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Evaluation of Knowledge, Attitude, and Practice Towards Cardiovascular Disease Risk Factors and Preventive Measures Among Preclinical Medical Students In Ibb University, Yemen

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Abstract

Background

Cardiovascular diseases (CVDs) are a leading cause of morbidity and mortality in Yemen. Raising awareness of CVD and the factors affecting cardiovascular health, particularly among young people, is essential for reducing its prevalence. This study aimed to assess the knowledge, attitudes, and practices (KAP) regarding CVD risk factors and preventive measures among preclinical medical students at Ibb University, Yemen.

Methods

A cross-sectional survey was conducted among preclinical MBBS students in Years 1, 2, and 3. Using a stratified random sampling method, the sample size was 205. Participants were required to complete a survey questionnaire on CVD risk factors and preventive measures. The questionnaire was adapted from previously published studies. Data entry, cleaning, and analysis were performed using SPSS 27, with appropriate adjustments for reverse-scored items.

Results

Among the 205 preclinical medical students, the population was predominantly single (93.7%) and female (54.1%). A significant portion of participants were in Year 1 (34.6%), and the majority came from urban areas (81.5%) with moderate family income (85.4%). A notable proportion were Khat chewers (39.5%) and non-smokers (94.6%), with 81.5% reporting a family history of cardiovascular disease. The mean (± SD) scores for knowledge, attitude, and practice were 8.70 ± 1.43 (79%), 23.98 ± 2.46 (88.8%), and 22.9 ± 3.5 (57%), respectively. There was no significant correlation between total attitude and practice scores ($p > 0.676$), or between total knowledge and attitude scores ($p = 0.346$), or between total knowledge and practice scores ($p = 0.962$). However, total knowledge scores significantly differed by academic year ($p = 0.001$). Significant differences in total attitude and practice scores were observed between smokers and non-smokers ($p = 0.010$ and 0.007, respectively). Additionally, practice scores showed significant differences between males and females, as well as between Khat chewers and non-chewers ($p = 0.001$, $p = 0.050$, respectively).

Conclusion

This study identifies a significant knowledge-practice gap among medical students, despite generally positive attitudes. Academic progression and positive health behaviors, especially non-smoking, were key determinants of better outcomes, with female students demonstrating significantly superior results.

These findings underscore the need for targeted cardiovascular health education among preclinical medical students.

Introduction

Cardiovascular diseases (CVDs), a cluster of disorders affecting the heart and vasculature, including coronary heart disease, cerebrovascular disease, and peripheral arterial disease, are the leading cause of mortality globally, presenting a formidable and persistent public health challenge (World Health Organization [WHO], 2025; Nezhad et al., 2016). While this burden is universal, it is disproportionately shouldered by low- and middle-income countries, which are experiencing a steep rise in both the incidence and prevalence of CVDs. A particularly alarming trend in these regions is the ninefold increase in heart failure fatalities among individuals under 45, signaling a significantly higher rate of premature mortality compared to the developed world (Amini et al., 2021).

The etiology of CVDs is multifaceted, involving an interplay of non-modifiable and modifiable risk factors. Non-modifiable determinants include age, gender, and genetic predisposition (Ibrahim et al., 2016). However, the major contributors to the escalating epidemic are modifiable behavioral and metabolic factors. These include hypertension, smoking, dyslipidemia, diabetes, obesity, and physical inactivity. A substantial body of evidence indicates that up to 90% of cardiovascular events are preventable through the effective management of these modifiable risks, specifically by addressing unhealthy diets, sedentary lifestyles, and tobacco use (McGill et al., 2008). Consequently, effective prevention strategies —ranging from population-wide primordial and primary prevention to patient-focused secondary prevention—are critical for curtailing CVD-related morbidity and premature mortality (Mogre et al., 2015; Raitakari et al., 2013).

The efficacy of any preventive strategy is fundamentally contingent upon the awareness, attitudes, and proactive practices of both the public and healthcare providers. Empirical reviews, however, consistently reveal substantial deficits in knowledge, attitudes, and practices (KAP) concerning CVD risk factors. Studies across diverse populations in Cameroon, Tanzania, and Nigeria have documented poor knowledge of risk factors and warning signs (Aminde et al., 2017; Muhihi et al., 2020; Odunaiya et al., 2021). This gap is not confined to the general public; it extends to younger populations and even those within the healthcare pipeline. For instance, Padmavathy et al. (2022) found a high prevalence of cardiovascular health risk behaviors among medical students, including smoking (22%) and episodic heavy drinking (35%), coupled with a concerning disconnect between risk awareness (53%) and the adoption of preventive practices (38%). Such findings underscore an urgent, global need for targeted cardiovascular health education, particularly among the younger generation whose behaviors are formative (Padmavathy et al., 2022).

This imperative is acutely pronounced in Yemen, a nation grappling with a complex humanitarian crisis and a mounting burden of non-communicable diseases. CVDs are now the leading cause of death in the country, with a notably higher mortality rate observed among women (WHO, 2025). Despite this severe

and growing burden, there is a profound scarcity of local data on knowledge, attitudes, practices, risk factors, and preventive behaviors. This lack of information constitutes a major obstacle to the design and implementation of effective, evidence-based national prevention programs. This knowledge gap is particularly concerning regarding future healthcare providers. Medical students, as the physicians of tomorrow, play a pivotal role in combating the CVD epidemic. Their role extends beyond clinical treatment to encompass health promotion, patient education, and serving as role models for healthy living.

