AJND Reports
African Journal of Nutrition and Dietetics

https://doi.org/10.58460/ajnd.v5i03.211

RESEARCH ARTICLE

Metabolic and Lifestyle Characteristics of Abdominal Obesity in Urban Areas of Togo

Hèzouwè MADJALANI[*1,2,3,4], Kafui C. KOUASSI[1,2,5], Komlanvi F. GBEASOR[1], Tchagbélé OURO-BERE[1,2,7], Kossi METOWOGO[4], Mouawiyatou BOURAIMA[8], Midassirou BEBOU[8]

Author Affiliation(s)

[1] Department of Biochemistry, Faculty of Sciences, University of Lomé (Togo)

[2] Laboratory of Biomedical, Agri-Food, and Environmental Health Sciences (LaSBASE) - University of Lomé, Lomé, Togo

[3] Biomedical Laboratory of the WOSSINU ET GBOGBO POLYCLINIC, Lomé, Togo

[4] Department of Animal Physiology and Pharmacology

[5] Campus University Hospital Center - Biochemistry Unit, Lomé, Togo

[6] Department of Public Health, University of Lomé, Lomé, Togo

[7] Sylvanus Olympio University Hospital Center - Biochemistry Unit, Lomé, Togo

[8] Nutrition Division of the Ministry of Health

*Corresponding Author: ismaeltchedre981@yahoo.fr

Submitted: 15th March 2026 | Accepted 1st September 2026 | Published Online: 2nd November 2026

To read this paper online, please scan the QR code below:

ABSTRACT

In Togo, overweight and obesity represent a major public health challenge. This study aimed to identify factors associated with abdominal obesity to design relevant preventive approaches for the Togolese population. It was a cross-sectional study among 834 adult representatives of urban regions. The Cochran formula determined the sample size. WHO criteria defined obesity, and IDF criteria (waist circumference >80 cm for women, >94 cm for men) defined abdominal obesity (AO). Participants were black Africans aged 15-59 years from multiple localities. The link between metabolic syndrome parameters, types of obesity, and AO was evaluated by adjusted Odds Ratio test. Among 834 participants, IDF-defined abdominal obesity affected 9.1% (n=34; 95% CI: 6-12.0%) of men and 53.9% (n=247; 95% CI: 49-59) of women. Among obese subjects (n=180), AO prevalence reached 78.3% (n=124/157; 95% CI: 71.1-84.6) in women and 68.2% (n=15/23; 95% CI: 45.1-86.1) in men ($p<0.001$). Abdominal obesity was strongly associated with hypertension in men (OR=12.00; 95% CI: 1.15-159.55; p=0.010). Type I obesity predominated (56.67%), with metabolic parameters worsening with severity; systolic blood pressure and triglycerides rose progressively from type I to III. This study provides essential data on general and abdominal obesity prevalence in Togo and highlights the importance of a sex-differentiated approach in prevention and management to optimize clinical outcomes and improve population cardiovascular health.

Keywords: *Abdominal obesity, Metabolic syndrome, Physical activity, Togo*

How to Cite this Article: MADJALANI, H., KOUASSI, K. C., FIFONSI GBEASOR, K., OURO-BERE, T., METOWOGO, K., BOURAIMA, M., & BEBOU, M. (2026). Metabolic and Lifestyle Characteristics of Abdominal Obesity in Urban Areas of Togo. *African Journal of Nutrition and Dietetics*, 5(03). 467-477. https://doi.org/10.58460/ajnd.v5i03.211

This open access article is published by MJ&M Biolabs, Kenya © 2026 The Author(s). This open access article is distributed under a Creative Commons Attribution (CC- BY-NC-SA) license.

INTRODUCTION

The imbalance between energy intake and expenditure is the fundamental mechanism underlying obesity development, regardless of individual genetic predispositions (Boirie, 2009). The World Health Organization (WHO) defines obesity as an abnormal or excessive accumulation of body fat that compromises health (Metzelard et al., 2021; WHO, 2025), a growing global scourge that represents a significant risk factor for cardiovascular and respiratory diseases, type 2 diabetes, hypertension, and certain cancers (Lauby-Secretan et al., 2019; Ngoa et al., 2001). During 2019-2022, individuals with a high body mass index were at increased risk of severe COVID-19, with higher hospitalization and mortality rates (World Obesity Federation, 2022). In 2022, 2.5 billion adults aged 18 and over were overweight, including 890 million obese, representing 43% of adults; the prevalence of overweight ranged from 31% in South-East Asia and Africa to 67% in the Americas. In Togo, the 2021 STEPS survey on risk factors for noncommunicable diseases showed that 30.8% of the population was overweight or obese (STEPS Togo, 2021). Beyond its health burden, obesity is also a global economic problem: without corrective action, its financial impact is projected to reach US$3 trillion per year by 2030 and could exceed US$18 trillion by 2060 (WHO, 2025).

Abdominal obesity, a specific form of general obesity in which excess fat is concentrated in the abdomen, is particularly dangerous because it increases the risk of type 2 diabetes, cardiovascular disease and metabolic syndrome, independently of body mass index (BMI). Its prevalence varies considerably by sex, age and diagnostic criteria: the IDF defines it as a waist circumference (WC) > 94 cm in men and > 80 cm in women. In comparison, the NCEP defines it as WC ≥ 102 cm in men and ≥ 88 cm in women (Obépi, 2012). According to the 2021 STEPS report, abdominal obesity by IDF criteria is increasingly prevalent in Togo, especially among women, whose average waist circumference (86.3 cm) already exceeds the 80 cm threshold; in Togolese hospitals, its overall prevalence reached 51.3%, with a marked disparity between men (29.4%) and women (85.2%) (Kouassi et al., 2021). However, abdominal obesity has not been characterized in the most urbanized regions, where rapid socio-economic change is directly reshaping eating habits and lifestyles (INSEED, 2025). This urban setting is particularly relevant because it is the locus of the ongoing nutrition transition in Togo, characterized by a shift from traditional diets toward energy-dense, processed foods and more sedentary lifestyles.

Which local foods or lifestyles are linked to abdominal obesity in non-hospitalized subjects? The present study aims to determine the prevalence of types of obesity and abdominal obesity, and the metabolic and lifestyle factors associated with this obesity.

