Systematic Review

Cardiometabolic Risk Factors Among African University Students: A Systematic Review

Jude Eteneneng Enoh *[ID]**, Roland Tiagha Akah and Benedicta Nkeh-Chungag** [ID]

Cardio-Metabolic Health Research Group, Department of Biological and Environmental Sciences, Faculty of Natural Sciences, Walter Sisulu University (WSU), Nelson Mandela Drive, Private Bag X1, Mthatha 5117, Eastern Cape, South Africa; rakah@wsu.ac.za (R.T.A.); bnkehchungag@wsu.ac.za (B.N.-C.)
* Correspondence: jenoh@wsu.ac.za; Tel.: +27-834321592

Abstract: Background: Cardiometabolic risk factors such as hypertension, overweight, and obesity have become increasingly common among African students who tend to become more sedentary in urban environments. This systematic review aimed to determine and identify major risk factors of cardiometabolic disease prevalence reported among African university students. Methods: The protocol was registered with PROSPERO (registration no.CRD42024553280). A comprehensive literature search was performed using scientific databases from Google Scholar, PubMed, Web of Science, Scopus, ProQuest, and African Journals Online (AJOL). The search was limited to articles published between 2000 and 2024, which reported cardiometabolic diseases/risk factors among African university students. Data were extracted using a standardised form, capturing details on study characteristics (author, year, location, study design), participant demographics (age, sex), prevalence of cardiometabolic diseases, and associated risk factors. Results: A total of thirty-seven studies that met the inclusion criteria, thirty-six cross-sectional and one longitudinal, were included in the study. The prevalence range of the various risk factors identified was 0.6–21.7% (obesity) and 0.28–26.4% (hypertension), 1.7–18.8% (diabetes), 0.5–18.2% (pre-diabetes), 1.9–48.6% (metabolic syndrome), and 1.1% to 57.3% (dyslipidemia). Some common sedentary lifestyles and unhealthy behaviours identified among the students were fast foods (21.3–85.73%), alcohol (3.7–63%), and smoking (1.02–13%). Conclusions: The review's findings suggest that rapid urbanisation and changes in lifestyle and behaviours are responsible for an increased prevalence of cardiometabolic risk factors in African university students. Targeted health promotion programmes, regular screening, and policy interventions might all go a long way in preventing the predicted increase in the prevalence of cardiovascular and metabolic diseases among this group of young adults in Africa.

Keywords: African universities; students; cardiovascular disease; lifestyle

1. Introduction

Cardiometabolic diseases, such as CVD, diabetes, and metabolic syndrome, are among the major public health challenges worldwide [1]. In Africa, the burden of these cardiometabolic diseases is on the increase, particularly among young populations such as university students [1–3]. The population is showing a greater predisposition to cardiometabolic disease risk factors because of sedentary lifestyle changes/behaviour, unhealthy dietary habits, and high levels of stress [2,3].

University students are an essential target population for early intervention because this stage of life corresponds to the transitional age during which habits are formed that set lifelong trajectories [4]. Thus, it is considered an excellent period to encourage healthy

behaviours. Knowledge of this population's prevalence and risk factors would be useful and helpful in guiding targeted health interventions and policies [4,5]. Recent studies have reported alarming trends; a majority of students demonstrate minimum levels of physical activity, leading to obesity and other metabolic disorders [6–8]. Poor nutrition, marked by a low intake of vegetables and fruits and a high consumption of processed foods, is characteristic [4,9,10].

Moreover, academic pressures and recent lifestyle changes add to high levels of stress associated with poor cardiometabolic outcomes [11]. Genetic and environmental socio-economic factors can contribute to vast differences in the risk factors and prevalence of cardiometabolic diseases across various African regions [9,11]. In some instances, regions have experienced higher urbanisation rates and the Westernisation of diets, contributing to greater obesity rates and its resultant conditions [2].

University students in Africa represent a unique demographic experiencing rapid lifestyle changes during a critical transition period [12]. This group often faces decreased physical activity, increased stress, and dietary shifts, which could lead to the development of cardiometabolic conditions [9,12]. Understanding these diseases' prevalence and risk factors within this population is crucial for developing targeted interventions and health promotion strategies.

This review aimed to systematically estimate the pooled prevalence of cardiometabolic disease risk factors among African university students. This review highlights key trends and offers recommendations + ns for public health strategies and future research directions.

- To determine the prevalence of major CVD risk factors such as obesity, hypertension, smoking, poor diet, and inactivity among university students.
- To explore patterns and differences in CVD risk factors among males and females.

Question: What is the pooled prevalence of major cardiometabolic disease risk factors among African university students with respect to their sociodemographic, academic, and environmental factors?

2. Methods

2.1. Eligibility Criteria

The protocol was registered with PROSPERO (registration no.CRD42024553280). The review included full English articles reporting cardiometabolic diseases and risk factors in university students in African countries involving a population of interest aged 18 years and above. The review also included studies published from 2000 upwards with a cross-sectional, cohort, or case–control study design. Those excluded were non-peer-reviewed articles, grey literature, and studies with unclear indications of cardiometabolic risk factors.

Population: University students in African universities.

Intervention/Exposure: Assessment of the various cardiometabolic risk factors (obesity, BMI, hypertension, physical inactivity, unhealthy diet, lipid profile, dyslipidemia, metabolic syndrome).

Comparators: Comparison of cardiometabolic risk factors between different demographic groups (gender, age groups, countries, and rural vs. urban).

Outcomes: The pooled prevalence of cardiometabolic risk factors, differences in risk factors, and potential interventions to reduce risk (university health policies, sedentary and unhealthy lifestyle changes).

2.2. Information Sources and Search Strategy

This review employed a comprehensive search strategy to identify relevant studies that reported cardiometabolic disease among African university students. Scientific search engines and databases used were Google Scholar, PubMed, Web of Science, Scopus,

ProQuest, and African Journals Online (AJOL). The search was performed using a combination of Medical Subject Heading (MeSH) terms and keywords such as; "cardiometabolic disease", "obesity", "diabetes", "hypertension", "cardiometabolic disease", "obesity", "diabetes", "hypertension", "metabolic syndrome", "metabolic syndrome" OR dyslipidemia* OR Hyperlipidemia OR "hyperlipidaemia" OR "high blood cholesterol" OR "hypercholesterolemia" OR "hypercholesterolaemia" OR "triglycerides" OR "hypertriglyceridemia" OR "hypertriglyceridaemia", "university students", "Africa", "prevalence", "risk factors", "outcomes". Such as "cardiometabolic disease", AND "university students", "Africa" (Supplementary Table S1). The search included studies published from 2000 to the present.

2.3. Data Extraction Procedure and Quality Assessment

Data were extracted using a standardised form, capturing details on study characteristics (author, year, location, study design), participant demographics (age, sex), prevalence rates of cardiometabolic diseases, and associated risk factors. Two reviewers reviewed the titles and abstracts independently to determine their relevance. The reviewers also conducted the extraction independently to ensure accuracy and reliability. The eligibility of full articles was assessed based on the inclusion and exclusion criteria. Any disagreement was resolved via discussion and consultation with a third reviewer. The Joanna Briggs Institute (JBI) SUMARI and Newcastle–Ottawa Scale (NOS) checklist were used to assess the quality of all included studies (Supplementary Tables S2 and S3). The studies were evaluated for methodological rigour, sampling methods, and data reporting.