It is therefore imperative that medical students possess a comprehensive understanding of CVD risk factors and embrace positive health behaviors from the earliest stages of their training. Preclinical students, in particular, are at a critical formative juncture where foundational knowledge and attitudes toward health are being solidified, shaping their future clinical practice and personal health choices. If these future physicians graduate with significant knowledge gaps or suboptimal preventive practices, the cycle of inadequate CVD prevention and management within the Yemeni population is likely to persist. Currently, to the best of our knowledge, there are no published reports from Yemen specifically assessing KAP regarding CVD risk factors among this crucial demographic of preclinical medical students. Therefore, this study aimed to assess the knowledge, attitudes, and practices (KAP) regarding CVD risk factors and preventive measures among preclinical medical students at Ibb University, Yemen.

Methods

Study Design and Setting

This study is a cross-sectional, descriptive-analytical research designed to assess the knowledge, attitudes, and practices (KAP) regarding risk factors for cardiovascular disease (CVD) and preventive measures among students at the Faculty of Preclinical Medicine, Ibb University, Yemen. The study was conducted at the College of Medicine, Ibb University, between May and November 2025. The research's spatial scope was limited to preclinical medical students at Ibb University, Yemen. The study's geographic boundary ensured a focused investigation within a specific group, enabling a detailed examination of KAP-related risk factors for CVDs among preclinical medical students in this region.

Study Population and Selection Criteria

The study population consisted of 435 male and female students in the pre-clinical medicine department, distributed across three levels: Level 1: 150 male and female students. Level 2: 145A male and female student. Level 3: 140 A male and female student.

3.4. Selection criteria:

Inclusion criteria: Yemeni preclinical medical students of both genders. The inclusion criteria for participants were age 18 years and above, both genders, and Years 1 to 3 from the Department of

Medicine in the faculty. A third Clinical year students were also included, as they had only completed a course unrelated to the research topic.

Exclusion criteria: Preclinical medical students' refusal to participate in the study. Students with CVD were excluded from this survey. Students transferring from other universities and those who had completed a Medical Laboratory Sciences or Clinical Nutrition program were also excluded.

Study Sampling and Sample Size

Study Sampling: Stratified random sampling was used to select participants. Sample size**:** The calculated sample size was 205. Seventy-one first-year students, sixty-eight second-year students, and sixty-six third-year students, both male and female, were selected to participate in the study. Recommended overall sample size (95% confidence, 5% margin of error, p=0.5. Use the standard sample size formula for proportions: n0 = (Z2 p (1-p) / e2. Where Z = 1.96 (for 95% confidence), p = 0.5 (maximizes variance), and e = 0.05 (margin of error). n0 = (1.962. 0.5. 0.5) / 0.052 = 384. Apply finite population correction (FPC) because N is small: n = n0 / (1 + (n0 - 1)/N). n = 384.16 / (1 + (384.16 - 1) / 435) = 205.

Alternatively, use the Sampling site: http://www.raosoft.com/samplesize.html**.** Recommended sample size (n) = 205. Stratified (proportional) allocation to each level. Compute proportion and allocate: Level 1: proportion = (150/435) 205 = 71. Level 2 proportion = (145/435) × 205 = 68. Level 3: proportion = (140/435) 205 = 66. Total Sample size: 71 + 68 + 66 = 205

Collect data Tool

Tool design:

A set of KAP questionnaires was developed based on the literature, including studies by Ibrahim et al. (2016) and Padmavathy et al. (2022). The questionnaire was administered in four sections, each evaluating aspects of: the first section was the characteristics of the study participants, such as Gender, Academic year, and Marital Status. living area, Khat. Smoking, family income, and family history of CVD. The second section consisted of (11) closed-ended questions on Knowledge regarding CVD risk factors and their preventive measures, the third section: Attitudes. The third section comprised 9 Likert-type questions on attitudes towards the risk factors of CVD. It had three choices, ranging from Agree to "Disagree." Section 4: Practice. This section consisted of (10) four-point items. The fourth section used the scheme of four answer choices: "Always", "Frequent", "Seldom", and "Never", centered on the practice towards the prevention of CVD risk factors [Always means at all times, Frequent means happening often, seldom means not often or rarely, never means not ever or not at any time.

Tools' validity and reliability:

to assess the objectivity, applicability, clarity, and feasibility of the research tools. The questionnaire's validity was verified in two ways: expert **validity.** Experts from the Faculty of Medicine at Ibb University

verified the content validity. Pilot study: The questionnaire was pre-tested with 20 students. All item correlations were statistically significant at $p < 0.05$, indicating a strong relationship between the individual items and their respective constructs.

Tool's reliability: The questionnaire's reliability was assessed by calculating Cronbach's alpha coefficients for test internal consistency: knowledge (0.79), attitude (0.80), and practice (0.79). Total Cronbach's alpha was (0.82). which showed acceptable internal consistency

3.8. Ethical Considerations

Ethical approval was obtained from the Ibb University Faculty of Medicine Institutional Review Board, with a waiver of informed consent due to the analysis's retrospective nature. The investigation adhered to the principles of the Declaration of Helsinki and followed TRIPOD guidelines for transparent reporting of multivariable prediction model development and validation.

The KAP Score

An assessment system was developed to calculate the Knowledge, Attitudes, and Practices (KAP) score.

- **Knowledge Score:** Each correct answer was coded as 1, and each incorrect answer as 0. The Knowledge Score was calculated by summing the scores of the correct answers. The total Knowledge score ranged from 0 to 11. It was categorized as follows: Low Knowledge (<50%), Moderate Knowledge (50%–80%), and High Knowledge (81%–100%).
- **Attitude Score:** Items were scored on a 3-point Likert scale, ranging from 1 (Positive Attitude) to 3 (Negative Attitude). The total Attitude scores ranged from 9 to 27. The total scores were categorized as follows: Negative Attitude (<50%); Moderate Attitude (50%–<80%); and Positive Attitude (81%–100%).
- **Practice Scoring:** Each item was scored on a four-point scale, e.g., (4) for "always" and (1) for "never." The total practice scores ranged from 10 to 40. They were classified as follows: Low practice (<50%), Medium practice (50%-80%), and High practice (81%-100%).

