Collection

Data will be collected using a structured interviewer-administered questionnaire and direct anthropometric measurements.

The questionnaire will be used to collect information about the child's age, sex, and school grade. It will be completed through interviews with the child and, when necessary, with the parent or guardian.

Anthropometric data will include the measurement of weight and height. Body mass index (BMI) will be calculated for each participant. BMI-for-age Z-scores will then be determined according to the age and sex of each child using the WHO growth reference for children aged 5–19 years, through WHO AnthroPlus software or an equivalent WHO growth-reference tool.

3.6.1 Anthropometric Measurements

Weight Measurement

Each child will be weighed without shoes and while wearing light clothing using a calibrated digital weighing scale. The weighing scale will be placed on a flat, hard surface and checked for zero before each measurement. Weight will be recorded to the nearest 0.1 kilogram.

Height Measurement

Height will be measured without shoes using a stadiometer or a fixed measuring board. The child will stand erect with heels together, arms at the sides, and head positioned in the Frankfurt horizontal plane. Height will be recorded to the nearest 0.1 centimetre.

Body Mass Index Calculation

Body mass index will be calculated using the following formula:

$$BMI = Weight\ (kg) \div Height\ (m)^2$$

The calculated BMI will be converted to BMI-for-age Z-scores and interpreted using the WHO age- and sex-specific growth reference for children aged 5–19 years.

3.6.2 Operational Definitions

Primary-school-age child: A child aged 5–12 years who is enrolled in a primary school in Jertude Village.

Body Mass Index (BMI): A measure calculated by dividing weight in kilograms by height in metres squared.

Overweight: BMI-for-age greater than +1 standard deviation and less than or equal to +2 standard deviations, based on the WHO growth reference.

Obesity: BMI-for-age greater than +2 standard deviations, based on the WHO growth reference.

Normal nutritional status: BMI-for-age from −2 standard deviations to +1 standard deviation, based on the WHO growth reference.

Thinness: BMI-for-age less than −2 standard deviations, based on the WHO growth reference.

3.7 Study Variables

The main study variable will be obesity status among primary-school-age children.

Obesity status will be determined using BMI-for-age Z-scores according to the WHO growth reference for children aged 5–19 years. A child with BMI-for-age greater than +2 standard deviations will be classified as obese [2].

Variables Required for Description

The following variables will be collected to describe the study participants and calculate BMI-for-age:

- Age in completed years.

- Sex.
- School name and School grade.
- Weight in kilograms.
- Height in centimetres.
- Body mass index in kilograms per metre squared.
- BMI-for-age Z-score.
- Nutritional status classification: thinness, normal weight, overweight, or obesity.
- Parents factors: occupation, education, obesity in parents or family

3.8 Data Quality Control

To ensure the quality of data, the data-collection form will be prepared in English and translated into Arabic. The Arabic version will be checked for clarity and appropriateness before the start of data collection.

The weighing scale will be checked and calibrated before use, and height-measuring equipment will be positioned on a flat surface.

Weight and height measurements will be taken using standardized procedures. Completed data-collection forms will be reviewed daily for completeness, accuracy and consistency. Data will be checked for missing values and entry errors before analysis.

3.9 Data Analysis

Data will be entered, cleaned and analysed using Statistical Package for the Social Sciences (SPSS).

Descriptive statistics will be used to summarize the data. Age, weight, height, BMI and BMI-for-age Z-scores will be summarized using mean and standard deviation, or median and interquartile range when appropriate. Sex and school grade will be presented using frequencies and percentages.

The prevalence of obesity will be calculated using the following formula:

(Number of children classified as obese / total number of children) × 100

The prevalence of obesity will be presented as a percentage with a 95% confidence

interval. The distribution of obesity according to sex and age group will be described using tables and figures.

A child will be classified as obese when his or her BMI-for-age is greater than +2 standard deviations according to the WHO reference for children aged 5–19 years.

4. Ethical Considerations

Ethical approval will be obtained from the Faculty of Medicine, Dongola University, and the Ethics Committee of the State Ministry of Health, before the beginning of the study. Permission to conduct the study will also be obtained from the relevant local education authority, the administrations of the selected primary schools, and local community leaders where necessary.

Written informed consent will be obtained from the parents or legal guardians of all participating children before data collection. The purpose of the study, procedures of weight and height measurement, potential benefits, and the voluntary nature of participation will be clearly explained to parents or guardians.

Children will be informed about the study in simple, age-appropriate language, and verbal assent will be obtained from children who are able to understand and agree to participate.