2.4. Data Synthesis

Quantitative data were synthesised where appropriate to estimate pooled prevalence and risk factors. Qualitative data were summarised narratively. Subgroup analyses were conducted based on gender, study design, geographic regions, and quality. The findings were reported according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses guidelines and checklist (Supplementary Tables S4 and S5).

This review highlights, determines, and identifies major risk factors of cardiometabolic disease prevalence reported among African university students.

3. Results

3.1. Characteristics of Included Studies

As shown in Figure 1, a total of 1400 articles were identified from an initial search of the different databases. After screening titles and abstracts and removing duplicates, one hundred eighty studies were selected for full-text screening. Thirty-seven studies were included in the final analysis because they met the predefined inclusion criteria (Figure 1).

The studies included were conducted across 12 African countries: Botswana (1), Cameroon (4), Cote d'Ivoire (1), Demographic Republic of Congo (2), Ethiopia (1), Ghana (7), Kenya (2), Nigeria (11), Somaliland (1), South Africa (4), Sudan (1), Uganda (2) (Table 1).
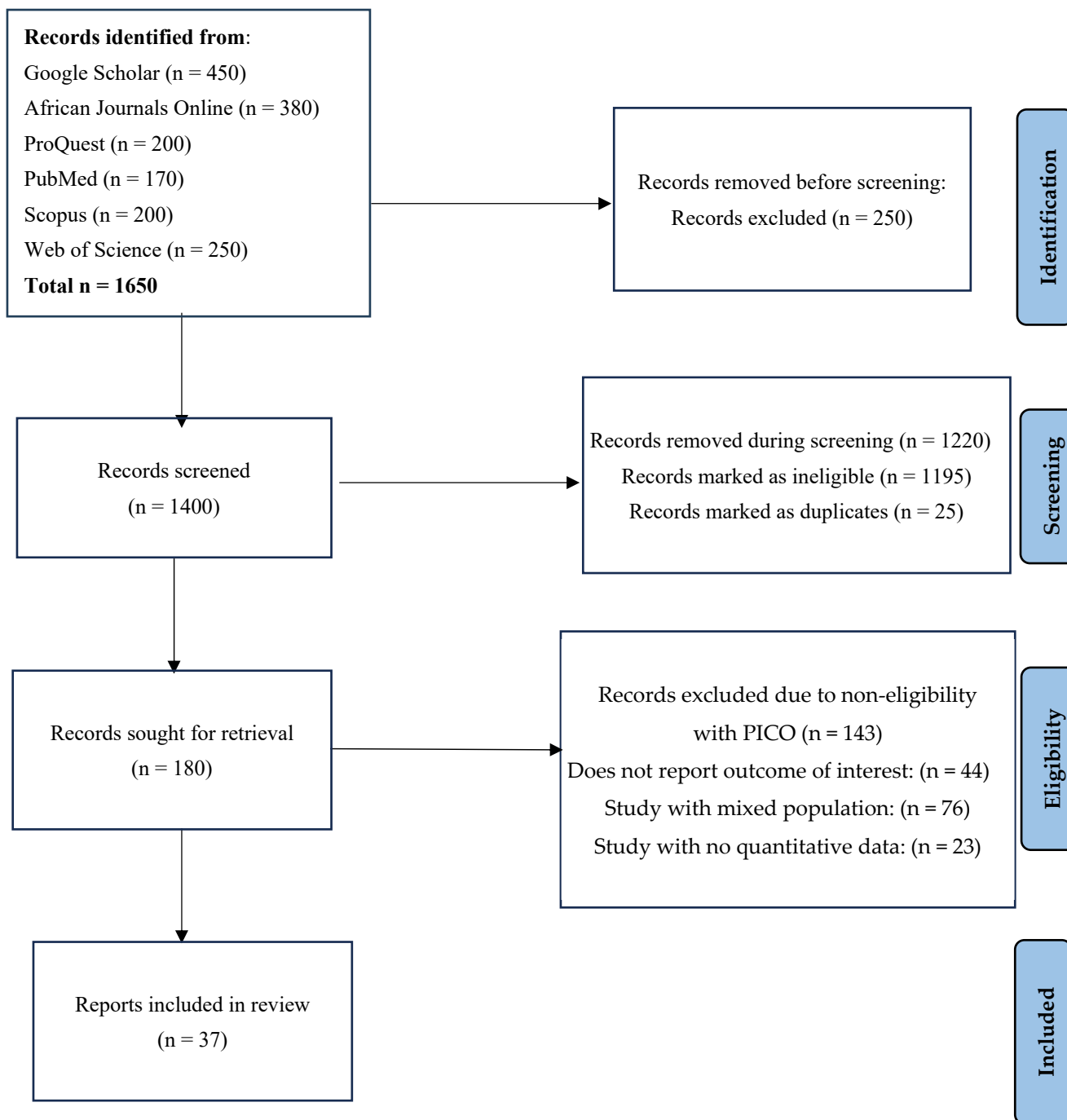
Figure 1. PRISMA flow diagram.

Table 1. Characteristics of included studies and prevalence of cardiometabolic risk factors.

SN	First Author, Year, Country, Reference	Study Design	Sample Size	Population	Exposure	Outcome	Diagnostic Criteria and Instruments
1.	Tapera, 2017 Botswana [13]	Descriptive cross-sectional study, February and April 2016	202 students 85 Males: 117 Females.	University students from University of Botswana (Urban) with age range from 18 to 30 years and a mean age of 21.59 ± 1.81	Aged Physical inactivity Fatty meals Family history of obesity	Overweight 24.9% Obesity 11.9%	WHO international classification (WHO, 2004)
2.	Bede, 2020 Cameroon [9]	Cross-sectional study Dec 2013 to March 2014	203 students 113 Female 90 Male Three state universities in Cameroon: (Buea, Bamenda, and Yaounde)	Second-year students of medical studies (medicine) in three public universities (Urban) aged 17–27 with a mean age of 20.8 ± 1.6 yrs	Irregular meals, low consumption of fruits, vegetables, and milk; high intake of candy and fried foods; and high consumption of refined sugars and fats Alcohol 63%	Overweight: 21.6% Obesity: 3.0% Meals pattern: 49.8% Snacking: 40.8%	WHO international classification (WHO, 2004)
3.	Nansseu, 2019 Cameroon [11]	Cross-sectional study May to July 2017	931 students Male 501 Female 430	Students aged 18–35 years in the University of Yaoundé I (Urban)	Physical inactivity: 88.9 Unhealthy diet: 99.0 Family history stroke: 6.3 Family history of heart attack: 3.1 Smoking: 3.33 Alcohol: 26.7 Smoking: 28.5 Anxiety: 39.8 Depression: 49.2	Overweight: 22.1% Obesity: 3.9% Abdominal obesity: 14.4% Excess body fat mass: 14.5% Prehypertension: 30.0% Hypertension: 2.8%	Stadiometer Body composition analyser (type BPF-300 MA, InBody, Seoul South Korea) Electronic sphygmomanometer (Omron M5-1, Omron Healthcare, Kyoto Japan) International Diabetes Federation (IDF) WHO guidelines (BMI)