3.9. Data Analysis

Data were entered into Excel for preliminary processing and analyzed using SPSS version 27. Descriptive statistics (frequencies, percentages, means, and standard deviations) were used to describe socio-demographic characteristics and KAP scores. The Mann-Whitney and Kruskal-Wallis tests were used to compare KAP scores across different socio-demographic characteristics. In contrast, Spearman's correlation test was used to assess the association between KAP and CVD risk factors. Correlations were interpreted using r values: weak (0–0.25), fair (0.25–0.5), good (0.5–0.75), and excellent (>0.75). A p-value of <0.05 was considered statistically significant.

Results

Characteristics of the study participants

A total of 205 preclinical medical students from Ibb University participated in this cross--

sectional study. The distribution of participants across academic years was relatively even: 71 (34.6%) from Year 1, 68 (33.2%) from Year 2, and 66 (32.2%) from Year 3. The sample comprised 94 males (45.9%) and 111 females (54.1%). The vast majority of participants were single (93.7%), and most resided in urban areas (81.5%). Regarding lifestyle factors, 81 students (39.5%) reported khat chewing. A significant majority were non-smokers (94.6%), with a small percentage being current smokers (2.4%) or ex-smokers (2.9%). Economically, most participants came from families with moderate income (85.4%), while 12.2% reported high family income and 2.4% reported low family income. In terms of family history of cardiovascular disease, 81.5% reported no history in immediate family members (father, mother, or siblings). Among those with a positive family history, it was most frequently reported in fathers (11.7%). See Table 1

Table 1
Characteristics of the study participants (n = 205).

Variable	Category	Frequency	Percent
Gender	Male	94	45.9
	Female	111	54.1
Academic year	1st	71	34.6
	2nd	68	33.2
	3rd	66	32.2
Marital Status	Single	192	93.7
	Married	13	6.3
living area	Rural	38	18.5
	Urban	167	81.5
Khat	Yes	81	39.5
	No	124	60.5
Smoking	Smoker	5	2.4
	Non-Smoker	194	94.6
	Ex-Smoker	6	2.9
Family income	Low	5	2.4
	Moderate	175	85.4
	High	25	12.2
Family History	Father	24	11.7
	Mother	11	5.4
	Siblings	3	1.5
	Others	167	81.5

KAP levels assessment of cardiovascular risk factors

The overall knowledge level regarding cardiovascular disease risk factors and preventive measures among preclinical medical students was moderate to high, with a mean and standard deviation of total knowledge scores of 8.70 ± 1.43 (79%). with a median of 9. The total knowledge scores ranged between 3 and 11. The highest level of awareness was observed for item a10, where 95.6% (n = 196) of students correctly recognized that adequate exercise can prevent CVD. The highest level of awareness was observed for item a10, where 95.6% (n = 196) of students correctly recognized that adequate exercise

can prevent CVD. The next highest level of awareness was observed for item a9, where 95.1% (n = 195) of participants correctly disagreed with the misconception that CVD is a disease affecting only women. A strong understanding was also demonstrated for items related to lifestyle and dietary factors. Specifically, 90.7% (n = 186) of students acknowledged that stress and psychological strain lead to heart disease (a11), and 89.8% (n = 184) recognized that irregular eating patterns are harmful (a4). Furthermore, the majority of students correctly identified the importance of controlling high-fat food consumption (a8, 89.3%, n = 183), acknowledged that CVD can occur in young people (a5, 87.3%, n = 179), and understood that eating fruits and vegetables can prevent CVD (a2, 86.8%, n = 178). Students demonstrated a good level of knowledge, though slightly lower, on several fundamental concepts. For item a1, 70.2% (n = 144) of participants correctly identified that CVD is the leading cause of death in Yemen. Similarly, 70.2% (n = 144) correctly recognized high-density lipoprotein (HDL) as the "good" type of cholesterol (a7). However, notable knowledge gaps were identified. A moderate level of understanding was observed for item a3, with just over half of the students (54.6%, n = 112) correctly recognizing that most CVD cases are not purely hereditary. Critically, the most significant knowledge deficit was observed for item a6, which assessed understanding of obesity classification. Only 40.0% (n = 82) of participants correctly identified that a Body Mass Index (BMI) greater than 30 indicates obesity, the lowest-scoring item on the knowledge assessment. See Table 2

Table 2
Knowledge on CVD Risk Factors and the Preventive Measure (n = 205)

Item	Incorrect	Correct
a1. Cardiovascular disease (CVD) is the leading cause of death in Yemen.	61 (29.8%)	144 (70.2%)
a2. Eating fruits or vegetables can prevent CVD.	27 (13.2%)	178 (86.8%)
a3. Most CVD cases are hereditary.	93 (45.4%)	112 (54.6%)
a4. Irregular eating patterns bring harm.	21 (10.2%)	184 (89.8%)
a5. Cardiovascular disease can occur in young people.	26 (12.7%)	179 (87.3%)
a6. BMI > 30 is considered obese.	123 (60.0%)	82 (40.0%)
a7 High-density lipoprotein (HDL) is a good type of cholesterol.	61 (29.8%)	144 (70.2%)
a8. Controlling high-fat food consumption is essential.	22 (10.7%)	183 (89.3%)
a9. Cardiovascular disease is a disease of women only.	10 (4.9%)	195 (95.1%)
a10. Adequate exercise can prevent CVD.	9 (4.4%)	196 (95.6%)
a11. Stress and psychological strain lead to heart disease	19 (9.3%)	186 (90.7%)
F=Frequency) %=Percentage *Expected correct: Score = 1; Incorrect Score = 0;		