Participation in the study will be voluntary. Parents, guardians, or children will have the right to refuse participation or withdraw from the study at any time without any penalty or effect on the child’s education or access to health services.

Confidentiality will be maintained throughout the study. The names of participants will not be recorded on the data-collection form. Each participant will be assigned a unique identification code, and all collected information will be kept confidential and used only for research purposes.

Parents or guardians of children found to have abnormal nutritional status will be advised to seek assessment at the nearest health facility.

5. Research Plan

The research will be conducted through the following steps:

1. Preparation of the research proposal.
2. Review of relevant literature related to childhood obesity and BMI-for-age assessment.
3. Submission of the proposal for scientific review and ethical approval.
4. Obtaining administrative permission from the local education authority and selected school administrations.
5. Development, translation, and pre-testing of the data-collection form.
6. Standardization of weight and height measurement procedures.
7. Obtaining lists of eligible primary-school-age children from the selected schools.
8. Selection of study participants using the planned sampling technique.
9. Obtaining informed consent from parents or guardians and assent from participating children, where applicable.
10. Collection of demographic information and anthropometric measurements, including weight and height.
11. Calculation of BMI and BMI-for-age Z-scores using the WHO growth reference for children aged 5–19 years.
12. Data entry, cleaning, and verification of completeness and consistency.
13. Data analysis and interpretation of results.
14. Writing of the final research report.
15. Submission of the report and presentation of the research findings in a group seminar.

6. Timeline

Table 1: Timeline of the study

Activity	Sep 2026	Oct 2026	Nov 2026	Dec 2026

Activity	Sep 2026	Oct 2026	Nov 2026	Dec 2026
Submission of proposals 20–24 Sep 2026	✓			
Presentation of proposals 27 Sep–1 Oct 2026	✓	✓		
Data collection 4–22 Oct 2026		✓		
Data analysis 25 Oct–5 Nov 2026		✓	✓	
Writing results and discussion 8–19 Nov 2026			✓	
Writing the final report 22 Nov–3 Dec 2026			✓	✓

7. Estimated Budget

Table 2: Estimated budget for the study (SDG)

Item	Quantity	Unit cost (SDG)	Total cost (SDG)
Printing of consent forms	350	150	52,500
Transport	10	15,000	150,000
Communication and internet	1	25,000	25,000
Data analysis	1	30,000	30,000
Report printing and binding	5	5,000	25,000
Contingency			50,000
Grand total			**332,500**

8. References

[1] World Health Organization. Noncommunicable diseases: Childhood overweight and obesity. Accessed September 2026. Available from: https://www.who.int/news-room/questions-and-answers/item/noncommunicable-diseases-childhood-overweight-and-obesity

[2] World Health Organization. Obesity and overweight. WHO Fact Sheet. Accessed September 2026. Available from: https://www.who.int/news-room/fact-sheets/detail/obesity-and-overweight

[3] Adom T, Kengne AP, De Villiers A, Puoane T. Prevalence of overweight and obesity among African primary school learners: a systematic review and meta-analysis. Obes Sci Pract. 2019 Aug 20;5(5):487-502. doi: 10.1002/osp4.355. PMID: 31687173; PMCID: PMC6819980.

[4] Salman Z, Kirk GD, Deboer MD. High Rate of Obesity-Associated Hypertension among Primary Schoolchildren in Sudan. Int J Hypertens. 2010 Dec 22;2011:629492. doi: 10.4061/2011/629492. PMID: 21234364; PMCID: PMC3014717.

[5] Nagwa MA, Elhussein AM, Azza M, Abdulhadi NH. Alarming high prevalence of overweight/obesity among Sudanese children. Eur J Clin Nutr. 2011 Mar;65(3):409-11. doi: 10.1038/ejcn.2010.253. Epub 2010 Nov 10. PMID: 21063434.

[6] Hussein MD, Alonazi NA, Mohamed S. Prevalence of obesity, overweight, underweight, and stunting among school children in Argo city, Northern Sudan. Sudan J Paediatr. 2018;18(2):15-19. doi: 10.24911/SJP.106-1544799078. PMID: 30799893; PMCID: PMC6378581.

[7] Alzain MA, Abdelaziz MO, Mustafa AE, Elsheikh M. Prevalence and determinants of underweight, overweight, and obesity among adolescent secondary school students in Dongola City, Northern Sudan in 2019. Int J Community Med Public Health. 2022;9(8):3106-10.

