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Cardiovascular Insight: A Study on Cardiovascular Disease Knowledge, Attitude and Practice among University Students

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Abstract

Understanding the interplay between knowledge, attitudes, and practices (KAP) concerning cardiovascular diseases (CVD) among university students is crucial for shaping healthcare-seeking behaviours and preventive measures. Understanding the university students' knowledge, attitude and practice of cardiovascular disease was the aim of the present study. The study was conducted in Pakistan. This study adopted a cross-sectional approach and utilized a convenient sampling technique. The sample size was 196 with a mean age of 21. For the measurement of knowledge, attitude and practice behaviour, a developed questionnaire CVD-KAP29 was used. The mean and standard deviation for the scores in knowledge, attitude, physical activity behaviour, as well as nutrition and smoking behaviour, were 30.04±4.95, 39.15±8.30, 1.92±1.14, and 5.37±1.77, respectively. A strong positive correlation emerged between knowledge and attitude scores ($r = 0.756$, $P < 0.001$). Conversely, no significant relationship was found between knowledge and practice scores, nor between attitude and practice scores. Notably, a significant correlation was identified between physical activity behaviour and dietary habits as well as smoking behaviour ($r = 0.448$, $p < 0.001$). The participants in the study exhibited commendable knowledge and positive attitudes toward cardiovascular disease; however, their practical behaviours demonstrated deficiencies, notably in areas such as inadequate dietary habits, lack of physical activity, utilization of vegetable or other oils in cooking, as well as regular consumption of tobacco products such as cigarettes and hookah. Additionally, while women exhibited higher scores in knowledge and attitude compared to men, no disparities were observed in their practice scores. Even though a majority of the participants in the present study exhibited an advanced level of understanding and positive attitudes towards CVD, their behaviours did not align satisfactorily. Consequently, there exists a crucial need to implement enhanced educational interventions focusing on fostering favourable health behaviours. It is important to communicate to young adults the interconnectedness between knowledge and proactive measures in reducing risk factors, subsequently leading to

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decreased incidences of CVD and mortality.

Keywords: Cardiovascular disease; Knowledge; Attitude; Physical Activity Behavior; Smoking and Nutrition Behavior; University Students; KAP

1 Introduction

Globally, cardiovascular diseases (CVDs) stand as the primary cause of mortality as compared to any other health conditions (Amini et al., 2021). In the recent World Heart Report of 2023, it is noted that over 500 million individuals worldwide are confronted with cardiovascular diseases. In 2021, almost 20.5 million deaths will be caused by this health issue, comprising almost 33% of the total worldwide fatalities. This figure spots a rise from the previously estimated 121 million deaths due to CVDs (Cesare et al., 2023). In accordance with current estimations, it is anticipated that if the prevailing pattern of cardiovascular disease (CVD) fatalities persists, by 2030 the yearly count of CVD-related deaths could surge to 23.3 million, primarily stemming from strokes and heart attacks (Heidenreich et al., 2011; Sultana et al., 2020).

In the year 2023, the global population has reached a staggering 8 billion individuals. Remarkably, approximately 620 million individuals are suffering from heart and circulatory ailments worldwide. Annually, an estimated 60 million individuals worldwide are newly diagnosed with heart or circulatory diseases (Kunadian, 2023). Throughout the globe, around 1 in every 13 individuals contend with a heart or circulatory condition. These diseases, which comprise heart-related issues, contribute to about one in every three deaths worldwide. Shockingly, an estimated 20.5 million people yielded to these conditions in 2021, marking an average of 56,000 lives lost each day or roughly one death occurring every 1.5 seconds (British Heart Foundation, 2023). Furthermore, statistics from 2019 show a higher number of women affected by heart and circulatory diseases compared to men, with approximately 290 million women (53%) and 260 million men affected generally.