The overall attitude level regarding cardiovascular disease risk factors and preventive measures among preclinical medical students was positive, with a meanand standard deviation of total attitude scores of 23.98 ± 2.46 (88.8%). with a median of 25. The total attitude scores ranged between 12 and 27. The most favorable attitudes were observed for dietary habits and awareness of tobacco harm. An overwhelming majority of students expressed a positive attitude towards consuming fruits and vegetables for health maintenance (item b1, 97.1%) This was closely followed by the recognition that smoking is detrimental to health (item b5, 96.6%) and the belief that stress should be controlled to avoid illness (item b2, 90.7%), Most students agreed that they should exercise to maintain a healthy lifestyle (item b9, 88.3%), maintain their weight according to their Body Mass Index (item b4, 74.6), and consume less oily food (item b8, 73.2%). Additionally, a majority expressed a preference for walking over taking transportation for nearby places (item b6, 70.2%). For item b3 ("I should eat or buy fast food when going out with friends"), only 32.2% of students demonstrated a positive attitude by disagreeing with this statement. In contrast,

40.0% held a moderate view, and 27.8% expressed a negative attitude (i.e., agreeing with the statement). Similarly, item b7 ("I prefer to play with my laptop instead of doing exercise") revealed a tendency towards sedentary behavior. Just over half of the students (53.2%) expressed a positive attitude by disagreeing with the preference for laptops over exercise, while 22.9% were moderate, and nearly a quarter (23.9%) held a negative attitude. See Table 3

Table 3
Attitude regarding Risk Factors of CVD and its prevention (N = 205)

Item	Positive	Moderate	Negative
b1. I should include fruit or vegetables in my diet to maintain my health.	199 (97.1%)	4 (2.0%)	2 (1.0%)
b2. I should control my stress to avoid getting any disease.	186 (90.7%)	16 (7.8%)	3 (1.5%)
b3. I should eat or buy fast food when going out with friends.	66 (32.2%)	82 (40.0%)	57 (27.8%)
b4. I should maintain my weight according to my body mass index (BMI).	153 (74.6%)	42 (20.5%)	10 (4.9%)
b5. I know that smoking is bad for health.	198 (96.6%)	2 (1.0%)	5 (2.4%)
b6. I would rather walk than take transportation to nearby places.	144 (70.2%)	42 (20.5%)	19 (9.3%)
b7. I prefer playing on my laptop to exercising.	109 (53.2%)	47 (22.9%)	49 (23.9%)
b8. I should eat less oily food to maintain a healthy lifestyle.	150 (73.2%)	48 (23.4%)	7 (3.4%)
b9. I should be doing exercise to maintain a healthy lifestyle.	181 (88.3%)	16 (7.8%)	8 (3.9%)

The overall practice level regarding cardiovascular disease risk factors and preventive measures among preclinical medical students was moderate, with a mean and standard deviation of total practice scores of 22.9 ± 3.5 (57%). with a median of 23. The total practice scores ranged between 13 and 35. The most favorable practices were observed in relation to stress management and active transportation. A majority of students reported feeling stressed daily due to personal or study-related issues (item c5, 62.4%). Encouragingly, over half of the participants reported walking for at least 10 minutes to get to and from places cafes, classes, or the mosque daily (item c8, 56.6%), The frequency of exercise was notably low, with the majority of students exercising either never (42.4%) or only 2–3 times per week (38.5%), and only 10.2% reporting daily exercise (item c). While fruit and vegetable consumption was suboptimal, with nearly half of the students (49.3%) consuming them only 2–3 times per week and only 17.6% eating them daily (item c10), fast food consumption was also frequent (item c10). Approximately half of the participants (49.8%) reported eating fast food 2–3 times per week, and 16.1% consumed it daily (item

c2). Similarly, the consumption of high glycemic diets (item c3) and fried foods as a main course (item c4) was predominantly in the 2–3 times per week category, suggesting a routine inclusion of unhealthy dietary options. Sleep patterns emerged as another area of concern. The largest proportion of students (42.0%) reported getting enough sleep only 2–3 times per week, with only 22.4% achieving sufficient sleep daily (item c6). Several healthy practices were notably infrequent. The majority of students reported never engaging in vigorous physical activity such as heavy lifting or digging (item c7 76.6%). Furthermore, the use of supplements or special diets (e.g., Evening Primrose oil, oat diet) was rare, with 69.3% of participants never using them (item c9). See Table 4

Table 4
Practice regarding Risk Factors of CVD (N = 205)

Item	Never	2–3 times	4–6 times	Everyday
c1. How frequently do you exercise in a week?	87 (42.4%)	79 (38.5%)	18 (8.8%)	21 (10.2%)
c2. How often do you eat fast food in a week?	25 (12.2%)	102 (49.8%)	45 (22.0%)	33 (16.1%)
c3. How often do you consume a high glycemic diet as the main course of your meal in a week?	37 (18.0%)	111 (54.1%)	30 (14.6%)	27 (13.2%)
c4. Do you take fried food as your main course?	50 (24.4%)	101 (49.3%)	31 (15.1%)	23 (11.2%)
c5. How often do you feel stressed out due to personal or study-related issues?	18 (8.8%)	27 (13.2%)	32 (15.6%)	128 (62.4%)
c6. How often do you get enough sleep in a week?	37 (18.0%)	86 (42.0%)	36 (17.6%)	46 (22.4%)
c7. Does your daily activity involve vigorous activity such as heavy lifting or digging?	157 (76.6%)	33 (16.1%)	6 (2.9%)	9 (4.4%)
c8. Do you walk for at least 10 minutes to get to and from places such as a café, a class, or a mosque?	21 (10.2%)	33 (16.1%)	35 (17.1%)	116 (56.6%)
c9. Do you take any supplements or special diet (e.g., Evening Primrose oil, oat diet)?	142 (69.3%)	39 (19.0%)	14 (6.8%)	10 (4.9%)
c10. How often do you take fruits and vegetables in your diet?	20 (9.8%)	101 (49.3%)	48 (23.4%)	36 (17.6%)
Frequencies (Percentage)				

