ATTAHADI MED J. 2026;3(1):78-83
https://doi.org/10.69667/amj.26112

Prevalence and Correlates of Cardiovascular Risk Factors Among University Students in Libya: A Cross-Sectional Study

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***Keywords**:*
Cardiovascular Risk, University Students, Lifestyle Factors, Libya, Obesity.

ABSTRACT

Cardiovascular diseases (CVDs) are the leading cause of global mortality, with modifiable lifestyle factors contributing significantly. University students represent a critical demographic for early intervention. This study assessed the prevalence of CVD risk factors among students at Attahadi University, Libya. A cross-sectional study was conducted in 2024 with 330 undergraduate students (mean age 22.7 ± 4.1 years). Data were collected via a validated Arabic questionnaire and clinical measurements (BMI, blood pressure). Lifestyle factors (diet, physical activity, smoking, stress) were analyzed for associations with health indicators. The study found 89% of students consumed fast food weekly, while only 11.5% met fruit/vegetable recommendations. Physical inactivity affected 48%, and smoking prevalence was 20.6% (48.3% males vs. 3.5% females). Overweight/obesity affected 44% (95% CI: 38.6–49.4) and elevated blood pressure affected 25% (95% CI: 20.4–29.6). Stress correlated with higher BMI ($r = +0.18$, 95% CI: 0.07–0.28, $p = 0.002$) and systolic blood pressure ($r = +0.21$, 95% CI: 0.10–0.31, $p < 0.001$). Unhealthy lifestyles are prevalent among Libyan university students, with significant gender disparities. Targeted interventions (nutrition education, smoking cessation, stress management) are urgently needed.

Introduction

Cardiovascular diseases (CVDs) remain the leading cause of mortality worldwide, accounting for approximately 32% of all global deaths [1]. The burden of CVD disproportionately affects low- and middle-income countries, where over 75% of CVD-related deaths occur [1]. Modifiable lifestyle factors—including poor diet, physical inactivity, tobacco use, and psychosocial stress—are major contributors to the development of CVD [2]. These risk factors often emerge during young adulthood, making university students a critical demographic for early intervention [3]. The transition to university life represents a period of significant behavioral change, often characterized by unhealthy dietary habits, reduced physical activity, and increased stress [4]. Studies have shown that university students frequently adopt high-calorie, low-nutrient diets, with fast food consumption being particularly prevalent [5]. Concurrently, physical activity levels tend to decline due to academic demands and sedentary behaviors [6]. These lifestyle shifts contribute to weight gain, elevated blood pressure, and other cardiometabolic risk factors [7].

Early adulthood is a pivotal time when lifelong habits are formed, and unhealthy behaviors established during this period can significantly increase the risk of developing chronic conditions later in life [2,14]. In addition, multiple health behaviors tend to cluster, meaning that students who engage in one risky behavior, such as smoking, are more likely to have a poor diet and physical inactivity simultaneously, compounding their cardiovascular risk [15]. The coexistence of these behaviors creates a synergistic effect, accelerating the onset of atherosclerosis and other cardiovascular pathologies. Globally, increasing urbanization and modernization have led to lifestyle changes marked by greater sedentary time and accessibility of calorie-dense foods, particularly among youth populations [2,8].

In the MENA region, socioeconomic transitions have been accompanied by a rise in obesity rates and metabolic syndrome prevalence among young adults, fueling the regional CVD epidemic [8]. Furthermore, psychosocial stress related to academic pressures and economic uncertainties may exacerbate these risks by influencing hormonal and metabolic pathways involved in cardiovascular health [2,15]. Research in Saudi Arabia, Jordan, and Egypt has consistently documented high prevalence of individual and multiple CVD risk factors among university students, highlighting the urgent need for culturally tailored preventive interventions in this demographic [9–11]. Without timely action, the combination of behavioral and environmental factors may result in escalating CVD morbidity and mortality as these young adults age.