Table 1. *Cont.*

SN	First Author, Year, Country, Reference	Study Design	Sample Size	Population	Exposure	Outcome	Diagnostic Criteria and Instruments
4.	Nansseu, 2019 Cameroon [14]	Cross-sectional study May to July 2017	949 students Male 501 Female 430	Adults aged 18–35 years in Yaoundé I (Urban)	High CVD 5.1% Low CVD: 43.7	Hypertension: 3.1%	Stadiometer Body composition analyser (type BPF-300 MA) Electronic sphygmomanometer (Omron M5-1, Omron Healthcare) WHO guidelines (BMI INTERHEART Modifiable Risk Score (IHMRS)
5.	Choukem, 2017 Cameroon [15]	Longitudinal study (annual measurements from 2009 to 2012)	2726 Students 1893 Males: 833 Females	Aged 18 years and above mean (SD) of 21.8 (2.4) private university institute in Douala (Urban)		Overweight: 17.5% Obesity: 3.5% Overweight and obesity (Men): 13.1% to 20.9% Abdominal obesity (Women): Increased from 6.5% to 11.7% Hypertension: 6.3%	OMRON M3® (Omron Healthcare Co., Kyoto, Japan) Camry® scale World Health Organization classifications
6.	Zobo, 2023 Côte d'Ivoire [4]	Cross-sectional study November to December 2017	2030 students Male 1618 Female 412	Students of the National Polytechnic Institute of Côte d'Ivoire aged 18 and above with a mean of 20 years	Physical inactivity: 11.1% Salt: 41.2% Alcohol consumption: 44.0% Smoking: 2.5%	Overweight: 6.3% (Male: 4.5 Female: 13.1) Obesity: 1.0% (Male: 0.4 Female: 3.6) Abdominal obesity: 1.2% (Male: 0.3 Female: 4.9) Overweight/obesity: 7.3% Hypertension: 6.0% (Male: 6.8 Female: 2.7) 4 CVD risk factor: 0.1% 3 CVD risk factor: 0.5% 2 CVD risk factor: 5.5% 1 CVD risk factor: 26.8%	Pan-African Society of Cardiology" (PASCAR) guidelines Sphygmomanometer (Omron M5-1, Omron Healthcare, Kyoto, Japan) on both arms.

SN	First Author, Year, Country, Reference	Study Design	Sample Size	Population	Exposure	Outcome	Diagnostic Criteria and Instruments
7.	Wanghi, 2019 DRC [16]	Cross-sectional study	1281 students Male 570 Female 711	Students residing on the campus at the University of Kinshasa (urban) Aged 18–30 years	Low physical activity Smoking Alcohol intake	Hypertension: 26.4% (ACC/AHA) and 7.3% (JNC 7)	WHO STEPS5 7th Joint National Committee of High BP JNC-7 criteria The 2017 American College Cardiology/American Heart Association (ACC/AHA) Criteria Balance (SECA Germany Model 7621019009). Omron M6 comfort electronic sphyg momanometer (Tokyo, Japan). 3/30 s
8.	Mbutiwi, 2018 Democratic Republic of Congo (DRC) [17]	Cross-sectional study January and March of 2016	780 students 485 Males 297 Females	Students from the University of Kikwit in the Democratic Republic of the Congo aged 21–25 years	Alcohol consumption: 53.1% Tobacco consumption: 8.1%	Overweight: 16.4% Obesity: 10.4% General obesity: 1.9% Hypertension: 7.6% High pulse pressure: 6.4%	Automatic digital brachial sphygmomanometer (model BP-1209) (3/5 min) International Diabetes Federation (IDF) definition/Criteria
9.	Tadesse, 2014 Ethiopia [18]	Cross-sectional study December 2012 to January 2013	610 college students 453 Males 157 Females	Undergraduate students aged 18 ≥ years from University of Gondar, Ethiopia	Physical inactivity: 65.1 Family history of chronic diseases: 20% Alcohol: 7% Short sleep duration Smoking: 2.6% Khat chewing: 10%	Overweight: 3.9% Obesity: 0.7% Prehypertension: 35.7% Hypertension: 7.7%	Standard mercury sphygmomanometer BP cuff (3/2 min)

SN	First Author, Year, Country, Reference	Study Design	Sample Size	Population	Exposure	Outcome	Diagnostic Criteria and Instruments
10.	Obirikorang, 2024 Ghana [6]	Cross-sectional study August 2018 and July 2019	1027 undergraduate students Male: 454 Female: 573	First- to fourth-year undergraduate students aged 16–25 years Kwame Nkrumah University of Science and Technology, Kumasi, Ghana (Urban)	Physical inactivity: 20.6 Family history of hypertension: 17.6 Family history of Diabetes: 20.3 Family history of obesity: 8.0 Alcohol: 6.2 Smoking: 1.6	Overweight: 18.2% Obesity: 5.5% (Male: 6.7 Female: 9.4)	OMRON BF511 Clinically Validated Full Body Composition Monitor World Health Organization's criteria
11.	Sirikyi, 2020 Ghana [10]	Cross-sectional study August and September 2018	201 students Male 113 Female 89	First-year students aged 16 to 20 years from University of Cape Coast, Cape Coast in the Central Region of Ghana	Physical inactivity Unhealthy diet: 62.24 Smoking: 1.02 Alcohol: 2.04	Overweight: 11.22% Obesity: 4.59% Overweight + Obesity 15.81 (Male: 27.7 Female: 7.1) Elevated systolic blood pressure: 50.7% Elevated diastolic blood Pressure: 5.5% Total cholesterol: 28.4% Low-density lipoprotein: 10.0% High-density lipoprotein: 22.4% Triglyceride: 15.42%	Omron Body Composition Monitor BF511 (Omron Healthcare Inc., Lake Forest-Illinois, USA). Stadiometer
12.	Ofori, 2019 Ghana [19]	Cross-sectional study (Urban)	120 students Male 20 Female 100	Undergraduate students aged 18 years and above From the University of Ghana.	Physical inactivity: 38.5	Overweight: 31.7% Obese 21.7%	HBF-516 body composition monitor and scale WHO guidelines (BMI)

Table 1. *Cont*.

SN	First Author, Year, Country, Reference	Study Design	Sample Size	Population	Exposure	Outcome	Diagnostic Criteria and Instruments
13.	Ofori, 2018 Ghana [20]	Cross-sectional study (Urban)	120 medical students Male 20 Female 100	Undergraduate students aged 18 years and above from the University of Ghana.	Physical inactivity: 38.5	Overweight: 31.7 Obese: 21.7 Elevated systolic blood pressure: 45% Elevated diastolic blood Pressure: 32.5% Triglyceride: 4.2% Total cholesterol: 30% Low-density lipoprotein: 67.5% High-density lipoprotein: 32.5%	HBF-516 body composition monitor and scale. Omron blood pressure monitor. Seca Stadiometer. WHO guidelines (BMI)
14.	Smith, 2017 Ghana [21]	cross-sectional study April 2017 to May 2017	412 Students Males 238 Females 174	Undergraduate students aged 18–46 years from the KNUST public university located in Kumasi in the Ashanti	Blood group type	Overweight: 8.7% Obese: 6.3 (Male: 3.4 Female: 10.3)	Scale (Seca, Hamburg, Deutschland) Shahe stature meter (Shanghai, China)
15.	Mogre, 2015 Ghana [22]	Cross-sectional study January and July 2013	552 students Males 370 Females 182	Students aged 18–36 years attending the University for Development Studies, School of Medicine and Health Sciences (UDS-SMHS)	Physical inactivity 50% Poor dietary habits Alcohols 20.7%	Abdominally obese 15.2% (Female: 40.9 Male: 0.8) Overweight/obesity 12.5% (Female: 25.8 Male: 5.9)	UNICEF electronic scale manufactured by seca. World Health Organization classifications