The Correlation between KAP regarding CVD Risk Factors

There was no significant correlation between total attitude and practice scores ($r = 0.029$, $p > 0.676$), as shown in Fig. 1, Also, there was no significant correlation between total knowledge and attitude scores

(r = + .066, p = 0.346) as shown Figs. 2, and there was no significant correlation between total knowledge and practice scores (r = 0.003, p = 0.962) as shown in Figs. 3

Comparing KAP regarding CVD Risk Factors between different sample Characteristics

In comparing total knowledge scores, there is a significant difference by academic year (p = 0.001). The mean rank scores increased progressively from first-year students (mean rank = 80.94) to second-year students (mean rank = 104.89), with third-year students achieving the highest knowledge scores (mean rank = 124.79). This pattern suggests a positive association between advancing through the preclinical curriculum and the acquisition of knowledge related to CVD risk factors and preventive measures. In contrast, there is no significant difference between males and females (p = 0.405), between married and single students (p = 0.694), or between rural and urban residents (p = 0.666). Furthermore, knowledge scores did not differ significantly by khat chewing status (p = 0.220), smoking status (p = 0.192), family income level (p = 0.344), or family history of CVD (p = 0.676).

The comparison of total attitude scores shows a significant difference between smokers and Non-smokers (p = 0.010). Non-smokers demonstrated the most positive attitudes (mean rank = 105.63), followed by ex-smokers (mean rank = 78.67), while current smokers exhibited the least positive attitudes (mean rank = 30.00). This finding indicates a clear association between smoking behavior and less favorable attitudes towards CVD prevention.

The comparison of total attitude scores shows no significant difference between males and females (p = 0.377), across different academic years (p = 0.140), and between married and single students (p = 0.122). Likewise, no significant differences were observed based on living area (p = 0.244), Khat chewing (p = 0.356), family income (p = 0.783), or family history of CVD (p = 0.887). However, practice scores show a significant difference between males and females (p = 0.001), with females demonstrating a higher mean rank (115.96) compared to males (87.70), indicating that female students reported engaging in healthier practices more frequently. Consistent with the attitude findings, smoking status was also significantly associated with practice scores (p = 0.007). Ex-smokers reported the most favorable practices (mean rank = 120.50), followed by non-smokers (mean rank = 104.52), while current smokers had the lowest practice scores (mean rank = 22.90). This finding reinforces the pattern that smoking behavior is linked to poorer engagement in cardiovascular preventive practices. Khat chewing approached but did not reach statistical significance at the conventional alpha level of 0.05 (p = 0.050), suggesting a potential trend towards less healthy practices among khat chewers (mean rank = 93.03) compared to non-chewers (mean rank = 109.51). No statistically significant differences in practice scores were found for academic year (p = 0.150), marital status (p = 0.738), living area (p = 0.383), family income (p = 0.552), or family history of CVD (p = 0.536). See Table 5

Table 5
Comparison of Total KAP Scores between sample characteristics (n = 205).

Independent Variable	Group	N	Knowledge Mean Rank	p-value	Attitude Mean Rank	p-value	Practice Mean Rank	p-value
Gender	Male	94	106.66	0.405	106.92	0.377	87.70	**0.001**
	Female	111	99.90		99.68		115.96	
Academic year	1st	71	80.94	0.001	107.77	0.14	112.71	0.15
	2nd	68	104.89		95.24		93.51	
	3rd	66	124.79		105.86		102.33	
Marital Status	Married	192	103.41	0.694	104.64	0.122	103.36	0.738
	Single	13	96.88		78.73		97.69	
Living area	Rural	38	106.66	0.666	112.97	0.244	95.46	0.383
	Urban	167	102.17		100.73		104.72	
Khat	Yes	81	109.14	0.220	107.66	0.356	93.03	0.050
	No	124	98.99		99.96		109.51	
Smoking	Smoker	5	93.20	0.192	30.00	**0.010**	22.90	**0.007**
	Non-Smoker	194	101.96		105.63		104.52	
	Ex-Smoker	6	144.67		78.67		120.50	
Family income	Low	5	96.30	0.344	85.10	0.783	83.90	0.552
	Moderate	175	105.39		103.30		104.75	
	High	25	87.58		104.48		94.56	
Family History	Father	24	116.33	0.676	104.23	0.887	108.42	0.536
	Mother	11	106.27		103.91		100.95	
	Siblings	3	101.67		76.33		149.50	
	Others	167	100.89		103.24		101.52	
Mann-Whitney / Kruskal-Wallis Test								

Discussion

This study aimed to evaluate knowledge, attitudes, and practices (KAP) regarding cardiovascular disease (CVD) risk factors among preclinical medical students at Ibb University, Yemen. The study design was cross-sectional, aligning with previous studies, although the sampling frames and participant characteristics varied. Ghamri et al. (2017) focused on clinical-year students (third, fifth, and sixth years; N = 259), while Padmavathy et al. (2022) specifically examined preclinical students (first and second years; N = 168). Ibrahim et al. (2016) used a broader institutional approach, sampling students from all faculties at IIUM Kuantan Campus (N = 163), including medical and health sciences students. In contrast, the current study from Ibb University assessed preclinical medical students across three years (first, second, and third; N = 205).

The findings of this study from Ibb University indicated that preclinical medical students exhibited moderate to high knowledge of CVD risk factors, with a mean knowledge score of 8.70 ± 1.43 (79%). This result aligns with Padmavathy et al. (2022), who reported a composite mean knowledge score of 8.23 ± 2.46 among preclinical students, though without significant differences between first and second-year students. Ibrahim et al. (2016) reported a mean knowledge score of 42.98 ± 2.46 across all faculties, noting significant differences between faculties ($p < 0.001$), with medical students demonstrating superior knowledge compared to non-medical students.