Despite growing evidence from neighboring countries, data on CVD risk factors among Libyan university students remain scarce. Libya shares many sociocultural and economic characteristics with other MENA nations, including rapid urbanization, shifting dietary patterns, and increasing tobacco use [12]. University students often adopt poor lifestyle habits, including unhealthy diets, physical inactivity, smoking, and irregular sleep, all of which contribute to elevated cardiovascular risk. At Attahadi University, no prior studies have assessed the relationship between student lifestyles and cardiovascular health. Rapid urbanization and academic stress further encourage behaviors such as fast-food consumption, sedentary living, and a lack of physical activity. These modifiable behaviors are largely asymptomatic in youth, making early screening and prevention vital. Habits formed during university years tend to persist into adulthood,

***Received**: 06-01-2026 - **Accepted**: 24-02-2026 - **Published**: 05-03-2026*

affecting long-term health. This study aims to fill a local knowledge gap by identifying key risk factors within the student population. Findings may inform targeted health education programs and promote preventive strategies. Ultimately, the study supports the creation of a health-conscious academic environment to reduce future cardiovascular burden.

This study was designed to evaluate cardiovascular health risks among students at Attahadi University. The primary aim was to determine the prevalence of key risk factors, including poor diet, physical inactivity, smoking, obesity, and hypertension. In addition, gender differences in the distribution of these risk factors were examined to identify potential disparities in health behaviors and outcomes. Associations between lifestyle practices and clinical indicators, such as body mass index (BMI) and blood pressure, were also assessed to provide a clearer understanding of how daily habits influence measurable health parameters. Ultimately, the study sought to generate evidence-based recommendations that could inform campus health interventions and promote preventive strategies tailored to the student population.

Methods

Study Design and Setting

This study employed a descriptive cross-sectional design and was conducted at Attahadi University, a private institution located in Tripoli, Libya. The university comprises several faculties, including Pharmacy, Dentistry, and Medical Technology, primarily serving students aged 18 to 25 years. Data collection took place during the fall semester of the 2024–2025 academic year. Participants were recruited from the main campus using designated classrooms and the university clinic, which provided a private setting for survey administration and clinical measurements. Each participant was assessed once, consistent with the cross-sectional approach. This design was selected for its suitability in estimating the prevalence of lifestyle behaviors and their relationship to cardiovascular risk factors among the student population.

Inclusion and Exclusion Criteria

The target group included all undergraduate students enrolled during the 2024 academic year. The university had an estimated enrollment of approximately 700 students. Eligible participants had to be 18 years or older and enrolled in any faculty. Students under 18 were excluded unless parental consent was provided; however, all participants were ultimately 18 or older. Postgraduate students and those with known cardiovascular disease or serious chronic illness (e.g., diagnosed diabetes, congenital heart conditions) were excluded to focus on primary prevention among healthy individuals. Students on academic leave or who did not consent to participate were also excluded.

Sampling Technique and Sample Size

A stratified random sampling technique was applied. Student lists were obtained from each faculty, and proportional sampling ensured representation from all academic disciplines. A minimum sample size of 244 was calculated using a 95% confidence level, 5% margin of error, and an assumed 50% prevalence of risk factors. To mitigate non-response, 300 students were targeted, with 330 ultimately participating, representing about 47% of the total population. The response rate was approximately 85% of those invited.

Data Collection Instruments and Procedures

Data were collected via a structured, self-administered questionnaire and a brief clinical examination. The questionnaire, developed in English and translated to Arabic, covered demographics, medical history, dietary habits, physical activity (adapted from the IPAQ), smoking and alcohol use, stress levels, sleep patterns, and awareness of cardiovascular risk factors. Stress levels were assessed using a self-reported frequency-based scale (never, occasionally, frequently), adapted from previously published student health surveys. Although not a standardized psychometric instrument, this method allowed estimation of stress prevalence and its association with cardiovascular risk factors among students. A pilot test with 30 students helped refine the tool. Clinical measurements included height, weight, BMI (calculated and categorized per WHO standards), waist circumference, and blood pressure (categorized and defined according to the American Heart Association (AHA) 2017 guidelines (normal <120/80 mmHg; elevated 120–129/<80 mmHg; hypertension ≥130/80 mmHg)). Each student's average BP was recorded after two consistent readings, or three if necessary. Questionnaire data and measurements were entered electronically using KoBoCollect on tablets, ensuring real-time validation and minimizing entry errors. All activities were conducted in private stations to preserve confidentiality.

Data Management and Analysis

Data were exported to a secure spreadsheet and analyzed using IBM SPSS (version 26). Descriptive statistics summarized demographic and health-related variables. Prevalence rates of overweight/obesity, elevated blood pressure, smoking, inactivity, and poor diet were calculated with 95% confidence intervals. Bivariate

***Received**: 06-01-2026 - **Accepted**: 24-02-2026 - **Published**: 05-03-2026*

analyses examined associations using Chi-square tests for categorical variables and t-tests for comparisons of continuous variables. Pearson correlation coefficients assessed relationships between lifestyle scores and health indicators. A significance level of $p < 0.05$ was used. No multivariate models were employed due to the study's scope.