METHODS

Type and duration of study

This is a cross-sectional study conducted over a period of 17 months, from October 2023 to February 2025, in several urban areas.

Selection of districts, regions, municipalities and recruitment sites

The study was conducted in the three most urbanized and/or densely populated areas of Togo. Several localities were selected using a reasoned sampling approach based on urbanization rate and population density (INSEED, 2025): the Autonomous District of Greater Lomé (DAGL, 100% urbanization), the Kara region (28.9% urbanization; municipality of Kozah 1), and the rest of the Maritime Region (density 201-600 inhabitants/km²; municipalities of Aného, Vogan and Tsévié) (Senyo, 2025). Within the DAGL, the four most populous and accessible municipalities were retained: Aflao-Gakli, Agoè-Nyivé, Adidogomé and Bè (Université Laval, 2025).

A reasoned approach based on the criteria of the availability of a market, church, and a health centre, places likely to be frequented by all age groups targeted in the study, were selected as blood sampling and anthropometric data measurement sites. Thus, in the selected municipalities of the DAGL, the University Welfare Center of Lomé (COUL) of the University of Lomé in Aflao-Gakli, the market and CMS of Démakpoe in Agoè-Nyivé, the Minister Evangelique sky Overt (MECO) church in Adidogomé, and the large market in Bè were selected. (CHP-VOGAN and CHR-TSEVIE) not far from the markets in the municipalities of Vogan and Tsévié were selected. In the municipality of Aného, the main market was selected. In Kozah1, the university hospital (CHU-Kara), the University of Kara, and the large market in Kara were used.

Biochemical tests were carried out at the medical laboratory of the Wossinu and Gbogbo Polyclinic in Lomé. Blood specimens collected in Vogan, Tsévié, and Aného were centrifuged and decanted on-site, then stored at 2-8°C and transported the same day to Lomé for analysis. Samples collected in Kara were centrifuged and decanted on-site

each day, stored at 2-8°C, and pooled for a single transport to Lomé for analysis after 4 days of data collection.

Study population

The study population consisted of subjects with abdominal obesity with or not global obesity identified from a whole population recruited during a study to establish reference values for waist circumference. All subjects met the predefined inclusion criteria.

Inclusion and exclusion criteria

Inclusion criteria: adults aged 15 to 59 years, with the cognitive ability to complete the survey questionnaires. Exclusion criteria: pregnant women; individuals with mental disorders incompatible with understanding the questionnaires; individuals whose physical condition precluded anthropometric measurement; and individuals aged 60 years or over (WHO, 2023).

Size of the study population

The size of this population was calculated to ensure demographic representativeness according to the age and sex of the population, using data from the 5th General Population and Housing Census (RGPH-5) of 2022. Based on the Togolese population of 8,095,498 inhabitants, the regional distribution of the population was taken into account (DAGL 27.03%, rest of the Maritime Region 16.63%, Plateaux 20.21%, Savanes 14.13%, Kara 12.17% and Centrale 9.82%) (INSEED, 2025). The principle of minimum study population size for determining biological reference intervals based on a 95% confidence interval from the 2.5th to the 97.5th percentile was used; i.e., 120 male and female subjects for the Central Region (Ozarda, 2020). Proportionally based on the 9.82% from the Central Region, the expected population sizes for the Kara, Maritime, and DAGL regions are 149, 203, and 330 subjects, respectively. This means that 682 subjects will be recruited, taking into account the weight of the age groups ([15 → 40 [i.e. 39.17%; [40 → 50 [i.e. 8.4%; and [50 → 60 [i.e. 4.75%). The prevalence of obesity and abdominal obesity among subjects from this population was determined. The metabolic, nutritional, and lifestyle characteristics were assessed only in participants with global obesity who also presented with abdominal obesity.

The size of the global obesity subsample that the study was expecting to have was determined using the single population proportion (Cochran formula). This formula was applied separately by sex: $n = z^2 \times p \times (1-p) / d^2$, where $z = 1.96$. The prevalence of overweight/obesity (p) in urban Togo, taken from the national survey (57.3% in women and 24.4% in men) (STEPS Togo, 2021), and the desired absolute precision, set at approximately 10%, were used (d=0.1035 for women and d=0.1036 for men). For women: $n = (1.96^2 \times 0.573 \times 0.427) / 0.1035^2 \approx 88$ participants. For men: $n = (1.96^2 \times 0.244 \times 0.756) / 0.1036^2 \approx 66$ participants; for 154 obese subjects (Ozarda, 2020).

Measurement of anthropometric and biochemical constants

Data collection was conducted by a multidisciplinary team (nurses, a senior laboratory technician, a biochemist-nutritionist, a physio-pharmacology biologist) trained in good laboratory practice per ISO 15189:2012. The questionnaire was pre-tested on 48 participants and refined accordingly, and standardized training was provided for anthropometric measurements. Data were collected by face-to-face interview (Annex 1), covering sociodemographic characteristics (age, sex, education, region of origin, ethnicity) and anthropometric variables: weight (0.5 kg precision scale), height (SECA® stadiometer, 1 cm precision), waist and hip circumference (WIN TAPE retractable tape, 1 cm precision; waist measured midway between costal margin and iliac crest, hip at the widest point), and abdominal skinfold thickness (ASFT), measured at the umbilical point with a Harpenden caliper to 0.2 mm precision, in triplicate (Kali et al., 2022). BMI was calculated as weight/height² (kg/m²), with WHO thresholds used to define overweight (>25 kg/m²) and obesity (>30 kg/m²). Resting blood pressure was measured with a Spengler® monitor.

Assessment of metabolic status through biochemical tests

Venous blood (5 mL, no additive) was collected after a 12-hour fast and decanted within 30 minutes, following ISO 15189-compliant procedures. Analyses were performed on a Mindray BS-430 automated analyzer using Mindray reagent kits, with normal/pathological multi-parameter control sera (Multi control Sera N 'Mindray' Ref: MQ (ClinChem M)162) to monitor reproducibility (Fossati & Prencipe, 1982): fasting blood glucose (glucose oxidase-Trinder), total cholesterol (cholesterol esterase/oxidase), triglycerides (lipoprotein lipase), and HDL-cholesterol (PEG-modified enzyme/α-cyclodextrin sulphate direct method); LDL-C was derived using the Friedewald formula (applicable for TG < 4 g/L).