SN	First Author, Year, Country, Reference	Study Design	Sample Size	Population	Exposure	Outcome	Diagnostic Criteria and Instruments
16.	Mogre, 2014 Ghana [23]	Cross-sectional study January and July 2013	646 students Males 445 Females 201	Students aged 18–36 years attending the University for Development Studies, School of Medicine and Health Sciences (UDS-SMHS)	Physical inactivity: 63.5% Dietary habits (coffee 57.1%) Alcohols: 13.2% Smoking: 1.1%	Overweight: 9.3% (Female: 20.9 Male: 4) Obesity: 1.9% (Female: 4.5 Male: 0.7) Abdominally obese 4.2% (Female: 11.9 Male: 0.7)	UNICEF electronic scale manufactured by seca (2 measurements) World Health Organization classifications
17.	Brenda, 2022 Kenya [5]	Cross-sectional January to September 2018	72 students Females 37 Males 35	Undergraduate students aged 18–26 years at Pwani University, Coastal Kenya (rural setting)	Irregular Exercise: 29.2% Own meal preparation: 57.0% Irregular eating: 54.2% Imbalance diet: 27.8% Alcohol: 15.3% Smoking: 2.8%	Overweight: 31.4 Obesity: 21.6	World Health Organization classifications
18.	Mbugu, 2017 Kenya [24]	Cross-sectional study	323 students Male 116 Female 207	Students aged 18–25 years at Mount Kenya University, main campus, in Thika town on the outskirts of Nairobi, Kenya (rural setting)	Physical inactivity 61.3 Unhealthy diet 84.7	Overweight 19.5% (Female: 3.7 Male: 0.9) Obese: 3.7% (Female: 19.5 Male: 12.1) Hypertension: more in males Impaired fasting glucose: more in females Metabolic syndrome: 1.9% One component of metabolic syndrome: 48.6% Two components of metabolic syndrome: 11.8% Three components of metabolic syndrome: 3.1% None had all six components High-density lipoprotein: 15.8% Triglyceride: 24.8%	Seca Rod 220 Stadiometer TANITA weighing scale WHO guidelines (BMI) Harmonized Joint Scientific Statement (HJSS)

Table 1. *Cont.*

SN	First Author, Year, Country, Reference	Study Design	Sample Size	Population	Exposure	Outcome	Diagnostic Criteria and Instruments
19.	Agofure, 2024 Nigeria [25]	Cross-sectional study	273 undergraduate students Male: 61 Female: 212	Undergraduate students aged 18–47 years at the Public and Community Health Department of Novena University, Southern Nigeria	Family history of obesity and diabetes	Overweight: 28.3% Obese: 9.9% (more females)	World Health Organisation criteria
20.	Olufayo, 2022 Nigeria [7]	Cross-sectional study January 2016 to February 2016	546 Students Male 245 Female 301	Students aged 15–35 years newly admitted students at the University of Ibadan	Physical inactivity: 94.5 Unhealthy diet: 85.3 Alcohol use: 3.7 Current smoking: 1.6	Overweight/obese: 20.7% Abdominal obesity: 3.3% Clustering risk factors (>2): 23.4	World Health Organisation criteria
21.	Mukhtar, 2021 Nigeria [8]	Descriptive cross-sectional study June and July 2021	150 undergraduate students Male 92 Female 58	Students aged 17–31 years at the Department of Human Physiology, Bayero University, Kano	Physical inactivity: 32 Family history CVD: 40 Smoking: 3.33	General obesity: 0.67% Truncal obesity: 4% Metabolic syndrome: 4% Diabetes: 0% Elevated systolic blood pressure: 7.33% Elevated diastolic blood pressure: 50% Total cholesterol: 0.67% Triglycerides: 7.33% Low-density lipoprotein: 0.67% 1 CVD risk: 90%	Omron HN286 digital weighing scale WHO guidelines (BMI)

SN	First Author, Year, Country, Reference	Study Design	Sample Size	Population	Exposure	Outcome	Diagnostic Criteria and Instruments
22.	Olatona, 2020 Nigeria [26]	Descriptive cross-sectional design	503 Students Male 228 Females 275	Students aged 15 to 41 years, full-time undergraduate students in the three Universities in Lagos		Overweight: 16.4 (Male: 16.7 Female: 16.1) Obese: 3.2% (Male: 3 Female: 3.3) Abdominal obesity: 5% (Male: 1.3 Female: 8.4) Body fat: 45% (Male: 54 Female: 37.1)	Bio-electrical Impedance Analysis
23.	Olatona, 2018 Nigeria [27]	Cross-sectional study	503 Students Male 228 Female 275	Students aged 15 to 41 years, full-time undergraduate students in the three Universities in Lagos Mean age of 20.3 ± 3.5 years	Daily meat consumption: 32.0% Daily alcohol consumption: 6.2%	Overweight: 16.4% (Male: 16.7 Female: 16.1) Obese: 3.2% (Male: 3 Female: 3.3) Abdominal Obesity: 5% (Males: 1.3 Females: 8.4). Prehypertension: 8.2%. Hypertension: 2.8%. Pre-diabetes: 1.0%. Dyslipidemias: 57.3%. Total cholesterol: 32.4% Triglyceride: 0 High-density lipoprotein: 57.3% Low-density lipoprotein: 23.8% Fasting blood sugar: 1%	Electronic blood pressure monitor (Omron M2 and M7) WHO standards and classification
24.	Agwu, 2017 Nigeria [28]	Cross-sectional study	1549 students	Full-time university students were recruited from six universities		Hypertension: 10%	

Table 1. *Cont*.

SN	First Author, Year, Country, Reference	Study Design	Sample Size	Population	Exposure	Outcome	Diagnostic Criteria and Instruments
25.	Odili, 2015 Nigeria [29]	Cross-sectional descriptive study	172 students Male 81 Female 91	Undergraduate pharmacy students aged 18–33 years in the Faculty of Pharmacy, University of Benin, Benin City		Overweight: 10.5 (Male: 12.3 Female: 8.8) Obesity: 1.2% (Male: 1.2 Female: 1.1) Hypertension: 2.3% High FBG: 0.58% Abdominal obesity: 1.7% (Male: 0 Female: 3.3)	Standard mercury Sphygmomanometer (2/5 min) World Health Organisation criteria
26.	Otemuyiwa, 2014 Nigeria [30]	Cross-sectional Study	402 students Male 199 Female 203	Undergraduate students of mean age of 23 years at Obafemi Awolowo University (OAU) and Adekunle Ajasin University (AAU)	Dietary: 38.8	Overweight: 29% Obese: 6%	
27.	Oghagbon, 2010 Nigeria [31]	Cross-sectional study	464 Students Male 238 Female 226	Undergraduate students of mean 22.0 ± 2.72 years of age undergoing medical examinations for admission were recruited from Delta State University, Abraka, Nigeria		Overweight: 23.9% (Male: 26.78 Female: 20.98) Obesity: 3.4% (Female: 4.0 Male: 2.9). Undernutrition: 3.1%. Hypertension: 3.4% (Male: 5.9 Female: 0.89).	Mercury sphygmomanometer Beam balance scale World Health Organisation Criteria International Society of Hypertension (ISH) guidelines
28.	Adu, 2009 Nigeria [32]	Cross-sectional study	100 undergraduate student 41 Males 59 Females	Students from 6 faculties of Ojo Campus of Lagos State University, Ojo, South-West Nigeria aged 15 to 40 years	Diet	Overweight: 53% Obese: 6%	Method of Scrimshaw and Gleason

Table 1. *Cont*.

