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Poor Eating Habits are the Primary Factor in Obesity - Induced NCD Vulnerability in Young Gabonese Adults

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Abstract: We previously reported obesity as an important behavioural risk factor for chronic non-communicable diseases (NCDs), which are increasingly prevalent among young, active populations in Gabon (Ongali et al., 2020). However, which one among lifestyle and diet remains the most responsible for the development of obesity is still debated. Herein, we investigate the relative impact of sedentary lifestyles versus poor dietary habits on obesity development within a university setting. Our findings reveal obesity rates of 18% among male students and 27% among female students. The data highlight that while physical inactivity contributes to weight gain, poor dietary habits, characterized by high consumption of fast food and sugary beverages, alongside irregular meal patterns, are the predominant drivers. These results suggest that dietary choices are the primary factor increasing NCD vulnerability among young Gabonese adults. This study calls on public health authorities to carry out awareness campaigns and take steps to combat obesity among young people to prevent NCD.

Keywords: Obesity, NCD, BMI, % muscle, % fat, metabolic aging

INTRODUCTION

Obesity is a complex, multifactorial condition characterized by the excessive accumulation of body fat (Gupta et al., 2011; Goossens, 2017; Lin & Li, 2021). It is well-established that obesity significantly increases the risk of non-communicable diseases (NCDs), such as Diabetes, hypertension, stroke and myocardial infarction, which are increasingly prevalent among young working populations globally (WHO, 2002; Ongali et al., 2020; Hildebrand and Pfeifer, 2025); Consequently, obesity has emerged as a critical public health challenge across sub-Saharan Africa (Scott et al., 2013; Steyn & Mchiza2014).

In Gabon, both national surveys and regional studies confirm that poor dietary habits and reduced physical activity are primary drivers of weight gain (Ongali et al., 2020; Steyn & Mchiza, 2014). Active young adults are particularly vulnerable to these trends due to rapid urbanization, lifestyle shifts, and dietary transitions (Popkin, 1999; Hawkes et al., 2017). While both sedentary behaviour and poor nutrition contribute to the rising incidence of NCDs, understanding the independent impact of each factor is essential for developing effective counterstrategies.

However, evaluating these parameters separately in the active workforce remains challenging, as time constraints often limit participation in structured physical activity (Edmunds et al., 2013). In contrast, university students represent a unique study group; while they often have access to sports facilities, their lifestyles remain precarious due to limited financial resources, academic stress, and the accessibility of inexpensive, calorie-dense foods (Almoraie et al., 2024). Addressing nutritional issues and eating behaviours among university students: a narrative review. *Nutrition research reviews*, 1-16. Their lifestyle is characterized by high prevalence of fast-food consumption, often linked to affordability and convenience, increased intake of sugary drinks and snacks during study sessions, irregular meal patterns, with many students skipping breakfast and compensating with calorie-dense foods later in the day. These rising cases of overweight and obesity are reported in student health services (Almoraie et al., 2024). From a physiological perspective, such a kind of poor lifestyle promotes the accumulation of visceral adipose tissue, which increases the intima-media thickness (IMT) of vessels (Qu and Qu 2015; Farb and Gokce, 2015). This intra-abdominal fat releases free fatty acids directly into the portal vein. This process exposes the liver to high concentrations of fatty acids and pro-inflammatory factors, leading to metabolic complications and the onset of NCDs. Therefore, while overweight and obesity are multifaceted public health issues, students who engage in regular physical activity provide an ideal cohort to isolate and evaluate the specific effects of poor eating habits, independent of a sedentary lifestyle. We then examined and compared weight proportions and obesity rates among age-matched young women and men from the Université des sciences de la santé who practiced regular sporting activities. Anthropometric indicators included body mass index (BMI), muscle percentage, fat percentage, and metabolic age.

SUBJECTS, MATERIALS AND METHODS

Ethical Considerations and Study Population

All experiments were conducted in accordance with the ethical standards of the Ethics Committee of the Université des Sciences de la Santé de Libreville and the national guidelines of the Gabonese Republic regarding human research. Informed consent was obtained from all participants for the use of their questionnaire responses and anthropometric data, ensuring total anonymity according to Ongali et collaborator 2020. The study population consisted of Gabonese students from the Université des Sciences de la Santé, aged 18 years and older, who voluntarily visited our wellness center for body composition assessments.

Inclusion and Exclusion Criteria

To ensure a homogenous study group, the following criteria were applied:

- Inclusion Criteria: Gabonese nationality; active student status at the Université des Sciences de la Santé; apparent good health; and a consistent physical activity routine (approximately 4 days per week).
- Exclusion Criteria: Pregnancy (verified via OMRON medical device protocols); age under 18; smoking or chronic alcohol consumption; and a history of diagnosed non-

communicable diseases (NCDs), such as hypertension, diabetes, hypercholesterolemia, or stroke.