Assessment of physical activity and dietary behavior

Dietary habits, including food group consumption and snacking, were assessed by questionnaire. The behavioural responses of AO to different food stimuli were assessed using a 5-point Likert scale. Physical activity was assessed based on the type and duration of activities practiced over the seven days preceding the interview.

Ethical considerations

The study was authorized by the Bioethics Committee for Health Research of the Ministry of Health and Public Hygiene (no. 021/2022/CBRS, 23 June 2022). Free, informed consent, including for blood sampling, was obtained from all participants, and anonymity was maintained; data were used exclusively for scientific purposes.

Data analysis

Data were entered in Microsoft Excel 2020 and analyzed using Stata 16. Continuous variables were expressed as mean ± SD and compared by ANOVA; graphs were generated with GraphPad Prism 9. Categorical variables were expressed as frequencies/percentages and compared using the chi-square or Fisher's exact test. Logistic regression assessed associations between abdominal obesity and risk factors such as hypertension, expressed as odds ratios (OR) with 95% confidence intervals. Participants with missing data on key variables were excluded from the relevant analyses. Significance was set at 5%.

RESULTS

Demographic and sociodemographic characteristics

A total of 987 participants were initially recruited; sequential application of exclusion criteria yielded the final analytic sample, as shown in Figure 1.

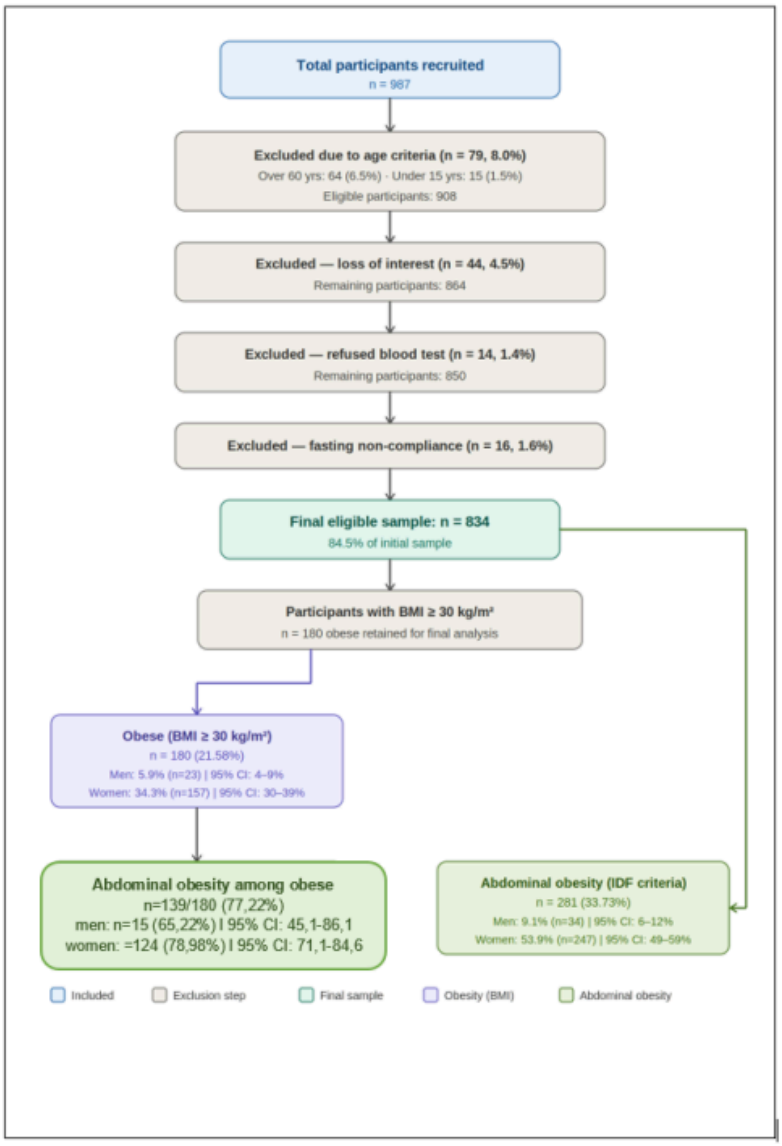


Figure 1: *The Participant Flow Diagram*

Among the 180 obese participants retained for analysis, the female/male ratio was 6.83 (7 women for 1 man); the minimum age observed was 17 years in both sexes. Participants were recruited from Greater Lomé (n=64), Kara (n=52), Vogan (n=27), Tsévié (n=19) and Aného (n=18), with the Ewe ethnic group predominating (n=94). Most obese participants were married (n=123) and had either a university education (n=48) or primary-school certification (n=47).

Prevalence of overweight, obesity and abdominal obesity

Among the 834 participants, the prevalence of overweight was 19.7% (n=164). Table 1 presents overweight, obesity and abdominal obesity prevalence by sex.

Table 1: *Demographic Characteristics of Children*

Sex					Abdominal obesity			
	Overweight		Obesity		FID		NCEP-ATP III	
	%(n)	95%IC	%(n)	95%IC	%(n)	95%IC	%(n)	95%IC
Men(n=376)	15,2 (57)	12-19	5,9 (23)	4-9	9,1 (34)	6-12	3,7 (14)	2-6
Women(n=458)	22,1 (106)	19-27	34,3 (157)	30-39	53,9 (247)	49-59	39,3 (180)	35-44
Total (n=834)	19,7 (163)	17-23	21,5 (180)	19-24	33,73 (281)	31-37	23,29 (194)	21-26

Women showed significantly higher rates of overweight (p=0.0115), obesity (p<0.0001) and abdominal obesity by both IDF (p<0.0001) and NCEP (p<0.0001) criteria.

Association between abdominal obesity and BMI

Odds ratios were used to assess the likelihood of abdominal obesity across BMI categories and its association with hypertension (Table 2).