SN	First Author, Year, Country, Reference	Study Design	Sample Size	Population	Exposure	Outcome	Diagnostic Criteria and Instruments
29.	Onyechi, 2009 Nigeria [33]	Cross-sectional Study	620 students Male 200 Female 420	Undergraduate students 17–36 years from University of Nigeria Nsukka, Enugu State, South Eastern Nigeria	Physical inactivity: 14.5%. CVD: 6.1% Diabetes: 2.3% Gallbladder disease: 3.8%	Overweight: 16.9% Obesity: 21% (Male: 8.1 Female: 13.1)	
30.	Ali, 2015 Somaliland [34]	Cross-sectional survey	173 students Male 117 Female 56	Undergraduate Students aged 18–29 years of Hargeisa University, Somaliland	Physical inactivity: 43 (Female: 52 Male: 27) Smoking: 5.1% (all males)	Overweight: 9.2%(Female: 14 Male: 7) Obese: 6% Hypertension: 6.4%	
31.	Torres, 2022 South Africa [35]	Cross-sectional cohort study design	133 students Male 34 Female 90	Fifth-year medical students aged 17–31 years in the Graduate Entry Medical Programme (GEMP) at the Faculty of Health Sciences, University of the Witwatersrand	Physical inactivity: 19.5% Family history of CVD: 8.3% Alcohol: 7% Smoking: 7.5	Obesity: 7.5% Hypertension: 7.5% Abnormal glucose test: 18.8% Total cholesterol: 84.2% Dyslipidemia: 4.5%	Automated blood pressure cuff (Fora Active Plus P30, FaraCare Suisse, Switzerland) Seca scale and stadiometer.
32.	Ntlahla, 2021 South Africa [36]	Cross-sectional study	151 students Males 74 Females 77	Students aged 18–25 years at Walter Sisulu University, Nelson Mandela Drive campus in Mthatha		Prehypertension: 40.4% (Female: 48.6 Male: 32.5) Hypertension: 17.88% (Female: 14.3 Male: 21.6)	Microlife BP monitor, which is accredited by the British Hypertension Society
33.	Nkeh-Chungag, 2015 South Africa [37]	Cross-sectional study	214 students 73 Male 141 Female	Students aged 19–31 years at Walter Sisulu University, Nelson Mandela Drive campus in Mthatha		Prehypertension: 40.2% (Female: 28.4 Male: 63.0) Hypertension: 6.1% (Female: 2.1 Male: 13.7)	Microlife BP monitor which is accredited by the British Hypertension Society

Table 1. *Cont.*

SN	First Author, Year, Country, Reference	Study Design	Sample Size	Population	Exposure	Outcome	Diagnostic Criteria and Instruments
34.	Smith, 2009 South Africa [38]	Cross-sectional	266 students Males 88 Females 178	Third-year physiology students with a mean age of 21 ± 2 years at Stellenbosch University	Smoking: 13%	Hypertension: 0.28% (Male: 44 Female: 20) TG: 30.8% (Male: 35 Female: 37) Three metabolic risk factors: 4% (Male: 6 Female: 3) Two metabolic risk factors: 38% (Male: 47 Female: 33) One metabolic risk factor: 18 (Male: 18 Female: 19)	International Society for the Advancement of Kinanthropometry (ISAK) International Diabetes Federation (IDF) criteria stadiometer (Invicta, IP 1465, Leicester, UK) Automated sphygmomanometer (BP3BA0, Microlife AG, Widnau, Switzerland) 2/3 min
35.	Musaiger et al., 2016 Sudan [39]	Cross-sectional survey	400 university students Male 83 Females 217	University students of mean age 22.3 years at the College of Education, University of Khartoum, Sudan	Unhealthy diet (red meat, fast food): 36.5 (Female: 44.2 Male: 27.3) Sleep deprivation: 17.25 (Female: 23 Male: 33.9)	Overweight: 14.3% Obese: 1.7%	WHO guidelines (BMI)
36.	Nyombi, 2016 Uganda [40]	Cross-sectional study April 2013	180 medical students Male 107 Female 73	Students with a mean age of 22 ± 3 years from Makerere University, College of Health Sciences, Kampala, Uganda	Excessive salt intake: 13%. Family history HT: 12.2 Family history diabetic: 7.2 Alcohol consumption: 31.7%.	Overweight: 7.8% Obese: 1.1% Hypertension: 14% Prehypertension: 18.8% Pre-diabetic: 3.3% Diabetic: 1.7%	7th Joint National Committee of High BP JNC-7 criteria. Secca weighing scale Stadiometer Sphygmomanometer (3/5 min)
37.	Bimenya, 2005 Uganda [41]	Cross-sectional study	183 undergraduate students Male 120 Female 63	Students aged 20–26 years at the College of Health Sciences Makerere University, Uganda	Physical activity: 37.6 Smoking: 10.8%	Diastolic hypertension: 18% (more males) Diastolic prehypertension: 34% Systolic hypertension: 11% Systolic Prehypertension: 53%	Scottish Intercollegiate Guidelines Network, 9 Queen Street, Edinburgh EH2 IJQ, Sign 2001. Sphygmomanometer

Of the thirty-seven studies included, thirty-six were cross-sectional and one was longitudinal. The included studies had sample sizes ranging from 65 to 2726 participants, with approximately 20,152 university students. The majority of the included students were male (10,420), with 8183 being female (Table 1).

3.2. Prevalence of Cardiometabolic Diseases

Obesity: The prevalence of obesity among university students ranged from 0.6% to 21.7%, with an average of 6.7% observed. The highest prevalence (21.7%) was reported in Ghana [19], while the lowest (0.6%) was reported in Nigeria [8]. The average prevalence of abnormal obesity recorded was 6.86%, and it ranges from 1.2% (lowest) to 15.2% (highest) among university students in Cote d'Ivoire and Ghana, respectively [4,22]. Concerning being overweight, the average prevalence was 19.3%, and it ranges from 6.3% to 53%. The highest, 53%, was reported among undergraduates in Nigeria [42], and the lowest, 6.3%, from Cote d'Ivoire [4]. Also, a study performed in Nigeria reported that 45% of students had an abnormal body fat mass [26]. With regard to gender, the majority of the studies reported a higher frequency observed in females compared to males (Table 1).

Hypertension: The prevalence of hypertension ranged from 0.28% to 26.4%. A study performed among 3rd-year physiology students in South Africa recorded the lowest prevalence of 0.28% [21], while the highest 26.4% was reported in DRC [16]. The lowest prevalence (8.2%) of prehypertension was observed in Nigeria and the highest (40.4%) in South Africa [27,36]. Most studies observed hypertension more in males than females (Table 1). The average prevalence of hypertension and prehypertension reported by the included studies among university students was 7.7% and 28.8%.