[8] Mosha MV, Msuya SE, Kasagama E, Ayieko P, Todd J, Filteau S. Prevalence and correlates of overweight and obesity among primary school children in Kilimanjaro, Tanzania. PLoS One. 2021 Apr 22;16(4):e0249595. doi: 10.1371/journal.pone.0249595. PMID: 33886578; PMCID: PMC8061999.

9. Annexes

The following annexes will be used during the implementation of the study:

Annex 1: Data Collection Form.

Annex 2: Parent/Guardian Informed Consent Form.

Annex 3: Child Assent Form, where applicable.

Annex 1: Data Collection Form

Title of the Study:
Prevalence of Obesity among Primary School Children in Jertude Village, Dongola Locality, Northern State, Sudan, 2026

Participant Code: _____

Date of Data Collection: ____ / ____ / _____

School Name: _____

School Grade: _____

Section A: Demographic Information

Age in completed years: _____ years

Sex: ☐ Male ☐ Female

Section B: Anthropometric Measurements

Weight: _____ kg

Height: _____ cm

Height in metres: _____ m

BMI: _____ kg/m²

BMI-for-age Z-score: _____

Table 3: Nutritional status classification according to the WHO BMI-for-age reference

Tick	Nutritional status	BMI-for-age (WHO reference)
☐	Thinness	Below −2 SD
☐	Normal weight	−2 SD to +1 SD
☐	Overweight	Above +1 SD and up to +2 SD

Tick	Nutritional status	BMI-for-age (WHO reference)
☐	Obesity	Above +2 SD

Data collector’s code/name: _____

Signature: _____

Annex 2: Parent/Guardian Informed Consent Form

نموذج الموافقة المستنيرة لولي الأمر/الوصي

عنوان الدراسة

مدى انتشار السمنة بين أطفال المدارس الابتدائية في قرية جيرتود، محلية دنقلا، الولاية الشمالية ، السودان، 2026م

عزيزي/عزيزتي ولي الأمر أو الوصي،

نحن نقوم بإجراء دراسة بعنوان:

«مدى انتشار السمنة بين أطفال المدارس الابتدائية في قرية جيرتود، محلية دنقلا، الولاية الشمالية، السودان، 2026م».

تهدف هذه الدراسة إلى معرفة مدى انتشار السمنة بين الأطفال في سن المرحلة الابتدائية في قرية جيرتود، شمال السودان.

إذا وافقت على مشاركة طفلك/طفلتك في هذه الدراسة، سيقوم الباحث بجمع بعض المعلومات الأ ساسية عن الطفل، مثل العمر، الجنس، الصف الدراسي. كما سيتم قياس وزن الطفل وطوله فقط.

لن يتم أخذ أي عينة دم من الطفل، ولن يتم إعطاؤه أي حقن أو أدوية، ولن يتعرض لأي إجراء طبي مؤلم أو تدخلي أثناء الدراسة.

إن مشاركة طفلك في هذه الدراسة اختيارية تمامًا. لك الحق في رفض مشاركة طفلك، أو سحبه من الدراسة في أي وقت دون أي عقوبة أو ضرر. كما أن رفض المشاركة أو الانسحاب من الدراسة لن يؤثر على تعليم الطفل، أو حضوره للمدرسة، أو حصوله على أي خدمات صحية.

لن يتم تسجيل اسم الطفل في استمارة جمع البيانات، بل سيتم استخدام رقم أو رمز خاص بـ المشارك. وستُحفظ جميع المعلومات بسرية تامة، ولن تستخدم إلا لأغراض البحث العلمي و الدراسة الأكاديمية.

إذا كنت قد فهمت المعلومات المذكورة أعلاه ووافقت على مشاركة طفلك/طفلتك في هذه الدراسة، يرجى التوقيع أو وضع بصمة الإبهام في المكان المخصص أدناه.

إقرار الموافقة

أنا أقر بأنني قرأت المعلومات السابقة، أو تم شرحها لي بصورة واضحة، وأنني فهمت هدف الدراسة وإجراءاتها. كما أوافق طوعًا على مشاركة طفلي/طفلتي في هذه الدراسة.

اسم ولي الأمر/الوصي:

.....

صلة القرابة بالطفل:

.....

اسم الطفل/الطفلة أو رمز المشارك:

.....

توقيع ولي الأمر/الوصي أو بصمة الإبهام:

.....

التاريخ:

.... /.... /.....

اسم الباحث:

.....

توقيع الباحث:

.....

التاريخ:

.... /.... /.....