Table 2: *Evaluation of the Degree of Association between Abdominal Obesity and Absence of Overweight, Overweight, Types of Obesity, and Hypertension*

BMI Category	Sex	n	Prevalence of Abdominal Obesity according to IDF			
			Prevalence % (n)	IC 95%	OR (IC 95%)	P
Normal	Men	296	1,7 (5)	0,6-4,0	1 (Reference)	NA
	Women	195	16,4 (32)	11,6-22,0	-	-
Overweight	Men	57	24,6 (14)	14,5-37,8	18,95 (5,98-69,65)	<0,001
	Women	106	59,4 (63)	49,4-68,9	7,46 (4,19-13,32)	<0,001
Overall Obesity	Men	23	68,2 (15)	45,1-86,1	124,71 (30,69-539,74)	<0,001
	Women	157	78,98 (124)	71,1-84,6	18,43 (10,43-32,71)	<0,001
Type I Obesity	Men	16	62,5 (10)	35,4-84,8	97,00 (21,18-462,15)	<0,001
	Women	83	95,2 (79)	88,3-98,7	100,60 (33,44-394,88)	<0,001
Type II Obesity	Men	5	80,0 (4)	28,4-99,5	232,80 (16,79-11484,25)	<0,001
	Women	45	97,8 (44)	88,5-99,9	224,12 (34,54-9101,32)	<0,001
Type III Obesity	Men	1	100,0 (1)	-	-	-
	Women	29	100,0 (29)	-	-	-
No Hypertension	Men	9 (39,1%)	33,3 (3)	7,5-70,1	1 (Reference)	NA
	Women	57	98,2 (56)	90,6-99,9	-	-
Hypertension	Men	14 (60,9%)	85,7 (12)	57,2-98,2	12,00 (1,15-159,55)	0,010
	Women	100	96,0 (96)	89,8-98,9	0,43 (0,05-3,97)	0,441

***Note**: odds ratios for small strata (e.g., type II/III obesity in men) show very wide 95% confidence intervals, reflecting small sample sizes rather than precise effect estimates, and should be interpreted with caution.*

A strong, progressive association was observed between increasing BMI and abdominal obesity in both sexes, from 1.7% (normal BMI) to 100% (type III obesity) in men, and from 16.4% to 100% in women. In the normal-weight category, women had a nearly 10-fold higher prevalence of abdominal obesity than men (16.4% vs. 1.7%). Highly significant odds ratios ($p < 0.001$) observed across type 1 and 2 obesity levels are consistent with a dose-response relationship. Hypertensive men had a 12-fold higher risk of abdominal obesity than normotensive men (OR=12.00; p=0.010), a relationship not significant in women (p=0.441), where prevalence remained high (96-98%) regardless of blood pressure status.

Cardiometabolic parameters according to degree of obesity

Comparison of anthropometric and biochemical parameters between obese men (n=23) and women (n=157) showed no statistically significant sex differences ($p>0.05$ for all variables), likely reflecting the large sample-size disparity; women nonetheless showed a numerically greater abdominal skinfold thickness (30.2 vs. 24.1 mm, p=0.0802), and hypo-HDLemia was near-universal in both sexes (>95%). Table 3 presents these parameters according to the degree (type) of obesity.

Table 3: *Cardiometabolic Parameters According to Degree of Obesity*

Variables	Type I Obesity	Type II Obesity	Type III Obesity
	Mean ± SD	Mean ± SD	Mean ± SD
ASFT (mm)	26,35 ± 7,48	31,30 ± 6,3	37,14 ± 8,97
SBP (mmHg)	134,7 ± 19,4	138,4 ± 20,62	145,8 ± 21,7
DBP (mmHg)	82,39 ± 13,8	84,1 ± 13,8	86,97 ± 12,48
FBG (g/l)	0,91 ± 0,6	1,01 ± 0,6	1,10 ± 0,5
Total cholesterol (g/L)	1,82 ± 0,5	1,82 ± 0,5	1,98 ± 0,3
HDL-cholesterol (g/L)	0,49 ± 0,2	0,49 ± 0,14	0,48 ± 0,11
Triglycerides(g/l)	1,09 ± 0,6	1,31 ± 0,7	1,46 ± 1,06

Obesity I: BMI 30-34.9 kg/m² (n=102); Obesity II: BMI 35-39.9 kg/m² (n=48); Obesity III: BMI ≥40 kg/m² (n=30)
ASFT: Abdominal skinfold thickness; SBP: Systolic blood pressure; DBP: Diastolic blood pressure; HDL: High-density lipoprotein

A progressive, dose-response relationship was observed between obesity severity and cardiometabolic risk: abdominal skinfold thickness rose linearly from 26.35±7.48 mm (type I) to 37.14±8.97 mm (type III), paralleled by worsening blood pressure (SBP 134.7→145.8 mmHg; DBP 82.39→86.97 mmHg), rising fasting glycemia (0.91→1.10 g/L) and triglycerides (1.09→1.46 g/L), while HDL-cholesterol remained stable but abnormally low (0.48-0.49 g/L) across all types. These cross-sectional findings suggest that obesity severity is associated with greater cardiometabolic risk, supporting intensive management of type III obesity in particular, although causality cannot be established from this design.

Dietary behaviors and lifestyle

Psycho-emotional eating behaviors, assessed by a 5-point Likert scale, differed by sex across five items. Food hedonism ('I enjoy eating'): slightly higher in men than women (89.5% vs. 85.2% agree/strongly agree). Satiety perception ('I am easily satisfied'): men showed a marked deficit (78.9% disagree vs. 10.5% agree), whereas women showed balanced responses (40.6% disagree vs. 40.6% agree). Meal anticipation ('I look forward to mealtimes'): lower in men (52.6% disagree) than in women, whose responses were more balanced (44.5% disagree vs. 42.2% agree). Food preoccupation ('I always think about food'): rejected by most participants of both sexes (68.4% of men, 75% of women disagree), though slightly more men endorsed it (26.3% vs. 14.8% agree). Emotional eating ('I eat more when worried/upset/anxious'): more common in women (32.8% agree vs. 53.9% disagree) than in men (21.1% agree vs. 36.8% disagree).

Physical activity patterns also differed by sex across four domains. Vigorous activity: men had a slightly lower inactivity rate than women (71.4% vs. 77.4%); among those who were active, men spent markedly more time on it daily (5h20 vs. 3h28). Moderate activity: women were less often inactive than men (73.1% vs. 78.6%) and, when active, engaged more frequently (4.17±2.71 vs. 2.67±2.01 days/week) and for longer (3h21 vs. 1h30/day). Walking: the most common activity in both sexes (71.4% of men, 63.8% of women), with women showing both greater regularity (4.57±2.16 vs. 3.4±2.37 days/week) and a slightly longer daily duration (26.4±9.69 vs. 24.0±8.22 minutes). Sedentary behaviour: men reported sitting for an average of 35 minutes over 4.5±2.6

days/week, while women reported more frequent sedentary days (5.31±3.05 days/week), suggesting a greater overall sedentary burden in women.