Diabetes: The highest and lowest prevalence of diabetes was reported in Uganda (1.7%) and in South Africa (18.8%), respectively [35,40]. The majority of participants were reported to be pre-diabetics and not diabetic, with a prevalence of prediabetes ranging from 0.5% to 18.2%. Impaired fasting glucose (IFG)/prediabetic was recorded more among the female participants than the males. The study recorded the highest prevalence of IFG in Ghana (18.2%) and the lowest in Nigeria (0.58%) [29] (Table 1). The average prevalence among the studies was 5.52% and 2.2% for diabetes and pre-diabetes, respectively.

Lipid abnormality and metabolic syndrome: The prevalence of students having at least one component of metabolic syndrome ranged from 1.9% to 48.6% [24,27], with the highest prevalence of dyslipidemia (57.3%) reported by a study in Nigeria [27]. The prevalence range of abnormal lipid profiles were low-density lipoprotein cholesterol (LDL-C) (0.67–67.5%), high-density lipoprotein cholesterol (LDL-C) (HDLc) (21.4–57.3%), triglyceride (TG) (4.2–30.8%), and total cholesterol (TC) (0.67–32.4%) (Table 1). The average prevalence of abnormal total cholesterol, triglycerides, and dyslipidemia recorded among the university students was 30.1%, 16.51%, and 30.9%, respectively.

Lifestyle and sedentary behaviours: High-calorie diets and an increased consumption of processed foods were significant risk factors for obesity and diabetes [7]. The prevalence of students whose diets were unhealthy ranged from 21.3% to 85.73% [2,39]. Sedentary behaviour was associated with higher rates of obesity and hypertension, with a prevalence of alcohol consumption by the students ranging from 3.7 to 63% [9,40]. Some students also reported their smoking habits, with the prevalence ranging from 1.02 to 13% [10,38], with one study reporting 10% khat chewing by students [18]. High levels of academic and lifestyle stress with a short sleeping time contributed to the development of cardiometabolic conditions, with a prevalence of 17.25% of students with sleep deprivation recorded in Sudan [39]. One study in Nigeria reported that almost all participants (94.5%) were physically inactive and related this among the main other factors as the cause of CVD [7]. The prevalence of self-reported anxiety (29.2%) and depression (49.2%) among students

was reported in Cameroon [11]. Regarding family history, the common ones identified among the students were stroke (3.1%), diabetes (20.3%), hypertension (17.6%), and obesity (8.0%) [6,8,11,35] (Table 1).

4. Discussion

Obesity, diabetes, hypertension and other cardiovascular risk factors are among the major risk factors for chronic diseases [43]. Their high prevalence among university students suggests a potential increase in the burden of these diseases in the future [7,8]. These cardiovascular risk factors and their health-related issues will likely adversely affect students' academic performance and overall well-being [39]. The treatment and management of CVD and its complications can be costly, hence placing a burden on the affected individuals and health systems [1].

Based on the findings of this review, cardiometabolic diseases in the category of obesity, diabetes, and hypertension are significant health issues among university students across Africa [7,8]. With average overweight and obesity rates of 20.5% and 5.9%, respectively, the highest prevalence of 21.7% obesity reported was low compared to those reported in America (44%). This reflects poor diet, snacking, and sedentary behaviour linked to urbanisation and academic stress [42,44]. Though the prevalence of obesity was relatively low among African university students compared to global data, the increasing trend reflects regional health shifts and challenges influenced by rapid urbanisation and lifestyle changes [45]. Hypertension has been reported to be associated with severe complications in health, such as myocardial infarction and stroke [1,43]. The high prevalence of hypertension (26.4%) recorded among university students presumes a potential increase in the future burden of cardiovascular diseases. The findings show that hypertension prevalence is gradually increasing among university students in Africa [7,8]. The review also recorded a high prevalence of 57.3% for dyslipidemia, 48.6 for metabolic syndrome, and 1.7% for diabetes.

This high prevalence could be related to the dietary and lifestyle habits of the students, with approximately 21.3% to 85.73% of the students having unhealthy diets [2,39]. Although African students may have more traditional diets, urbanisation is changing this pattern as students move from rural to more urban areas for tertiary education where there is an abundance of fast foods [2]. In addition, the review findings show that physical activity (11.1–94.5%), alcohol consumption (3.7–63%), and smoking (1.02–13%) were common among the students. This finding could be related to reports that the transition to university may increase the consumption of processed foods, reduce physical activity, and cause higher stress, causing detrimental cardiometabolic risks [42]. The increasing prevalence of CVD among African students could be related to them not being involved in physical activity [44], which could be seen with the very high prevalence in the study in Nigeria [7]. Furthermore, the limited access to recreational facilities and the pressure from academic programmes may foster sedentary lifestyles on university campuses [44].

Furthermore, another study in Cameroon reported symptoms of depression (49.2%) and anxiety (29.2%) among the students, which could be related to the impact of their physical inactivity and sedentary behaviour [44,46]. Hence, this constitutes one of those areas where during that transition (first year in university), the intervention has to be focused on promoting a healthy lifestyle.

The review also identified some students with a family history of CVD: stroke (3.1%), diabetes (20.3%), hypertension (17.6%), and obesity (8.0%). This is aligned with the increasing CVD prevalence experienced by the general population in Africa [1,2]. The review consequently suggests that CVD among university students should be detected and managed as early as possible to avoid long-term health consequences. Health promotion programmes should pursue positive dietary practices, physical activity, and stress manage-

ment. Universities are well positioned to apply wellness programmes, incorporating these elements into the student experience.

The implications of cardiovascular disease (CVD) prevalence among university students are critical for public policy, as they highlight a need to address early health risks in young adults. The findings strongly suggest a need for public policies that will help overcome the challenges of early diagnosis and prevention [45]. The policies should emphasise early preventive screenings, campus wellness programmes, and lifestyle education to foster long-term health and reduce future healthcare burdens. Addressing such risk factors for CVD during younger years may lead to better outcomes in population health and reduce economic costs related to chronic diseases.

This review's limitations include the included studies' quality and reporting heterogeneity. Also, the differences in the diagnostic criteria between the included studies and measurement methods compromise the comparability of their prevalence. Most of the studies are cross-sectional [23]; thus, ensuring the inference of causality and the long-term trends poses a challenge.

5. Conclusions

The findings suggest that rapid urbanisation and changes in lifestyle and behaviours are responsible for the increased burden of cardiometabolic risk factors in African university students. In addition, academic stress is a key factor that increases the burden of cardiometabolic risk factors through the activation of the sympathetic nervous system, increased consumption of fast foods, and adopting risky behaviours. Targeted health promotion programmes, regular screening, and policy interventions might all go a long way in decreasing the prevalence of cardiovascular and metabolic diseases among these young adults in Africa.

5.1. Highlights of Key Findings

Cardiometabolic disease risk factors are increasingly prevalent among university students in Africa.

Obesity and hypertension are more common compared to diabetes.

Sedentary lifestyle factors, physical activity, and diet play a crucial role in the prevalence of these conditions.

5.2. Recommendations

Tailored public health promotion strategies and interventions to address the specific risk factors in different universities, such as well-being programmes, should be implemented.

Vegetables and fruits should be included in the menu of what is sold at the university canteens.

Wellness programmes on nutrition, physical activity, stress management, and education to support the coping strategies of university students against cardiovascular disease should be implemented.

Additional studies involving larger sample sizes and cohort designs to help understand better the trends and impact of cardiometabolic diseases among African university students should be conducted.