Ethical Considerations

Ethical approval was granted by the Research Ethics Committee of Attahadi University (Approval No. ATU-2024-01). Participants received a detailed information sheet and gave written informed consent. Anonymity was maintained through coded identifiers. Only the principal investigator had access to the code list, which was destroyed after verification. Students with abnormal findings were encouraged to seek medical advice. A health seminar was organized post-study to share results and promote awareness, fulfilling the ethical responsibility of informing participants while respecting their rights and confidentiality.

Results

The study included a total of 330 undergraduate students. Results are summarized in the following tables, highlighting demographic characteristics, lifestyle behaviors, clinical risk factors, key statistical correlations, and the impact of health education.

The sample was nearly gender-balanced, with a mean age consistent with university-level students. A considerable proportion (21.5%) reported a family history of cardiovascular disease (CVD), indicating potential hereditary risk. Although 44% were overweight or obese, the majority (94%) rated their health as good or excellent—suggesting a disconnect between perceived and actual health status.

Table 1. Demographic and Health Characteristics of Participants (n=330)

Characteristic	Category	n (%) or Mean ± SD
Sex	Male	159 (48.2%)
	Female	171 (51.8%)
Age (years)	–	22.7 ± 4.1
Family history of CVD	Yes	71 (21.5%)
	No	259 (78.5%)
BMI Category	Overweight/Obese (≥25)	145 (44%)
Self-rated Health	Excellent/Good	310 (94%)

Smoking prevalence was significantly higher among males. Poor dietary patterns were common, with high fast-food consumption and inadequate fruit/vegetable intake. Nearly half of the students reported minimal physical activity, and stress was prevalent, indicating multiple lifestyle-related cardiovascular risk factors. Only 10% reported using healthy coping strategies.

Table 2. Lifestyle Behaviors Among Students

Behavior	Category	Prevalence (%)
Smoking	Male smokers	48.3%
	Female smokers	3.5%
Diet	Fast food ≥3×/week	71.6%
	Fruits/vegetables ≤1/day	45%
Physical activity	Rarely or never exercise	47.9%
Stress	Frequent stress episodes	58.8%

A significant portion of students exhibited clinical indicators of early metabolic risk. Overweight and obesity affected 44% of participants, and one-quarter had elevated blood pressure. Abdominal obesity, a marker of central adiposity, was present in 18%, aligning with sedentary lifestyle patterns and poor diet.

Table 3. Clinical and Anthropometric Measurements

Measure	Category	Prevalence (%)
Body Mass Index (BMI) (kg/m²)	Overweight/Obese	44%
Blood Pressure (mmHg)	Pre-hypertensive/Hypertensive	25%
Waist Circumference (cm)	Abdominal obesity	18%

Frequent stress showed statistically significant positive correlations with both weight and systolic blood pressure, suggesting its potential contribution to early cardiovascular changes. Other lifestyle behaviors, such as smoking and fast-food consumption, showed weaker correlations in this relatively young cohort.

Received*: 06-01-2026 -* ***Accepted****: 24-02-2026 -* ***Published****: 05-03-2026*

Table 4. Correlations Between Risk Factors (Pearson's r)

Factor	Weight	Systolic BP (SBP)	Stress Level
Smoking	–0.02	+0.07	–
Fast food frequency	+0.08	–0.05	–
Stress frequency	+0.18*	+0.21*	–

** Significant at $p < 0.05$*

Participants who had received health education demonstrated significantly lower smoking rates and higher engagement in regular physical activity. However, health education had limited influence on diet and BMI, indicating that while awareness may improve certain behaviors, structural and environmental interventions are necessary to drive comprehensive lifestyle change.