Studies among migrants expose a marked vulnerability to cardiovascular diseases (CVD) among those of South Asian origin (India, Pakistan, Bangladesh) when relocating to prosperous nations. Their rates of CVD are at least 1.5 to 2 times higher compared to the local white population (Khan et al., 2022). Eight key risk factors contribute to 61% of cardiovascular deaths. These factors include high blood pressure, physical inactivity, alcohol and tobacco use, high blood cholesterol and glucose levels, insufficient intake of fruits and vegetables, and high body mass index (BMI) (WHO, 2011). According to Thienemann et al. (2023), major risk factors for cardiovascular diseases (CVD) are linked with high-income nations, over 84% of the disease's worldwide burden affects low- and middle-income countries. The partial influence of anti-smoking campaigns, inadequate early-stage screening conveniences, and lacking awareness of cardiovascular disease risk factors might contribute significantly to the elevated disease burden in developing nations.

Age, gender, and hereditary factors are categorized as non-modifiable risk elements, although factors like smoking, obesity, and physical inactivity fall under modifiable risks as they are controllable and susceptible to modification (Cardiovascular Consultants, 2006). Cardiovascular disease (CVD) stands as Pakistan's main cause of mortality, accountable for approximately 30% of all deaths. High blood pressure, poor diet and physical inactivity are the major risk elements including tobacco usage. CVD significantly contributes to illness and fatalities, often unidentified and unmanaged due to insufficient awareness and healthcare accessibility. Pakistan's government dynamically addresses this through the National Program for Control of Cardiovascular Diseases, emphasizing risk prevention, disease management, and early detection (Chaudhry, 2020; Haque, 2020).

Promoting awareness of cardiovascular diseases (CVD) among the younger generation holds

substantial importance in lessening its prevalence. Hence, there is an anticipation that young individuals will embrace healthier lifestyles as a result (Figueiro, & Pedler, 2023). Analyzing the preliminary Knowledge, Attitudes, and Practices (KAP) regarding cardiovascular diseases among young individuals, like university students, holds significant importance. Several studies have investigated KAP to understand disease patterns and behaviours in society. A thorough assessment of KAP, its influencing factors, and understanding aids in prevention and promotes commitment to a healthy lifestyle for life (Kebede et al., 2022).

Nevertheless, despite many studies representing a positive attitude, particularly concerning cardiovascular disease (CVD) risks, it was observed, as demonstrated in a study conducted in Saudi Arabia, that individuals' positive attitudes toward CVD risk factors, comprising smoking, high-fat diets, and weight concerns, did not persistently translate into corresponding practices. Among these factors, only the intention to cease smoking was found to exhibit a correlation with actual practice (Khattab et al., 1999). This study aims to assess the knowledge, attitudes, and practices (KAP) of the general population in Pakistan concerning cardiovascular disease (CVD) risks. It seeks to compare KAP levels across numerous sociodemographic factors and observe the correlation between knowledge, attitudes, and practices linked to risk factors of CVD.

2 Method

2.1 Material and Methods

This study employs a cross-sectional descriptive and analytical approach aimed at evaluating the Knowledge, Attitudes, and Practices (KAP) concerning cardiovascular disease (CVD) among students enrolled at Bahauddin Zakariya University (BZU), located in Pakistan. The research seeks to assess the understanding, perspectives, and behaviors related to CVD risk among this specific demographic. The investigation took place within the timeframe from December 1st to December 15th, 2023. The survey forms were disseminated among undergraduate students and postgraduate students across three distinct departments at BZU MULTAN: The Department of Commerce, the Department of Applied Psychology, and the Department of English. These questionnaires were administered with a time gap provided for completion, and subsequently collected once participants finished responding. To participate, individuals had to meet specific criteria: being 18 years old or above, encompassing both genders and comprising undergraduate as well as graduate students from each department.