Author Contributions: J.E.E. and R.T.A.: Identified and screened the included articles, Writing—review and editing, Writing—original draft, Methodology, Conceptualization. B.N.-C.: Writing—review and

References

1. WHO Regional Office for Africa. Overview (Cardiovascular diseases). Available online: https://www.afro.who.int/node/5537 (accessed on 21 February 2024).
2. Lemma, N.B.; Jeroen, M.H. The burden of cardiovascular disease in Africa: Prevention challenges and opportunities for mitigation. *Eur. J. Cardiovasc. Nurs.* **2023**, *23*, zvad134. [CrossRef]
3. Andersson, C.; Vasan, R.S. Epidemiology of cardiovascular disease in young individuals. *Nat. Rev. Cardiol.* **2018**, *15*, 230–240. [CrossRef] [PubMed]
4. Zobo, P.C.; Touré, F.Y.; Coulibaly, I.; Bitty-Anderson, A.M.; Boni, S.P.; Niangoran, S.; Guié, A.; Kouakou, H.; Tchounga, B.; Coffie, P.A.; et al. Prevalence of hypertension and other cardiovascular disease risk factors among university students from the National Polytechnic Institute of Côte d'Ivoire: A cross-sectional study. *PLoS ONE* **2023**, *18*, e0279452. [CrossRef] [PubMed]
5. Brenda, K.M.; Luke, O.O. Dietary patterns, behaviours, and their associated factors among university students in coastal Kenya. *Cogent Food Agric.* **2022**, *8*, 2132873. [CrossRef]
6. Obirikorang, C.; Adu, E.A.; Anto, E.O.; Afum-Adjei, A.A.; Fynn, A.N.B.; Osei-Somuah, G.; Ansong, P.N.; Boakye, A.O.; Ofori-Boadu, I.; Obirikorang, Y.; et al. Prevalence and risk factors of obesity among undergraduate student population in Ghana: An evaluation study of body composition indices. *BMC Public Health* **2024**, *24*, 877. [CrossRef]
7. Olufayo, O.E.; Ajayi, I.O.; Ngene, S.O. Clustering of cardiovascular disease risk factors among first-year students at the University of Ibadan, Nigeria: A cross-sectional study. *Sao Paulo Med. J. Rev. Paul. De Med.* **2022**, *141*, 98–106. [CrossRef]
8. Mukhtar, I.G.; Abdullahi, A.T.; Muhammad, S.M.; Sabiu, N.H.; Salisu, A.I. Prevalence of modifiable cardiovascular risk factors among undergraduate students in Kano Nigeria: A need for action. *J. Taibah Univ. Med. Sci.* **2021**, *17*, 578–586. [CrossRef] [PubMed]
9. Bede, F.; Cumber, S.N.; Nkfusai, C.N.; Venyuy, M.A.; Ijang, Y.P.; Wepngong, E.N.; Nguti, K.A.T. Dietary habits and nutritional status of medical school students: The case of three state universities in Cameroon. *Pan Afr. Med. J.* **2020**, *35*, 15. [CrossRef]
10. Sirikyi, I.H.; Eliason, S.; Ghartey, F.N.; Ekenam, E.; Pereko, K.K.A.; Okai, E.; Yiridong, F.; Hagan, O.C.K.; Nsiah, P. Anthropometric indices and cardiometabolic risk factors in a Ghanaian adolescent population. *J. Pediatr. Endocrinol. Metab. JPEM* **2020**, *34*, 35–44. [CrossRef] [PubMed]
11. Nansseu, J.R.; Kameni, B.S.; Assah, F.K.; Bigna, J.J.; Petnga, S.J.; Tounouga, D.N.; Tchokfe, N.S.; Noubiap, J.J.; Kamgno, J. Prevalence of major cardiovascular disease risk factors among a group of sub-Saharan African young adults: A population-based cross-sectional study in Yaoundé, Cameroon. *BMJ Open* **2019**, *9*, e029858. [CrossRef] [PubMed]
12. Owusu-Agyeman, Y.; Mugume, T. Academic adjustment of first-year students and their transition experiences: The moderating effect of social adjustment. *Tert Educ. Manag.* **2023**, *29*, 189–209. [CrossRef]
13. Tapera, R.; Merapelo, M.T.; Tumoyagae, T.; Maswabi, T.M.; Erick, P.; Letsholo, B.; Lee, A. The prevalence and factors associated with overweight and obesity among University of Botswana students. *Cogent Med.* **2017**, *4*, 1357249. [CrossRef]
14. Nansseu, J.R.; Assah, F.; Petnga, S.J.; Kameni, B.S.; Tene, H.D.F.; Nang, F.T.; Wouna, D.L.A.; Noubiap, J.J.; Kamgno, J. Assessing the global risk of cardiovascular disease among a group of university students: Population-based cross-sectional study in Yaoundé, Cameroon. *BMJ Open* **2019**, *9*, e030594. [CrossRef]
15. Choukem, S.P.; Kengne, A.P.; Nguefack, M.L.; Mboue-Djieka, Y.; Nebongo, D.; Guimezap, J.T.; Mbanya, J.C. Four-year trends in adiposity and its association with hypertension in serial groups of young adult university students in urban Cameroon: A time-series study. *BMC Public Health* **2017**, *17*, 499. [CrossRef]
16. Wanghi, G.I.; Mutombo, P.B.; Sumaili, E.K. Prevalence and determinants of hypertension among students of the University of Kinshasa, Democratic Republic of Congo: A cross-sectional study. *Afr. Health Sci.* **2019**, *19*, 2854–2862. [CrossRef]

17. Mbutiwi, F.I.N.; Lepira, F.B.; Mbutiwi, T.L.; Kumakuma, D.K.; Kumbukama, G.K.; Sylvestre, M.P. Prevalence and Sex-Specific Distribution of Cardiovascular Risk Factors in University Students in an Urban-Rural Environment of the Democratic Republic of the Congo. *J. Community Health* **2018**, *43*, 761–767. [CrossRef]

18. Tadesse, T.; Alemu, H. Hypertension and associated factors among university students in Gondar, Ethiopia: A cross-sectional study. *BMC Public Health* **2014**, *14*, 937. [CrossRef]

19. Ofori, E.K.; Angmorterh, S.K. Relationship between physical activity, body mass index (BMI) and lipid profile of students in Ghana. *Pan Afr. Med. J.* **2019**, *33*, 30. [CrossRef] [PubMed]

20. Ofori, E.K.; Intiful, F.D.; Asante, M.; Asare, G.A.; Adjei, P.K.; Steele-Dadzie, R.K.; Amoako-Mensah, A.; Mensah, D.; Angmorterh, S.K. Prevalence of cardiovascular disease risk factors among students of a tertiary institution in Ghana. *Food Sci. Nutr.* **2018**, *6*, 381–387. [CrossRef] [PubMed]

21. Smith, S.; Okai, I.; Abaidoo, C.S.; Acheampong, E. Association of ABO Blood Group and Body Mass Index: A Cross-Sectional Study from a Ghanaian Population. *J. Nutr. Metab.* **2017**, *2018*, 8050152. [CrossRef]

22. Mogre, V.; Nyaba, R.; Aleyira, S.; Sam, N.B. Demographic, dietary and physical activity predictors of general and abdominal obesity among university students: A cross-sectional study. *Springer Plus* **2015**, *4*, 226. [CrossRef] [PubMed]

