

# Obesity in University Settings: Study of Body Mass Index (BMI) and Body Fat Percentage among Students at Gaston Berger University of Saint-Louis in 2025

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## Abstract

**Objective:** Determining the frequency of obesity within the student population is crucial to anticipating the prevention of chronic diseases among future adult populations. This study aimed to assess the prevalence of obesity among university students. **Methods:** A cross-sectional descriptive study was conducted from February 14 to March 3, 2025, on the social campus of Gaston Berger University of Saint-Louis. Obesity was assessed using two anthropometric approaches: the Quetelet Body Mass Index (BMI) and body fat estimation using the Deurenberg formula. **Results:** A total of 800 students were included in the study. The population was predominantly male (59.2%) with a mean age of  $23.0 \pm 2.9$  years. Regarding lifestyle habits, 7.4% of participants reported tobacco use, and 3.0% reported alcohol consumption. The prevalence of overweight and obesity was 7.0% and 2.1%, respectively, based on BMI, and 5.2% and 1.0% based on body fat percentage. **Conclusion:** Obesity appears to be relatively uncommon in this student population, although isolated cases of overweight and obesity are notable. The study also highlighted a non-negligible proportion of underweight individuals. To combat all forms of malnutrition, targeted nutritional education and awareness strategies for students should be strengthened.

## Keywords

Body Mass Index, Body Fat, Obesity, Students, Senegal

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## 1. Introduction

Obesity is a major public health issue [1]. It is characterized by an excessive amount of body fat and is both statistically and clinically associated with the onset of numerous diseases, particularly cardiovascular diseases [2]. Indeed, 80% of type 2 diabetes cases are linked to obesity [3], 5.4% of new cancer cases in adults over 30 in France are attributable to obesity [4], and obesity is a major risk factor for cardiovascular diseases, which account for 38% of premature deaths due to non-communicable diseases [5].

This condition is generally caused by nutritional imbalance [6]. It develops when daily energy intake exceeds daily energy expenditure. Foods high in fat, ultra-processed products, sugary items, fast food, pastries, and sweets are among the most incriminated [7].

Globally, the obesity prevalence rate is estimated at 12.5% [8]. It is now recognized as an epidemic by the World Health Organization (WHO). Both developed and developing countries are affected by this condition. The obesity epidemic also has significant economic consequences. Without appropriate measures, the global costs related to overweight and obesity could reach 3 trillion USD per year by 2030 and exceed 18 trillion by 2060 [9].

In Africa, the obesity prevalence is estimated at 8% [10]. The continent, undergoing an epidemiological transition, is facing the emergence of chronic diseases while still dealing with persistent infectious diseases. Several studies have reported high prevalence rates of obesity. Indeed, Rotich *et al.* (2023) observed a prevalence rate of 19.6% among university students in Kenya. Additionally, prevalence rates of 36.8% and between 25.3% and 59.4% have been reported in Botswana and Egypt, respectively [11].

In Senegal, non-communicable diseases account for 51% of adult deaths. According to the 2024 STEPS survey, the obesity prevalence rate in the Senegalese population is 10.1%, up from 6.4% in 2015 [12].

However, few local studies have explored obesity among university students, despite them representing a key demographic for national development. Upon entering university, students gain autonomy over their diet and tend to adopt eating behaviors that may negatively impact their health. Investigating their nutritional status helps to anticipate health risks in the future adult population and supports the development of targeted prevention policies.

## 2. Study Method

### 2.1. Type of Study

A descriptive cross-sectional study was conducted in February 2025 among residents of Gaston Berger University of Saint-Louis.

### 2.2. Selection Criteria

Inclusion criteria:

To be eligible, participants must reside on the social campus of UGB, hold a valid student ID card or a certificate of enrollment for the current academic year, and be present in their room at the time of data collection.

Exclusion criteria:

Refusal to participate in the study, being unavailable or unfit (due to illness).