Compared to non-medical populations, Ibb University students performed relatively well. Research from Cameroon and rural Tanzania found that over half of participants had poor overall knowledge of CVD risk factors and warning signs (Aminde et al., 2017; Muhihi et al., 2020). The performance of Ibb University students was similar to that of student populations in India, where a larger proportion of students were categorized with only moderate knowledge (Yeluri et al., 2021). This superior knowledge is expected, given the participants' medical training. It is consistent with the finding that knowledge scores significantly improved with more advanced academic years ($p < 0.001$), highlighting the impact of medical education.

Ghamri et al. (2017) provided longitudinal insights, revealing that 36% of sixth-year students had sufficient knowledge of CVD risk factors compared to 22.2% of third-year students ($p = 0.045$). Notably, sixth-year students exhibited superior knowledge in specific domains, such as medication prescription (64% vs. 48% of fifth-year and 45% of third-year students; $p = 0.015$), awareness of mortality rates in Saudi Arabia ($p = 0.0001$), and knowledge of arterial blood pressure values in high-risk individuals ($p = 0.001$). However, third-year students demonstrated better knowledge of target LDL levels in diabetic patients ($p = 0.030$), suggesting that knowledge acquisition is not always linear and may be influenced by curriculum timing and reinforcement.

Despite adequate overall knowledge, critical knowledge gaps persisted within this educated group. A significant 60% of students could not identify a BMI > 30 as the threshold for obesity, and 45.4% incorrectly believed that "most CVD cases are hereditary." This misconception about the primacy of non-modifiable risk factors mirrors findings from other studies, where complex topics such as the roles of

genetics and cholesterol were poorly understood (Yeluri et al., 2021). While medical students grasp broad concepts, a deeper, more nuanced understanding of specific risk metrics requires focused reinforcement in the curriculum.

These findings mirror those of Ghamri et al. (2017), who concluded that while clinical-year students demonstrated better understanding than preclinical students, overall awareness remained insufficient. The consistency of this observation across diverse cultural and educational contexts—Saudi Arabia, India, Malaysia, and now Yemen—suggests that medical curricula globally may inadequately address the detailed aspects of CVD risk factors.

Students in the current study demonstrated overwhelmingly positive attitudes (mean score of 88.8%), surpassing levels observed in many other studies. For instance, research in Nigeria found that 65.8% of at-risk patients had poor attitudes (Ajayi & Ojo, 2007), and another study among Nigerian university adolescents and young adults revealed that 78.1% held an incorrect perception of CVD risk (Odunaiya et al., 2021). The strong agreement with statements on the importance of fruits and vegetables (97.1%), not smoking (96.6%), and stress control (90.7%) reflects a solid foundational belief in preventive health principles.

Padmavathy et al. (2022) reported composite mean attitude scores of 47.38 ± 9.24 among preclinical students, though they did not compare the scores across years due to a homogeneous sample. While the current study used a different scale, the attitude scores (23.98 ± 2.46) suggest a similarly positive orientation.

Despite this positive outlook, some areas of concern were evident. Attitudes were significantly less positive regarding eating or buying fast food when going out with friends (only 32.2% positive) and preferring laptop use over exercise (53.2% positive). These attitudes, similar to those found among Italian women who perceived CVD as a "male ailment" and did not view themselves as at high risk (Maffei et al., 2022), point to complacency or low perceived susceptibility. Furthermore, smokers exhibited significantly less positive attitudes than non-smokers and ex-smokers ($p = 0.010$), highlighting the negative influence of personal risk behaviors on attitudes toward prevention, necessitating targeted intervention.

The most critical finding was the stark contrast between high knowledge and attitude scores and moderate practice scores (57%). This "knowledge-doing gap" is a pervasive issue in healthcare, but its presence among future physicians is particularly concerning. Reported practices were considerably worse than those of diabetic patients in Ethiopia, 55% of whom exhibited good preventive practices, including high rates of avoiding fatty foods and smoking (Workina et al., 2022).

Specific unhealthy practices were prevalent: 42.4% of students never exercised, 76.6% never engaged in vigorous physical activity, and the majority consumed fast food (49.8%) and high-glycemic foods (54.1%) 2–3 times per week. These results are more concerning than those from Saudi Arabia, which also reported high fast-food consumption, but predominantly among males (Al-Rethaiaa et al., 2010). The

high prevalence of physical inactivity is particularly alarming, given the well-established link between sedentary behavior and CVD mortality (Pandey & Khadka, 2012).

Padmavathy et al. (2022) reported composite mean practice scores of 22.73 ± 6.53 among preclinical students, which is strikingly similar to the current study's practice score of 22.9 ± 3.5, suggesting that preclinical medical students globally may face similar challenges in translating knowledge into behavior.

In the current study, there was no significant correlation between total attitude and practice scores ($p > 0.676$). This result contrasts with Ibrahim et al. (2016), who reported a positive correlation between attitude and practice scores ($r = 0.354$, $p < 0.001$). However, consistent with Ibrahim et al. (2016), the current study found no significant correlation between total knowledge and attitude scores ($p = 0.346$) or between total knowledge and practice scores ($p = 0.962$). This lack of correlation between knowledge and practice is particularly noteworthy, suggesting that increased medical knowledge alone may not automatically translate into healthier personal behaviors. These findings underscore the need to revise the curriculum to address behavioral determinants better better.

The absence of a knowledge-practice correlation in both studies is particularly noteworthy. It suggests that increasing medical knowledge alone may not automatically translate into healthier personal behaviors among medical students. This finding has important implications for curriculum design, suggesting that health promotion interventions must go beyond knowledge transmission to address behavioral determinants.