23. Mogre, V.; Nyaba, R.; Aleyira, S. Lifestyle Risk Factors of General and Abdominal Obesity in Students of the School of Medicine and Health Science of the University of Development Studies, Tamale, Ghana. *Int. Sch. Res. Not.* **2013**, *2014*, 508382. [CrossRef]

24. Mbugua, S.M.; Kimani, S.T.; Munyoki, G. Metabolic syndrome and its components among university students in Kenya. *BMC Public Health* **2017**, *17*, 909. [CrossRef]

25. Agofure, O.; Mohammed, I.; Abiodun, O.O. Prevalence of obesity and awareness of diabetes mellitus and its relationship with obesity among undergraduate students of a private university in southern Nigeria. *Adv. Med. Pharm. Dent. Res.* **2024**. [CrossRef]

26. Olatona, F.A.; Aderibigbe, S.A.; Amu, E.O.; Onabanjo, O.O.; Nnoaham, K.E. Micro-nutrient related malnutrition and obesity in a university undergraduate population and implications for non-communicable diseases. *J. Glob. Health Rep.* **2020**, *4*, e2020091. [CrossRef]

27. Olatona, F.A.; Onabanjo, O.O.; Ugbaja, R.N.; Nnoaham, K.E.; Adelekan, D.A. Dietary habits and metabolic risk factors for non-communicable diseases in a university undergraduate population. *J. Health Popul. Nutr.* **2018**, *37*, 21. [CrossRef]

28. Agwu, E.M.; Draper, S.B.; Croix, M.D.; Egimot-Nwadiaro, R.; Onuoha, C.R. Health Rating, Obesity and Hypertension Among University Students in Nigeria by Gender and Ethnicity. *World J. Public Health* **2017**, *2*, 131–143. Available online: https://api.semanticscholar.org/CorpusID:53364826 (accessed on 20 August 2024).

29. Odili, V.U.; Egor, F.O.; Osarenmwinda, I.M.; Obieche, A.O. Prevalence of Overweight and Obesity among Pharmacy Students in a University in Benin City, Nigeria. *Trop. J. Pharm. Res.* **2015**, *13*, 2109–2114. Available online: https://api.semanticscholar.org/CorpusID:55077359 (accessed on 10 August 2024). [CrossRef]

30. Otemuyiwa, I.O.; Adewusi, S.R. Food choice and meal consumption pattern among undergraduate students in two universities in Southwestern Nigeria. *Nutr. Health* **2014**, *21*, 233–245. [CrossRef]

31. Oghagbon, K.E.; Odili, V.U.; Nwangwa, E.K.; Pender, K. Body mass index and blood pressure pattern of students in a Nigerian university. *Int. J. Health Res.* **2009**, *2*, 177–182. Available online: https://api.semanticscholar.org/CorpusID:73381835. (accessed on 18 August 2024). [CrossRef]

32. Adu, O.B.; Falade, A.M.; Nwalutu, E.J.; Elemo, B.O.; Magbagbeola, O.A. Nutritional status of undergraduates in a Nigerian university in south-west Nigeria. *Int. J. Med. Med. Sci.* **2009**, *8*, 318–324.

33. Onyechi, U.A.; Okolo, A.C. Prevalence of obesity among undergraduate students, living in halls of residence, University of Nigeria, Nsukka campus, Enugu state. *Anim. Res. Int.* **2009**, *5*, 928–931. Available online: https://api.semanticscholar.org/CorpusID:10372019 (accessed on 20 August 2024). [CrossRef]

34. Ali, M.; Yusuf, H.I.; Stahmer, J.; Rahlenbeck, S.I. Cardiovascular Risk Factors and Physical Activity Among University Students in Somaliland. *J. Community Health* **2015**, *40*, 326–330. Available online: https://www.jstor.org/stable/48716032 (accessed on 16 August 2024). [CrossRef] [PubMed]

35. Torres, G.; Gordon, N.F.; Constantinou, D. Cardio-Respiratory Fitness and Cardiovascular Disease Risk Factors Among South African Medical Students. *Am. J. Lifestyle Med.* **2022**, *17*, 791–798. [CrossRef] [PubMed]

36. Ntlahla, E.E.; Mfengu, M.M.; Engwa, G.A.; Nkeh-Chungag, B.N.; Sewani-Rusike, C.R. Gut permeability is associated with hypertension and measures of obesity but not with Endothelial Dysfunction in South African youth. *Afr. Health Sci.* **2021**, *21*, 1172–1184. [CrossRef]

37. Nkeh-Chungag, B.N.; Mxhosa, T.H.; Mgoduka, P.N. Association of waist and hip circumferences with the presence of hypertension and pre-hypertension in young South African adults. *Afr. Health Sci.* **2015**, *15*, 908–916. [CrossRef]

38. Smith, C.; Essop, M.F. Gender differences in metabolic risk factor prevalence in a South African student population. *Cardiovasc. J. Afr.* **2009**, *20*, 178–182.

39. Musaiger, A.O.; Al-Khalifa, F.; Al-Mannai, M. Obesity, unhealthy dietary habits and sedentary behaviors among university students in Sudan: Growing risks for chronic diseases in a poor country. *Environ. Health Prev. Med.* **2016**, *21*, 224–230. [CrossRef]

40. Nyombi, K.V.; Kizito, S.; Mukunya, D.; Nabukalu, A.; Bukama, M.; Lunyera, J.; Asiimwe, M.; Kimuli, I.; Kalyesubula, R. High prevalence of hypertension and cardiovascular disease risk factors among medical students at Makerere University College of Health Sciences, Kampala, Uganda. *BMC Res. Notes* **2016**, *9*, 110. [CrossRef] [PubMed]

41. Bimenya, G.S.; Byarugaba, W.; Kalungi, S.; Mayito, J.; Mugabe, K.; Makabayi, R.; Ayebare, E.; Wanzira, H.; Muhame, M. Blood pressure profiles among Makerere University undergraduate students. *Afr. Health Sci.* **2005**, *5*, 99–106. Available online: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1831913/ (accessed on 20 August 2024). [PubMed]

42. Obesity Medicine Association: Obesity Care in College Students in the US. Available online: https://obesitymedicine.org/blog/obesity-care-in-college-students-in-the-us/ (accessed on 20 August 2024).

43. Centers for Disease Control and Prevention. National Center for Chronic Disease Prevention and Health Promotion; About the Division for Heart Disease and Stroke Prevention. Available online: https://www.cdc.gov/heart-disease/risk-factors/index.html (accessed on 20 August 2024).

44. WHO: Promoting Physical Activity in the African Region. Available online: https://iris.who.int/bitstream/handle/10665/352475/WHO-AF-UHP-01-2022-eng.pdf (accessed on 21 February 2024).

45. Eteneneng, E.J. Challenges of early diagnosis and prevention of cardiovascular disease in Sub-saharan Africa. *Int. Heart Vasc. Dis. J.* **2024**, *12*, 33–40. Available online: http://heart-vdj.com/files/2024,43_en/Challenges_of_early_diagnosis.pdf (accessed on 20 August 2024).

46. Lewis, R.; Roden, L.C.; Scheuermaier, K.; Gomez-Olive, F.X.; Rae, D.E.; Lacovides, S.; Bentley, A.; Davy, J.P.; Christie, C.J.; Zschernack, S.; et al. The impact of sleep, physical activity and sedentary behaviour on symptoms of depression and anxiety before and during the COVID-19 pandemic in a sample of South African participants. *Sci. Rep.* **2021**, *11*, 1–11. [CrossRef]