### 2.3. Sampling

The sample size was calculated using the Schwartz formula:

$$N = (Z\alpha^2 \times p \times q) / d^2$$

with the following parameters:

Standard normal deviate ( $Z\alpha$ ) = 1.96 for a 5% margin of error

Assumed prevalence ( $p$ ) = 50%

Precision ( $d$ ) = 5%

The minimum sample size obtained was 385 students, rounded to 400. This number was then multiplied by 2 to account for the cluster effect used in the data collection process, bringing the final sample size to 800 students.

A three-stage sampling plan was implemented:

First stage: The survey exhaustively covered all student housing sites on campus.

Second stage: Selection of rooms to be surveyed. The number of rooms per village was determined based on each village's accommodation capacity and population distribution by sex. A list of random numbers was generated using the "RANDBETWEEN" function in Microsoft Excel to select the rooms.

If no occupants were present, the investigator returned to the room until the students were available.

If all occupants of a room refused to participate, the room was replaced by the next available one.

Third stage: Selection of students. One student was selected per chosen room. If several residents met the inclusion criteria, a random draw was conducted.

Data Collection Tools

The questionnaire consisted of two parts: one on socio-demographic information and the other on anthropometric measurements.

The questionnaire was digitized in XML format using the Open Data Kit (ODK) application and installed on electronic tablets. A trained team of investigators was deployed in the field to collect data. Their role was to explain the study context to participants, obtain informed consent, and administer the questionnaire.

Electronic weighing scales (SECA 803) were used, with a maximum capacity of 150 kg and a precision of 100 grams.

#### Operational Variable 1

The Body Mass Index (BMI) was categorized using the classification by Dionadji *et al.*, 2016, as follows:

$BMI < 18.5 \text{ kg/m}^2$  = Underweight

$18.5 \leq BMI < 24.9$  = Normal weight

$25 \leq \text{BMI} < 29.9 = \text{Overweight}$

$\text{BMI} \geq 30 = \text{Obesity}$  [13]

### Operational Variable 2

Body fat percentage was estimated using the Deurenberg formula [14]:

$$\text{Body Fat (\%)} = (1.20 \times \text{BMI}) + (0.23 \times \text{Age}) - (10.8 \times \text{Sex}) - 5.4$$

where, BMI = weight (kg)/height<sup>2</sup> (m<sup>2</sup>), Age = age in years, Sex = 1 for males, 0 for females. The following scale was used to interpret the results.

Sex	Body fat (%)	Interpretation
Men	<8%	Underweight
	8% - 20%	Normal
	20% - 25%	Overweight
	>25%	Obesity
Women	<21%	Underweight
	21% - 33%	Normal
	33% - 39%	Overweight
	>39%	Obesity

## 2.4. Data Processing and Analysis

The collected data were exported to an Excel file, then cleaned and analyzed using the R software. Descriptive analysis of the questionnaire variables included identifying outliers along with the median, and calculating means with standard deviations. For qualitative variables, both absolute and relative frequencies were calculated.

## 2.5. Ethical Considerations

Participants were informed about the framework and objectives of the study. They were also made aware that they had the right to refuse participation without facing any risk or consequence. Informed consent was obtained from each participant and formalized through the signing of a consent form.

The data collected are anonymous and may only be used by members of the research team. No financial incentive was involved in participation in this study.

## 3. Results

### Sociodemographic Characteristics

A total of 800 students were included in this study. The mean age of participants was  $23 \pm 2.9$  years, with extremes ranging from 17 to 45 years. The sex ratio was 1.5 in favor of males. Furthermore, 95.1% of surveyed students were single. Tobacco consumption was reported by 7.4% of participants, while 3.0% reported consuming alcohol. The full set of sociodemographic characteristics is presented in **Table 1**.

The analysis of anthropometric parameters showed a mean weight of  $61.2 \pm$

10.8 kg and a mean height of  $1.70 \pm 0.10$  meters. The average BMI was  $20.5 \pm 3.4$  kg/m<sup>2</sup>. These results are detailed in **Table 2**.