Correlation analysis revealed that better practices were significantly associated with being female ($p = 0.001$) and not being a current smoker ($p = 0.007$). The gender difference aligns with global trends, where women tend to engage in more health-seeking behaviors. The strong association between smoking status and poor practices underscores smoking as a key marker for an overall unhealthy lifestyle.

The study also revealed significant differences in knowledge across academic years ($p = 0.001$), with progressive improvement from first-year (mean rank = 80.94) to third-year students (mean rank = 124.79). This progressive improvement in knowledge supports Ghamri et al. (2017), who found that clinical-year students had a better understanding than preclinical students. However, Ghamri's study showed inconsistent knowledge across specific domains.

Regarding gender differences, the study found no significant gender differences in knowledge ($p = 0.405$) or attitude ($p = 0.377$), but females demonstrated significantly better practices ($p = 0.001$). This finding aligns with Ibrahim et al. (2016), who found that females scored better in attitude ($p = 0.005$) and practice ($p = 0.017$), though no gender differences in knowledge were observed ($p = 0.837$). Padmavathy et al. (2022) did not report gender-based comparisons, limiting cross-study analysis.

Lastly, this study uniquely explored khat chewing, a culturally specific behavior in Yemen, finding that khat chewers showed a trend toward less healthy practices ($p = 0.050$). This trend underscores the importance of incorporating region-specific risk factors in CVD prevention education. Ibrahim et al.

(2016) emphasized the need for faculty-specific interventions, noting significant differences in knowledge across faculties and recommending increased physical activity among students. Ghamri et al. (2017) highlighted the relevance of curriculum localization in enhancing students' awareness of local mortality rates ($p = 0.0001$), suggesting that tailored educational content improves knowledge retention.

Conclusion

This study effectively assessed knowledge, attitudes, and practices (KAP) related to cardiovascular disease (CVD) risk factors among preclinical medical students at Ibb University, Yemen. While the students demonstrated moderate to high levels of knowledge and positive attitudes, their personal preventive practices were inadequate, revealing a significant "know-do" gap. The lack of a correlation between knowledge and practice reported by Ibrahim et al. (2016) suggests that acquiring knowledge alone is insufficient to foster healthy behaviors. The observed progressive improvement in knowledge across academic years underscores the value of medical education. However, the persistent knowledge gaps and unhealthy practices highlight the need for curriculum enhancements that integrate personal health promotion alongside theoretical learning. These findings contribute to the growing body of literature on cardiovascular health education in medical schools and emphasize the necessity of interventions that target not only knowledge but also attitudes and practices, tailored to the cultural context.

Declarations

Ethical Approval:

Ethical approval was obtained from the Ibb University Faculty of Medicine Institutional Review Board, with a waiver of informed consent due to the analysis's retrospective nature. The investigation adhered to the principles of the Declaration of Helsinki and followed TRIPOD guidelines for transparent reporting of multivariable prediction model development and validation.

Competing Interests

All authors declare that they have no competing interests to disclose.

Consent for publication

All authors have read and accepted the final version of the work, and they agree to its publication.

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Data availability

The datasets used and analyzed in the current analysis are available from the corresponding author upon reasonable request.