DISCUSSION

Sociodemographic characteristics

The 180 participants (predominantly women) were broadly representative of Togo's major ethnic groups, although the Ewe/Mina were over-represented relative to national figures (52.2% vs. 26.8%) (Université Laval, 2025), which may partly reflect geographic recruitment bias rather than ethnic representativeness alone. The predominance of obesity among married participants is consistent with reports that marriage, particularly among men, increases obesity risk (Lee et al., 2020), plausibly through post-marital behavioral changes (larger portions, more home-cooked meals, reduced activity linked to family responsibilities), although these mechanisms were not directly assessed here.

With regard to educational attainment, the high prevalence of obesity among both university and primary school participants highlights that obesity is not limited to a single socio-economic profile, but can affect various social categories. This distribution suggests a complex relationship between education and obesity, which does not follow a simple linear gradient (Anekwe et al., 2020). Among participants with low levels of education, obesity could be linked to limited access to nutritional information and socio-economic constraints that favour the consumption of processed and inexpensive foods. Conversely, among highly educated individuals, obesity may result from a sedentary lifestyle associated with office jobs, work-related stress, and, paradoxically, higher purchasing power allowing access to high-calorie foods (Mas et al., 2021); however, none of these mechanisms (stress levels or sedentary behavior) was directly measured in this study.

Distribution of obesity types and diagnostic criteria

Type I obesity predominated (56.67%), followed by types II (26.67%) and III (16.67%), consistent with international data showing moderate forms of obesity to be more common than severe forms, which nonetheless carry disproportionately higher morbidity (Flegal et al., 2016; Fleming et al., 2014). The three diagnostic criteria for abdominal obesity yielded markedly different prevalence estimates IDF (92.78%) > the threshold used in this study (87.78%) > NCEP-ATP III (80.56%), reflecting differing waist-circumference thresholds (Alberti et al., 2009; Grundy et al., 2005). Since abdominal obesity is a recognized independent predictor of cardiovascular disease and type 2 diabetes (Després, 2012), these disparities underscore the need to harmonize clinical thresholds and adapt reference criteria to the population studied, in order to standardize epidemiological comparisons and optimize screening.

Progression of cardiometabolic parameters with obesity severity

Anthropometric and metabolic parameters progressed proportionally from type I to type III obesity. Abdominal skinfold thickness rose from 26.35±7.48 mm to 37.14±8.97 mm, reflecting increasing subcutaneous and, indirectly, visceral fat accumulation, a tissue central to the pathophysiology of obesity-related metabolic complications (Després, 2012; Ross & Janiszewski, 2008), including insulin resistance and systemic inflammation, although visceral adiposity was not directly measured here. This paralleled a linear worsening of blood pressure, consistent with obesity as a major hypertension risk factor via sympathetic activation and renin-angiotensin-aldosterone dysregulation (Guerre-Millo, 2004; Pathak et al., 2007), and of the lipid profile, with rising triglycerides (+34% between extreme types, a sensitive marker of atherogenic risk possibly related to increased visceral lipolysis; Estruch et al., 2018) alongside stable but low HDL-cholesterol (Guo et al., 2017), however, neither sympathetic activity nor renin-angiotensin-aldosterone markers were assessed in this study, and this mechanism remains a plausible hypothesis.

Fasting glycemia rose by 21% from type I to type III, reflecting progressive insulin resistance, plausibly driven by pro-inflammatory adipokines (TNF-α, IL-6) secreted by visceral fat (Chevalier & Fénichel, 2016; Faucher & Poitou, 2016); none of these hormonal or inflammatory pathways was directly assayed in this study, and these interpretations remain hypotheses drawn from the literature rather than demonstrated mechanisms in this cohort. Taken together, these findings support early, severity-adapted screening for metabolic complications (Pathak et al., 2007). However, no adipokine assays were performed in this study, and this inflammatory pathway could not be directly verified in our population.

Psycho-emotional eating behaviors and lifestyle

The sex differences observed in eating behavior echo prior findings on gendered psychological and behavioral dimensions of obesity (Anekwe et al., 2020). Greater food hedonism in men, alongside a pronounced satiety deficit (78.9% disagreeing with feeling easily satisfied) and low meal anticipation, may reflect disrupted appetite-regulating hormonal signals such as leptin (Stice

& Yokum, 2016) or greater leptin resistance (Nurgül, 2016), and may favor energy overconsumption and the maintenance of male obesity (Dakin et al., 2023); however, without hormonal assays, this remains hypothetical. Women's more pronounced emotional eating in response to worry or anxiety (32.8% vs. 21.1% in men) is consistent with food being used more as an emotional-regulation mechanism in women, a recognized risk factor for female obesity (Bertin et al., 2021).

Regarding physical activity, men's greater average duration of vigorous activity, despite a similar inactivity rate, may reflect greater muscle mass and anaerobic capacity. This is consistent with literature showing that men favor more intense, less frequent exercise, while women favor lighter, more regular activity such as walking (Bauman et al., 2012; Westrop et al., 2019). These patterns may also be shaped by women's domestic role and the greater accessibility of activities like walking or gardening (Hallal et al., 2012), although these physiological parameters were not measured directly in this study. Sedentary behavior, however, remained substantial in both sexes and slightly more pronounced in women. This is consistent with reports identifying prolonged sedentarity as an independent metabolic risk factor, often more marked in women due to social and occupational constraints (Katzmarzyk & Lee, 2012).

STRENGTHS AND LIMITATIONS

This study provides original data on abdominal obesity in an urban West African population, where such data remain scarce, and compares three internationally recognized diagnostic criteria (IDF, NCEP-ATP III, and the threshold proposed here), alongside detailed anthropometric, metabolic, behavioral, and lifestyle characterization rarely combined in a single dataset from this region.