Data Collection and Anthropometric Measurements

Data collection took place between December 2024 and March 2025. Anthropometric measurements followed the standardized procedures described by Ongali et al. (2020) and the Food and Nutrition Technical Assistance (FANTA) Anthropometric Indicators Measurement Guide. After completing a questionnaire on dietary habits and lifestyle, subjects' body composition was analyzed using an OMRON Body Composition Monitor BF511 (OMRON, Paris, FRANCE). Physical activity was a primary screening factor; participants who did not meet the minimum requirement of 4 days of activity per week were excluded from the final analysis.

Statistical Analysis

Due to the limited sample size, data for male and female subjects were pooled. Results are expressed as Mean ± SEM (Standard Error of the Mean). Statistical analyses were performed using GraphPad Prism 8.1.2. Unpaired Student's t-tests were used for group comparisons, with a significance threshold set at $p < 0.05$.

RESULTS AND DISCUSSION

Participant Characteristics

A total of 120 students were initially screened, with 113 meeting the inclusion criteria for analysis. Due to the small sample size of the study population, we have pooled male and female data since the aim of the study was to examine the effects of poor eating habits on a physically active population.

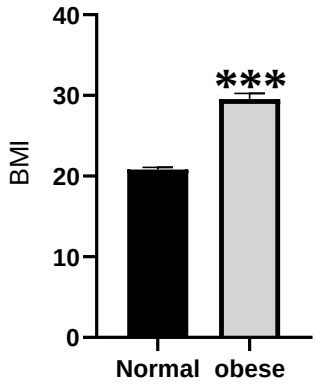

Figure 1: BMI of all males and females in the study

The male and female students screened were classified according to their BMIs. Normal subjects (in black) had a BMI of around 20.80±2.38, and overweight subjects (in gray) had a BMI of 29.55±3.57

However, from the 113 students retained, among these, 24 subjects (21.2%), comprising 17 women and 7 men, were classified as overweight or obese based on their Body Mass Index (BMI). The mean BMI was 20.80 ± 0.66 for the normal group compared to 29.55 ± 0.65 for the overweight group ($p < 0.001$). No significant differences were observed between the groups regarding height (1.61 ± 0.09 vs. 1.70 ± 0.09 m) or biological age (20.42 ±3.14 vs. 21.13 ± 2.46 years), ensuring that weight-related differences were not biased by these factors (data not shown).

Body Composition and Metabolic Aging

Overweight subjects harboured a significant physiological shift characterized by a marked decrease in muscle mass (Figure 2A) as well as a significant increase in total body fat (Figure 2B) and visceral fat (Figure 2C).

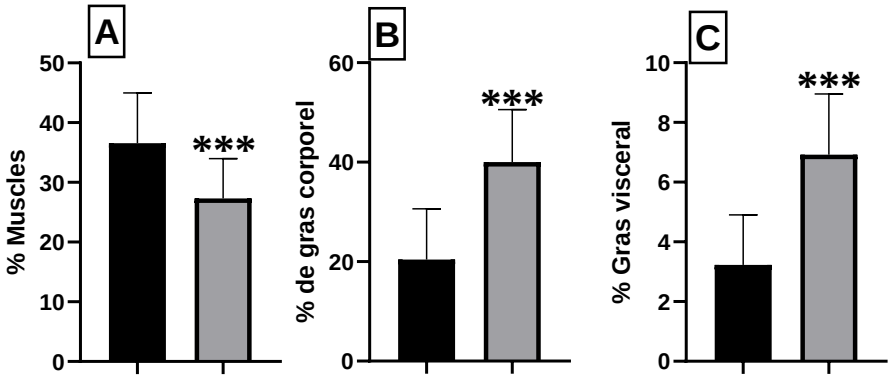

Figure 2: Percentage of muscle, body fat, and visceral fat in screened students

Students (male and female) screened as overweight (grey histogram) showed a low percentage of muscle (A) while their percentages of body fat (B) and visceral fat (C) were high. *** P<0.001

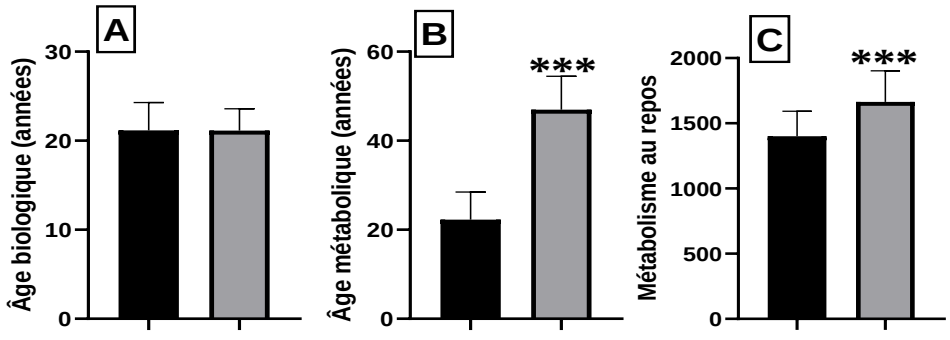

Figure 3: Biological age, metabolic age, and resting metabolic rate in screened students