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Figures

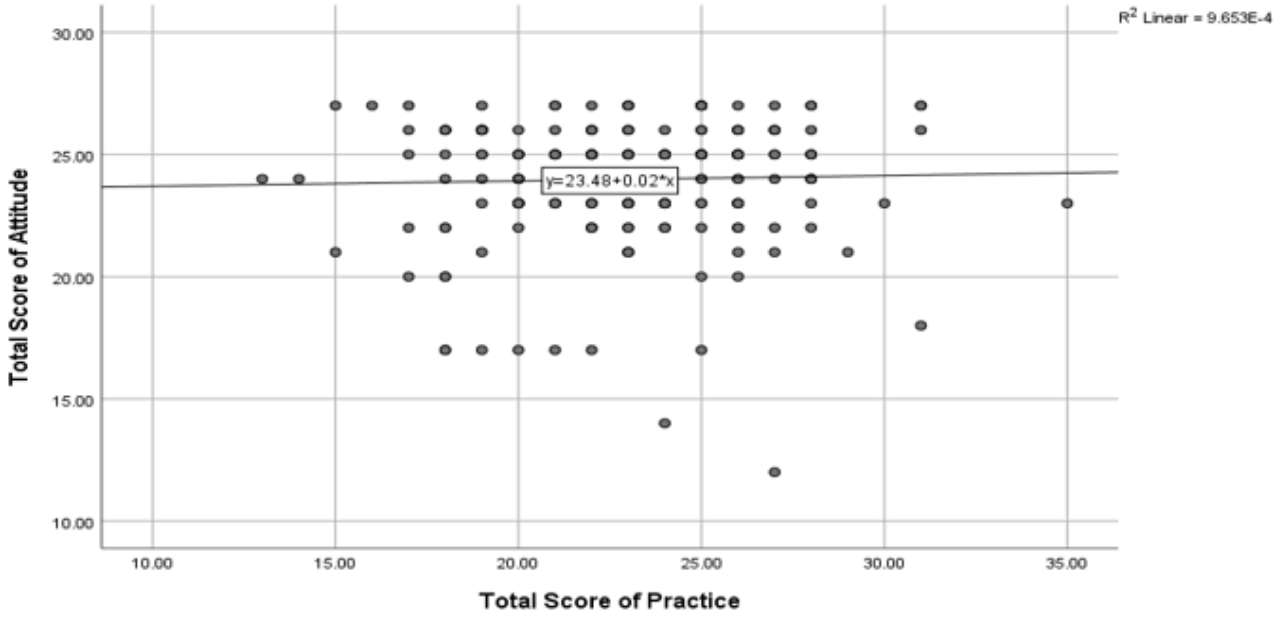


Figure 1

Correlation between total scores of Attitudes and Practice

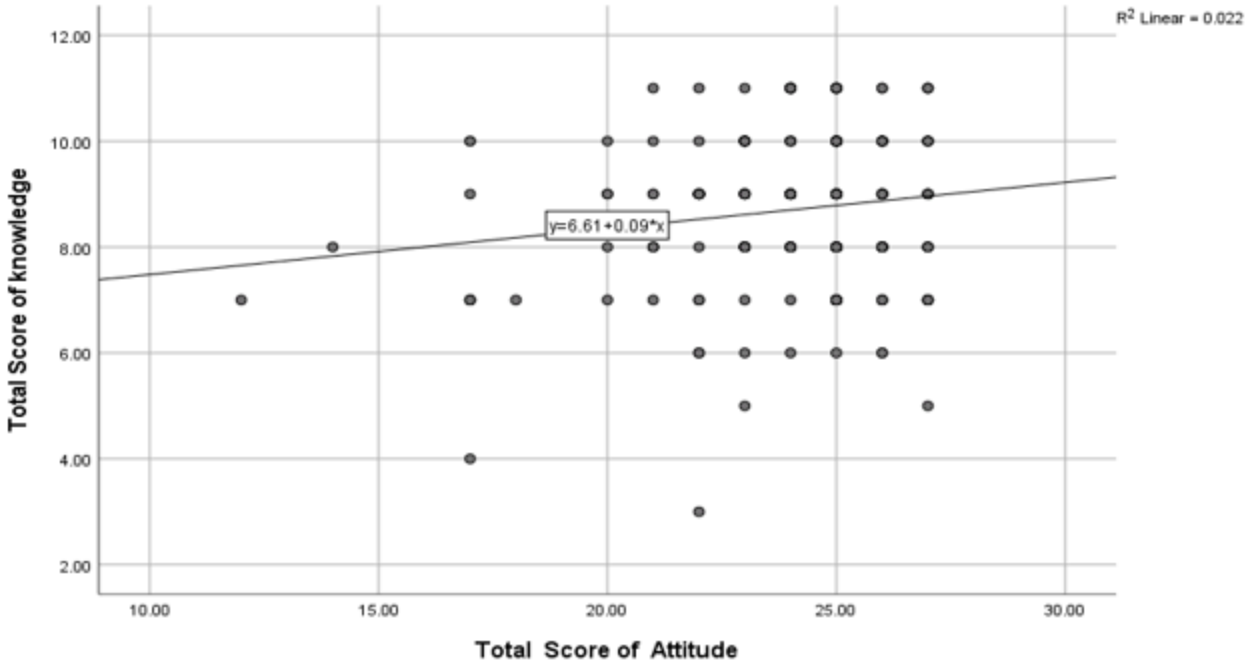


Figure 2

Correlation between Total Scores of Knowledge and Attitude

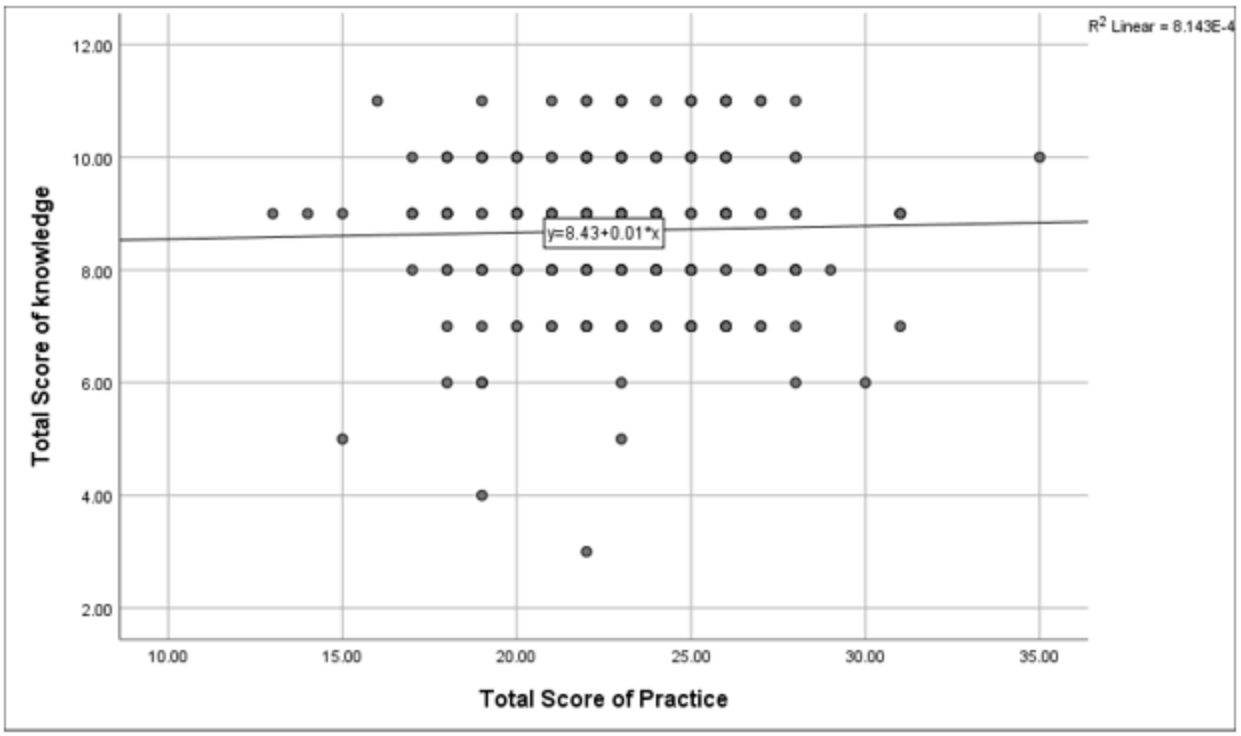


Figure 3

Correlation between Total Scores of Knowledge and Practice