Several limitations should nonetheless be acknowledged. The cross-sectional design precludes causal inference and cannot exclude reverse causality or residual confounding. The modest, sex-imbalanced sample (23 men vs. 157 women) limits the statistical power and generalizability of sex-stratified analyses. Several physiological mechanisms invoked in interpretation (leptin resistance, sympathetic activity, visceral fat accumulation, adipokine secretion) were not directly measured and remain hypothetical extrapolations from the literature. Finally, the absence of a non-obese control group limits the ability to fully contextualize these metabolic and behavioral findings. Future studies with larger, sex-balanced samples, longitudinal follow-up, and direct biological measurements (hormonal and inflammatory markers, visceral fat imaging) are needed to confirm these findings and clarify underlying mechanisms.

CONCLUSION

This cross-sectional study of 180 obese adults in urban Togo highlights notable gender disparities in eating behaviors, metabolic profiles, and physical activity practices. Men exhibited more pronounced food hedonism and a marked deficit in satiety perception, associated with reduced meal anticipation, patterns that may favor energy overconsumption.

Biological parameters showed a progressive worsening of blood pressure, lipid profile, and blood glucose with increasing obesity severity, suggesting a cardiometabolic risk that warrants closer monitoring in this population. Regarding physical activity, men favored vigorous but infrequent exercise, whereas women engaged more regularly in moderate activities such as walking, despite higher overall sedentary behavior.

RECOMMENDATIONS

1. **Systematic, severity-adapted cardiometabolic screening.** Blood pressure, fasting glycemia and triglycerides worsened progressively from type I to type III obesity, and hypo-HDLemia was near-universal (>95%) in both sexes. We therefore recommend that health services routinely combine anthropometric assessment (BMI and waist circumference) with blood pressure measurement, fasting glucose and a lipid profile in obese adults, with closer follow-up for types II and III. As the prevalence of abdominal obesity varied markedly with the criterion applied (IDF 92.78% vs. NCEP-ATP III 80.56%), population-specific waist-circumference thresholds should be validated and harmonized to optimize screening in urban West African populations.
2. **Sex-tailored lifestyle interventions.** Prevention and management programs should address the sex-specific behavioral profiles observed. In men, interventions should target satiety perception and portion control, and complement vigorous but infrequent exercise with regular moderate activity. In women, they should include nutritional and psychological counselling on emotional eating and strategies to reduce sedentary time, building on existing regular walking habits. These interventions should be culturally adapted and tested in future longitudinal studies with larger, sex-balanced samples.

Conflict of Interest

Authors declare no conflict of interest.

Acknowledgements

- Financial support: SUNU BANK-TOGO, ORABANK-TOGO, FAO, BCEAO-KARA
- Technical support: National Programme for the Control of Non-Communicable Diseases (Professor BELO Mofou) and the Nutrition Division of the Ministry of Health and Public Hygiene.

Funding

The funding bodies provided financial support for the study but had no role in study design, data collection, data analysis, data interpretation, manuscript writing, or the decision to submit the article for publication.

Authors' Contributions

HM: Conceptualization, methodology, investigation, formal analysis, writing the original draft, preparation, and writing review & editing. KCK: Methodology, validation, and review & editing of the manuscript. KFG: Methodology; OBT: Methodology. KM: Resources, MB-1: Resources, MB-2: Resources.

REFERENCES

Alberti, K. G., Eckel, R. H., Grundy, S. M., Zimmet, P. Z., Cleeman, J. I., Donato, K. A., et al. (2009). Harmonizing the metabolic syndrome: A joint interim statement of the international diabetes federation task force on epidemiology and prevention; national heart, lung, and blood institute; American heart association; world heart federation; international atherosclerosis society; and international association for the study of obesity. Circulation, 120(16), 1640-1645. https://doi.org/10.1161/circulationaha.109.192644

Anekwe, C. V., Jarrell, A. R., Townsend, M. J., Gaudier, G. I., Hiserodt, J. M., & Stanford, F. C. (2020). Socioeconomics of obesity. Current Obesity Reports, 9(3), 272-279. https://doi.org/10.1007/s13679-020-00398-7

Bauman, A. E., Reis, R. S., Sallis, J. F., Wells, J. C., Loos, R. J., & Martin, B. W. (2012). Correlates of physical activity: Why are some people physically active and others not? The Lancet, 380(9838), 258-271. https://doi.org/10.1016/S0140-6736(12)60735-1

Bertin, É., Barrois, M., Benzerouk, F., Pierre, A., & de la Tribonnière, X. (2021). Interest of a brief therapy based on sensory acceptance of emotions for emotional eating in obesity. Cahiers de Nutrition et de Diététique, 56(2), 126-130. https://doi.org/10.1016/j.cnd.2021.01.005

Boirie, Y. (2009). Obésité : physiopathologie et conséquences, Obesity: Pathophysiology and consequences. In Société Française de Médecine d'Urgence (Ed.), Urgences 2009 (pp. 151-157). SFMU. https://www.sfmu.org/upload/70_formation/02_eformation/02_congres/Urgences/urgences2009/donnees/som_titre/art_tout.htm

Chevalier, N., & Fénichel, P. (2016). Obesity, type2 diabetes and endocrine disruptors. La Presse Médicale, 45(1), 88-97. https://doi.org/10.1016/j.lpm.2015.08.008

Dakin, C., Beaulieu, K., Hopkins, M., Gibbons, C., Finlayson, G., & Stubbs, R. J. (2023). Do eating behavior traits predict energy intake and body mass index? A systematic review and meta-analysis. Obesity Reviews, 24(1), e13515. https://doi.org/10.1111/obr.13515

Després, J.-P. (2012). Abdominal obesity and cardiovascular disease: Is inflammation the missing link? Canadian Journal of Cardiology, 28(6), 642-652. https://doi.org/10.1016/j.cjca.2012.06.004

Estruch, R., Ros, E., Salas-Salvadó, J., Covas, M.-I., Corella, D., Arós, F., Gómez-Gracia, et al. (2018). Primary prevention of cardiovascular disease with a Mediterranean diet supplemented with extra-virgin olive oil or nuts. New England Journal of Medicine, 378(25), e34. https://doi.org/10.1056/NEJMoa1800389

Faucher, P., & Poitou, C. (2016). Pathophysiology of obesity. Revue du Rhumatisme Monographies, 83(1), 6-12. https://doi.org/10.1016/j.monrhu.2015.08.002