Students (male and female) who were screened as overweight (gray histogram) exhibited a higher metabolic age (B) and basal metabolic rate (C), despite having the same biological age (A) as their peers with a normal BMI. *** P<0.001

A critical finding was the discrepancy between biological and metabolic ages. Indeed, while subjects with a normal BMI showed a metabolic age consistent with their biological age (20.42 ± 3.14 vs. 21.27 ± 4.81 years), overweight subjects exhibited a metabolic age significantly higher than their biological age (32 ± 6 years; Figure 3A and B). These findings suggest accelerated metabolic aging in overweight students, reflecting potential dysfunction in nutrient metabolism (Ongali et al., 2020). This is further supported by the significantly higher resting metabolic rate (RMR) observed in overweight subjects compared to their normal-weight peers (Figure 3). Essentially, at rest, overweight individuals require more energy to maintain basic organ function, despite having similar lean mass or daily protein requirements as subjects with a normal BMI.

Dietary Habits and Lifestyle Patterns

Assessment of dietary behaviours revealed a significant disparity between the two groups. While 38% of participants with a normal BMI reported suboptimal eating habits, this prevalence rose sharply to 62% among overweight individuals. Specific dietary triggers identified in the overweight cohort included high intake of refined sugars and sugar-sweetened beverages (Te Morenga et al., 2013), frequently consumed during study sessions, irregular meal frequency and chronic snacking, and high-calorie intake, often associated with late-night (nocturnal) consumption etc.

Regarding lifestyle patterns, unhealthy behaviours were observed in 12% of overweight subjects compared to 8% of the normal BMI group. These behaviours were primarily characterized by sedentary-leaning tendencies such as adhering only to the minimum physical activity requirement of four days per week and disrupted circadian rhythms, notably sleep deprivation with bedtimes consistently exceeding midnight.

The significant discrepancy between biological and metabolic age in overweight students (32± 6 years vs. 21.13 ± 2.46 years) can be largely attributed to the observed nutritional and lifestyle dysregulation. The high prevalence of poor eating habits among overweight individuals (62%) suggests a state of chronic metabolic stress. The frequent consumption of sugar-sweetened beverages and high-calorie snacks, particularly during study sessions, leads to repeated glycemic spikes. When combined with late-night eating, these habits interfere with the body's natural fasting state and lipid metabolism. These behaviours likely contribute to the accumulation of visceral fat (Figure 2C), which is metabolically active and pro-inflammatory. This internal fat deposition explains why overweight subjects exhibit an "older" metabolic profile; their organs are forced to process excessive caloric loads during periods (such as late at night) when the body is physiologically prepared for rest and repair. The lifestyle data revealed that overweight students were more likely to suffer from sleep deprivation (sleeping past midnight). Scientific literature consistently links late bedtimes and shortened sleep duration to hormonal imbalances, specifically involving cortisol and ghrelin, which increase appetite and promote fat storage. Furthermore, the fact that these students met the minimum physical activity requirement

(4 days/week) but still exhibited signs of metabolic aging suggests a "compensation effect." The high caloric intake and late-night sedentary study habits appear to outweigh the benefits of their exercise routines. This explains the paradoxical finding of a higher Resting Metabolic Rate (RMR) in the overweight group: their systems are struggling to maintain homeostasis under the burden of poor nutrition and disrupted circadian rhythms, effectively "wearing out" the metabolic machinery at an accelerated rate. This study highlights a notable prevalence of overweight (21.2%) among the student population at the Université des Sciences de la Santé, despite reported regular physical activity. Our findings demonstrate that excess body weight, even in young adults, is associated with profound alterations in body composition, specifically a reduction in muscle mass and an accumulation of visceral fat, leading to premature metabolic aging.

The most striking finding is the evidence of that physical activity alone is insufficient to counteract the negative metabolic effects of poor nutrition and irregular sleep patterns, yet observed elsewhere (Chaput, 2014; Chaput et al., 2023; Chomiuk et al., 2024). These findings suggest that poor eating habits are the primary factor contributing to obesity (Kuźbicka and Rachoń, 2013), constituting the risk for early-onset non-communicable diseases. There is then an urgent need for institutional health programs that emphasize nutritional education and sleep hygiene alongside physical exercise to preserve the metabolic capital of the student population.

Table 1: Bad dietary habits vs Bad lifestyle

	Bad dietary habits	Bad lifestyle
Normal	38%	8%
obese	62%	12%

CONCLUSION

Physical activity alone is insufficient to counteract the negative metabolic effects of poor nutrition and irregular sleep patterns. These findings suggest that the future healthcare professionals of Gabon are at risk for early-onset non-communicable diseases. There is an urgent need for institutional health programs that emphasize nutritional education and sleep hygiene alongside physical exercise to preserve the metabolic capital of the student population.

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