**Table 1.** Sociodemographic characteristics of participants.

	Absolute frequencies (n)	Relatives frequencies (%)
<b>Sex</b>		
Men	474	59.2
Women	326	40.8
<b>Marital status</b>		
Single	761	95.1
Married	38	4.8
Divorced	1	0.1
<b>Tobacco use</b>		
Yes	59	7.4
No	741	92.6
<b>Alcohol use</b>		
Yes	24	3.0
No	776	97.0

**Table 2.** Anthropometric parameters of participants.

	Mean	SD	Minimum	Median	Maximum
<b>Age (years)</b>	23	2.9	17	23	45
<b>Weight (kg)</b>	61.2	10.8	30.0	60.0	98.0
<b>height (m)</b>	1.7	15.6	1.3	1.7	2.0
<b>BMI (kg/m<sup>2</sup>)</b>	20.5	3.4	9.9	20.1	35.7

According to the Quetelet classification, 62.4% of participants had a normal weight, while 28.5% were underweight and 9.1% were overweight. Among the overweight group, 23.3% were classified as obese, and 76.7% as overweight.

The sex-disaggregated BMI analysis revealed that although 51.8% of overweight individuals were male, 76.4% of those with obesity were female. These results are summarized in **Table 3**. In the table, excess weight is defined as the combined total of overweight and obesity.

**Table 3.** Distribution of BMI by sex of participants.

	Underweight (%)	Normal (%)	Overweight (%)	Obesity (%)	Excess weight (%)
<b>Male</b>	115 (50.4)	326 (65.3)	29 (51.8)	4 (23.5)	33 (45.2)
<b>Female</b>	113 (49.6)	173 (34.7)	27 (48.2)	13 (76.5)	40 (54.8)
<b>Total</b>	228 (100)	499 (100)	56 (100)	17 (100)	73 (100)

The average body fat percentage estimated using the Deurenberg formula was  $24.3\% \pm 6.8\%$  for females and  $13.8\% \pm 6.1\%$  for males.

The sex-disaggregated body fat analysis showed that 89.9% of men and 66.4% of women had a normal body fat percentage. Details are provided in **Table 4**.

**Table 4.** Distribution of body fat percentage by sex of participants.

Indicator	Men (%)	Women (%)
Underweight	18 (3.8)	83 (0.4)
Normal	426 (89.9)	223 (66.4)
Overweight	25 (5.2)	17 (5.2)
Obesity	5 (1.0)	3 (0.92)

## 4. Discussion

### Sociodemographic Characteristics

The study population was relatively young, with a mean age of 23 years, and predominantly male (59.2%), yielding a sex ratio of 1.5 in favor of men. This male predominance in university enrollments is not unique. Similar findings were reported in other sub-Saharan African contexts, such as a study in Benin where male students represented 64.3% of the university population compared to 35.7% for females [15], and in Cameroon, where a health survey at the University of Yaoundé I found that men made up 61% of the student population [16].

These data reflect persistent gender disparities in access to higher education, although significant progress has been made in female enrollment over the past decade. According to UNESCO, the proportion of women in sub-Saharan university enrollment increased from 29% in 2000 to nearly 42% in 2020, thanks to equity and gender-promotion policies [17]. However, notable disparities remain across fields of study, with science, medical, and technical fields still largely male-dominated in many countries. The gender composition of the sample may therefore reflect both persistent structural inequalities and a gradual shift toward better gender parity.

The low reported rates of tobacco (7.4%) and alcohol (3.0%) consumption align with trends seen in regional studies, where religious and cultural norms especially in Muslim-majority countries like Senegal strongly limit such behaviors among young adults [18]. This suggests that the sociocultural context continues to play a protective role against certain health-risk behaviors. However, this should be interpreted with caution. Prior studies have highlighted underreporting, especially in settings with strong social or religious norms where tobacco and alcohol use may be seen as morally unacceptable [19]. This social desirability bias could lead to an underestimation of risky behaviors, reinforcing the need for more robust methodological approaches in future surveys.