Flegal, K. M., Kruszon-Moran, D., Carroll, M. D., Fryar, C. D., & Ogden, C. L. (2016). Trends in obesity among adults in the United States, 2005 to 2014. JAMA, 315(21), 2284-2291. https://doi.org/10.1001/jama.2016.6458

Fossati, P., & Prencipe, L. (1982). Serum triglycerides determined colorimetrically with an enzyme that produces hydrogen peroxide. Clinical Chemistry, 28(10), 2077-2080. https://doi.org/10.1093/clinchem/28.10.2077

Grundy, S. M., Cleeman, J. I., Daniels, S. R., Donato, K. A., Eckel, R. H., Franklin, B. A., et al. (2005). Diagnosis and management of the metabolic syndrome. Circulation, 112(17), 2735-2752. https://doi.org/10.1161/CIRCULATIONAHA.105.169404

Guerre-Millo, M. (2004). Adipose tissue and adipokines: For better or worse. Diabetes & Metabolism, 30(1), 13-19. https://doi.org/10.1016/S1262-3636(07)70084-8

Guo, J., Astrup, A., Lovegrove, J. A., Gijsbers, L., Givens, D. I., & Soedamah-Muthu, S. S. (2017). Milk and dairy consumption and risk of cardiovascular diseases and all-cause mortality: Dose-response meta-analysis of prospective cohort studies. European Journal of Epidemiology, 32(4), 269-287. https://doi.org/10.1007/s10654-017-0243-1

Hallal, P. C., Andersen, L. B., Bull, F. C., Guthold, R., Haskell, W., Ekelund, U., & et al. (2012). Global physical activity levels: surveillance progress, pitfalls, and prospects. Lancet, 380(9838), 247-257. https://doi.org/10.1016/S0140-6736(12)60646-1

Kali, A., Gusmanov, A., Aripov, M., & Chan, M.-Y. (2022). Proposing new body mass index and waist circumference cut-offs based on cardiometabolic risks for a Central Asia population: A feasibility study. Frontiers in Endocrinology, 13, 963352. https://doi.org/10.3389/fendo.2022.963352

Katzmarzyk, P. T., & Lee, I.-M. (2012). Sedentary behaviour and life expectancy in the USA: A cause-deleted life table analysis. BMJ Open, 2(4), e000828. https://doi.org/10.1136/bmjopen-2012-000828

Kouassi, K. C., Pessinaba, S., Kaaga, L., Lamboni, C., & Damorou, F. (2021). Correlation between dietary habits and prevalence of obesity: A preliminary study among 106 adult outpatients recruited at the CHU Campus of Lomé. Sciences de la Vie, de la Terre et Agronomie, 8(2), 24-30. https://publication.lecames.org/index.php/svt/article/view/1649

Lauby-Secretan, B., Dossus, L., Marant-Micallef, C., & His, M. (2019). Obesity and cancer. Bulletin du Cancer, 106(7), 635-646. https://doi.org/10.1016/j.bulcan.2019.04.008

Lee, J., Shin, A., Cho, S., Choi, J.-Y., Kang, D., & Lee, J.-K. (2020). Marital status and the prevalence of obesity in a Korean population. Obesity Research & Clinical Practice, 14(3), 217-224. https://doi.org/10.1016/j.orcp.2020.04.003

Mas, M., Brindisi, M.-C., & Chambaron, S. (2021). Socioeconomic, psychological and environmental factors of obesity: Towards a better understanding for new perspectives for action. Cahiers de Nutrition et de Diététique, 56(4), 208-219. https://doi.org/10.1016/j.cnd.2021.06.001

Metzelard, M., Ullmer, A., Schmidt, J., Salle, V., Smail, A., Brault, C., et al. (2021). Body mass index, inflammatory syndrome and autoimmune diseases. La Revue de Médecine Interne, 42, A63. https://doi.org/10.1016/j.revmed.2021.03.270

STEPS Togo. (2021). Final report of the STEPS Survey Togo 2021. Ministry of Health and Public Hygiene, Togo. Retrieved April 30, 2025, from https://sante.gouv.tg/wp-content/uploads/2024/04/Togo-rapport-enquete-STEPS_2021_VF-10.06-2023-divsmnt_clean-FR-2.pdf

Ng, M., Fleming, T., Robinson, M., Thomson, B., Graetz, N., Margono, C., et al. (2014). Global, regional, and national prevalence of overweight and obesity in children and adults during 1980-2013: A systematic analysis for the Global Burden of Disease Study 2013. The Lancet, 384(9945), 766-781. https://doi.org/10.1016/S0140-6736(14)60460-8

Ngoa, L. E., Longo, F., Sego, F. M., Takam, S. T., & Bopelet, M. (2001). Obesity, arterial hypertension and diabetes in a rural female population in western Cameroon. Médecine d'Afrique Noire, 48(10), 391-393. https://www.santetropicale.com/manelec/fr/resume_oa.asp?id_article=1580

National Institute of Statistics and Economic and Demographic Studies (INSEED). (2025). Official website of INSEED. Retrieved April 30, 2025, from https://inseed.tg/

Nurgül, U. (2016). Overweight, slimming diets and slimming products: Evaluations, warnings and advice from the community pharmacist [Doctoral thesis, Université de Lorraine]. HAL. https://hal.univ-lorraine.fr/hal-01733183

Obépi. (2012). National epidemiological survey on overweight and obesity. Retrieved November 19, 2022, from https://www.academia.edu/9678567/Obepi_2012

Ozarda, Y. (2020). Establishing and using Ozarda, Y. (2020). Establishing and using reference intervals. *Turkish Journal of Biochemistry*, *45*(1), 1-10. https://doi.org/10.1515/tjb-2017-0299

Kali, A., Gusmanov, A., Aripov, M., & Chan, M.-Y. (2022). Proposing new body mass index and waist circumference cut-offs based on cardiometabolic risks for a Central Asia population: A feasibility study. Frontiers in Endocrinology, 13, 963352. https://doi.org/10.3389/fendo.2022.963352

Katzmarzyk, P. T., & Lee, I.-M. (2012). Sedentary behaviour and life expectancy in the USA: A cause-deleted life table analysis. BMJ Open, 2(4), e000828. https://doi.org/10.1136/bmjopen-2012-000828