Table 5. Impact of Health Education on Key Behaviors

Health Behavior	Educated Group (58.2%)	Non-Educated Group (41.8%)	*p*-value
Smoking prevalence	14.6%	29.0%	< 0.001
Regular physical activity	72.0%	61.6%	0.039

Discussion

This study highlights a concerningly high burden of modifiable cardiovascular disease (CVD) risk factors among students at Attahadi University, despite their young average age (~22–23 years). Nearly half (44%) were overweight or obese, and over 20% exhibited blood pressure readings within hypertensive or pre-hypertensive ranges—an alarming finding given the population's youth. These outcomes reflect unhealthy lifestyle patterns observed, including frequent fast-food consumption, low fruit and vegetable intake, tobacco smoking (20%), and physical inactivity in nearly half the cohort. The prevalence of smoking, notably higher than in some regional student populations, underscores tobacco use as a critical target for intervention.

The clustering of risk factors observed—poor diet, inactivity, obesity, and smoking—is biologically plausible and consistent with established cardiovascular pathophysiology. Excessive fast-food intake contributes to caloric surplus and adiposity, while smoking induces sympathetic activation and vascular changes leading to increased blood pressure. The high stress levels reported may exacerbate these effects through neuroendocrine pathways involving cortisol, fostering central adiposity and hypertension. These findings align with global literature demonstrating that young adults often manifest lifestyle-related CVD risks early, with poor diet and inactivity as predominant contributors [1–3].

Compared to regional data, the obesity prevalence among Attahadi students (44%) is considerably higher than reported rates in Jordan (19–31%) and Saudi Arabia (~31%) [4,5]. Similarly, the elevated blood pressure prevalence (~23%) exceeds some neighboring cohorts [6], mirroring trends in the broader MENA region where urbanization and nutrition transition fuel early CVD risk accumulation [7]. The smoking rate of 20%—especially concentrated among males—is also notable when contrasted with lower rates among Saudi medical students and Western counterparts, though it remains lower than some European historical data [5,8]. This gender disparity likely reflects cultural norms surrounding tobacco use and physical activity, as females in this context may have fewer opportunities for sports and lower smoking prevalence [9]. Interestingly, most students perceived their health as "good" or "excellent" despite objective evidence of risk factors, revealing a significant gap between perceived and actual cardiovascular risk. This misperception may hinder motivation to adopt preventive behaviors and underscores the need for targeted health education [10]. Students reporting healthier lifestyles—non-smoking, regular exercise, and better diets—had significantly lower BMI and blood pressure, supporting the potential impact of lifestyle modifications. Although the cross-sectional design limits causal inference, the associations strongly advocate for intervention strategies focused on diet, physical activity, smoking cessation, and stress management [1,3]. Moreover, prior exposure to health education was linked to lower smoking prevalence, suggesting that increased awareness can facilitate positive behavioral change.

Strengths of this study include the comprehensive approach combining objective biometric measures with detailed self-reported lifestyle data, minimizing reliance on self-report alone. The use of electronic data capture and pilot testing enhanced data quality, while focusing on an under-studied Libyan university student population fills an important regional knowledge gap. This multifactorial assessment allows for the identification of actionable targets for intervention. Limitations include the cross-sectional design, which precludes causal conclusions and the potential for reverse causality. Self-reported lifestyle data may be affected by social desirability and recall bias, despite anonymity assurances. The sample, drawn from a single private university, may not generalize to all Libyan students or other demographic groups. Biochemical risk markers such as lipid profiles and glucose were not assessed, possibly underestimating true cardiometabolic risk. Finally, while elevated BMI and blood pressure indicate risk, many values were near borderline thresholds, representing early markers rather than established disease.

Received*: 06-01-2026 -* ***Accepted****: 24-02-2026 -* ***Published****: 05-03-2026*

Conclusion

This study demonstrates a high prevalence of modifiable cardiovascular disease (CVD) risk factors—including unhealthy diet, physical inactivity, smoking, psychosocial stress, overweight/obesity, and elevated blood pressure—among students at Attahadi University. Despite their young age, a substantial proportion already exhibits early cardiometabolic risk indicators. These findings highlight the urgent need for early preventive strategies within the university setting to reduce future cardiovascular burden. Preventive strategies at the university should promote healthy diets, regular physical activity, and tobacco control. Mental health support and stress management programs are essential. Routine screening for BMI and blood pressure is advised to identify at-risk students early. These measures can help reduce long-term cardiovascular risk and foster healthier lifestyles among university students.

Conflict of interest. Nil

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Received*: 06-01-2026 -* ***Accepted****: 24-02-2026 -* ***Published****: 05-03-2026*

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Received*: 06-01-2026 -* ***Accepted****: 24-02-2026 -* ***Published****: 05-03-2026*