### Anthropometric Parameters and BMI

The mean student weight was 61.2 kg and mean height was 1.70 m, with an average BMI of  $20.5 \text{ kg/m}^2$ , indicating overall good nutritional status. However, a

significant 28.5% of participants were underweight. This high rate may reflect dietary deficiencies, limited access to balanced food, or inadequate eating behaviors often linked to the university context (stress, irregular meals, poor food choices).

Conversely, 9.1% of students had excess weight, including 2.1% classified as obese. These results reveal the double burden of malnutrition undernutrition and overnutrition an increasingly observed phenomenon in countries undergoing nutritional transition.

For instance, in Mauritania, the prevalence of obesity among medical students at the University of Nouakchott was reported at 3.3% [20], and at Joseph Ki-Zerbo University in Burkina Faso, 4.3% of students were classified as obese [21], both higher than the present study.

#### Sex Differences

The sex-disaggregated BMI analysis revealed that while overweight was slightly more common among men (51.8%), obesity was significantly more prevalent among women (76.4% of all obese participants). This trend, also observed in other African studies [22], may be explained by biological, sociocultural, and behavioral differences for instance, the cultural valorization of curvier female bodies, or differing dietary and physical activity patterns between men and women.

#### Body Fat Estimation

Body fat estimated using the Deurenberg formula yielded a mean of 24.3% in women and 13.8% in men, which is expected, as women naturally have a higher fat mass [23].

Importantly, most students 89.9% of men and 66.4% of women had normal body fat levels, which is reassuring. This finding also confirms that BMI alone can be misleading when evaluating nutritional status, especially in women, for whom body fat is naturally higher even at the same BMI [14].

While the present study highlights the high prevalence of underweight among students, this phenomenon may reflect broader structural challenges, particularly related to campus-based food insecurity and inadequate dietary practices. Several studies have shown that university students, especially in low- and middle-income countries, often face economic constraints that limit access to balanced and sufficient nutrition [24] [25]. In the context of Senegal, a qualitative study by Ndiaye *et al.* (2021) [26] revealed that many students rely on low-cost, energy-dense foods, often skipping meals due to financial difficulties. These patterns, combined with academic stress and irregular eating schedules, contribute to undernutrition despite the assumption that university students represent a relatively advantaged population. Addressing underweight in this population therefore requires a multidimensional approach, including nutritional support policies and student-centered food security programs.

The coexistence of high rates of underweight and a notable fraction of excess weight underscores the need for targeted nutritional interventions. On the one hand, it is crucial to combat undernutrition through the promotion of accessible, balanced diets. On the other hand, obesity prevention, particularly among

women, should be strengthened via culturally sensitive awareness programs.

## 5. Conclusions

This study, conducted in 2025 among students at Gaston Berger University of Saint-Louis, highlights a dual nutritional challenge, marked by the coexistence of a high rate of underweight (28.5%) and a notable prevalence of excess weight (9.1%), including 2.1% classified as obese based on BMI and 1.0% based on body fat percentage.

Although the prevalence of obesity remains relatively low in this young population, the presence of isolated cases, particularly among female students, points to the importance of not overlooking this emerging trend in university settings.

The findings also show that most students have a normal body fat percentage, which is encouraging. However, the significant level of underweight observed may reflect difficulties in accessing balanced nutrition or inadequate eating habits.

In the face of this double burden of malnutrition, it is essential to strengthen prevention strategies and nutritional education, specifically targeting university students, while taking into account the cultural and economic realities of the academic environment.

Looking ahead, it would be relevant to complement this research with longitudinal studies and to use more precise methods of body composition assessment in order to better understand the evolution of dietary behaviors and their impact on student health.

## Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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