Kouassi, K. C., Pessinaba, S., Kaaga, L., Lamboni, C., & Damorou, F. (2021). Correlation between dietary habits and prevalence of obesity: A preliminary study among 106 adult outpatients recruited at the CHU Campus of Lomé. Sciences de la Vie, de la Terre et Agronomie, 8(2), 24-30. https://publication.lecames.org/index.php/svt/article/view/1649

Lauby-Secretan, B., Dossus, L., Marant-Micallef, C., & His, M. (2019). Obesity and cancer. Bulletin du Cancer, 106(7), 635-646. https://doi.org/10.1016/j.bulcan.2019.04.008

Lee, J., Shin, A., Cho, S., Choi, J.-Y., Kang, D., & Lee, J.-K. (2020). Marital status and the prevalence of obesity in a Korean population. Obesity Research & Clinical Practice, 14(3), 217-224. https://doi.org/10.1016/j.orcp.2020.04.003

Mas, M., Brindisi, M.-C., & Chambaron, S. (2021). Socioeconomic, psychological and environmental factors of obesity: Towards a better understanding for new perspectives for action. Cahiers de Nutrition et de Diététique, 56(4), 208-219. https://doi.org/10.1016/j.cnd.2021.06.001

Metzelard, M., Ullmer, A., Schmidt, J., Salle, V., Smail, A., Brault, C., et al. (2021). Body mass index, inflammatory syndrome and autoimmune diseases. La Revue de Médecine Interne, 42, A63. https://doi.org/10.1016/j.revmed.2021.03.270

STEPS Togo. (2021). Final report of the STEPS Survey Togo 2021. Ministry of Health and Public Hygiene, Togo. Retrieved April 30, 2025, from https://sante.gouv.tg/wp-content/uploads/2024/04/Togo-rapport-enquete-STEPS_2021_VF-10.06-2023-divsmnt_clean-FR-2.pdf

Ng, M., Fleming, T., Robinson, M., Thomson, B., Graetz, N., Margono, C., et al. (2014). Global, regional, and national prevalence of overweight and obesity in children and adults during 1980-2013: A systematic analysis for the Global Burden of Disease Study 2013. The Lancet, 384(9945), 766-781. https://doi.org/10.1016/S0140-6736(14)60460-8

Ngoa, L. E., Longo, F., Sego, F. M., Takam, S. T., & Bopelet, M. (2001). Obesity, arterial hypertension and diabetes in a rural female population in western Cameroon. Médecine d'Afrique Noire, 48(10), 391-393. https://www.santetropicale.com/manelec/fr/resume_oa.asp?id_article=1580

National Institute of Statistics and Economic and Demographic Studies (INSEED). (2025). Official website of INSEED. Retrieved April 30, 2025, from https://inseed.tg/

Nurgül, U. (2016). Overweight, slimming diets and slimming products: Evaluations, warnings and advice from the community pharmacist [Doctoral thesis, Université de Lorraine]. HAL. https://hal.univ-lorraine.fr/hal-01733183

Obépi. (2012). National epidemiological survey on overweight and obesity. Retrieved November 19, 2022, from https://www.academia.edu/9678567/Obepi_2012

Ozarda, Y. (2020). Establishing and using Ozarda, Y. (2020). Establishing and using reference intervals. *Turkish Journal of Biochemistry*, *45*(1), 1-10. https://doi.org/10.1515/tjb-2017-0299

Pathak, A., Rouet, P., Despas, F., Jourdan, G., Verwaerde, P., Galinier, M., et al. (2007). Obesity and hypertension: Epidemiological, pathophysiological and therapeutical aspects. Médecine Thérapeutique Cardiologie, 3, 169-177. https://doi.org/10.1684/mtc.2007.0093

Ross, R., & Janiszewski, P. M. (2008). Is weight loss the optimal target for obesity-related cardiovascular disease risk reduction? Canadian Journal of Cardiology, 24, 25D-31D. https://doi.org/10.1016/S0828-282X(08)71046-8

Pathak, A., Rouet, P., Despas, F., Jourdan, G., Verwaerde, P., Galinier, M., et al. (2007). Obesity and hypertension: Epidemiological, pathophysiological and therapeutical aspects. Médecine Thérapeutique Cardiologie, 3, 169-177. https://doi.org/10.1684/mtc.2007.0093

Ross, R., & Janiszewski, P. M. (2008). Is weight loss the optimal target for obesity-related cardiovascular disease risk reduction? Canadian Journal of Cardiology, 24, 25D-31D. https://doi.org/10.1016/S0828-282X(08)71046-8

Senyo, L. (2025). The A.H.A.T releases two new history textbooks for primary and secondary school teachers. Université de Lomé. Retrieved June 21, 2025, from https://univ-lome.tg/la-h-a-t-met-deux-nouveaux-manuels-dhistoire-a-lintention-des-enseignants-du-primaire-et-du-secondaire/

Stice, E., & Yokum, S. (2016). Neural vulnerability factors that increase risk for future weight gain. Psychological Bulletin, 142(5), 447-471. https://doi.org/10.1037/bul0000044

Université Laval. (2025). Togo. Retrieved June 21, 2025, from https://www.axl.cefan.ulaval.ca/afrique/togo.htm

Westrop, S. C., Melville, C. A., Muirhead, F., & McGarty, A. M. (2019). Gender differences in physical activity and sedentary behaviour in adults with intellectual disabilities: A systematic review and meta-analysis. Journal of Applied Research in Intellectual Disabilities, 32(6), 1359-1374. https://doi.org/10.1111/jar.12648

World Health Organization. (2023, October 11). New WHO report on healthy ageing: By 2024, people aged 65 and over will outnumber the young. Retrieved June 3, 2025, from https://www.who.int/europe/fr/news/item/11-10-2023-by-2024--the-65-and-over-age-group-will-outnumber-the-youth-group--new-who-report-on-healthy-ageing

World Health Organization. (2025). Obesity and overweight. Retrieved September 22, 2025, from https://www.who.int/fr/news-room/fact-sheets/detail/obesity-and-overweight

World Obesity Federation. (2022). World Obesity Atlas 2022. Retrieved September 21, 2025, from https://www.worldobesity.org/resources/resource-library/world-obesity-atlas-2022