2.2 Questionnaire

We evaluated KAP regarding CVD by utilizing the CVD-KAP29 scale (Koohi et al., 2021). This comprehensive scale encompasses four distinct domains: knowledge, attitude, physical activity-related behavior, and nutrition and smoking behavior, comprising a total of 29 items. Participants rated their knowledge on a 3-point scale. Respondents were prompted to indicate their consensus by selecting from "2=Yes, 0=No, 1=I don’t know" for each item. For measuring attitude (items 13 to 22), a five-point Likert scale was employed. Participants were requested to indicate their agreement level by using the provided scale: "1 = Strongly Disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, 5 = Strongly Agree". The evaluation of practice behavior (items 23 to 29) was conducted using a scale based on a 3-point rating, with responses ranging from 0 to 2 based on the nature of each item. The practice section was further divided into two segments: two items focused on physical activity behaviors, while the remaining five items centred on nutrition and smoking behaviors.

3 Results

In this section, we discuss the psychometric characteristics and demographic attributes of study variables.

3.1 Psychometric Properties

Table 1: Reliability of the Scale

S. No.	Variables	No. of Items	Scale Alpha Value
1	Knowledge	12	0.818
2	Attitude	10	0.895
3	Physical Activity Behavior	2	0.57
4	Nutrition and Smoking Behavior	5	0.65

Table 1 demonstrates strong internal consistency among the variables under scrutiny. Specifically, the CVD-KAP29 displays a robust alpha value of 0.888. Moreover, the knowledge scale and attitude measures also showcase notable internal consistency, with alpha values of 0.806 and 0.889, respectively. The prior scale demonstrated reliability across its four subscales ranging from 0.95 to 0.36 (Koohi et al., 2021), whereas the current scale exhibits reliability ranging between 0.895 and 0.67. This range signifies a level of reliability from excellent too good for the present scale.

3.2 Demographic Properties

Table 2: Mean and Standard Deviation of age

Demographic Variables	Mean (*M*)	Standard Deviation (*SD*)	Minimum	Maximum
Age	21.77	2.47	18	35

As illustrated in Table 2, the study's 196 participants exhibited an age range spanning from 18 to 37 years, displaying a mean age of 21.77 years (SD=2.47). This data, categorized into four distinct groups, facilitates the segmentation of the sample into different demographic cohorts for subsequent analysis.

3.3 Frequencies, percentages, and categories of demographic characteristics of the participants

Demographic distribution statistics serve as a means to ascertain the diverse backgrounds of the participants involved. Within this study, the exploration of respondent backgrounds encompasses a comprehensive range of elements, encapsulated by ten key indicators: gender, age, socioeconomic status, education level, and marital status, place of residence, personality traits, occupation, family medical history concerning chronic diseases, and personal medical history relating to chronic diseases. Detailed in the subsequent table are the descriptive statistics portraying the characteristics of the entire population under scrutiny.

Table 3: Frequencies, percentages and categories of demographic characteristics of the participants

Variable	Category	F	%
Age	18-22	144	73.5%
	23-27	45	23.0%
	28+	7	3.6%
Gender	Male	78	39.8%
	Female	118	60.2%
Socioeconomic Status	Upper Class	13	6.6%
	Middle Class	179	91.3%
	Lower Class	4	2.0%
Education	BS	174	88.8%
	Master	11	5.6%
	Mphil	11	5.6%

Occupation	Student	182	92.9%
	Employed	12	6.1%
	Self-Employed	2	1.0%
Relationship Status	Married	21	10.7%
	Single	175	89.3%
Residence	Urban Area	130	66.3%
	Rural Area	66	33.7%
Personality Type	Introvert	107	54.6%
	Extrovert	89	45.4%
Family History of Chronic Disease	No	131	66.8%
	Yes	65	33.2%
Personal History of Chronic Disease	No	181	92.3%
	Yes	15	7.7%

In this research, 196 individuals voluntarily participated by completing the provided questionnaire. Among them, 78 (39.8%) identified as male, while 118 (60.2%) identified as female. The study intentionally targeted adults aged 18 years and older. Regarding the age distribution within the sample, a substantial majority, 73.5%, fell within the 18 to 22 age brackets, while 43 individuals (23%) were aged between 23 and 27. A smaller subset of the participants, constituting 5 individuals (3.6%), were above 28 years old. Regarding socioeconomic status, 13 participants (6.6%) belonged to the upper class, while the majority, 179 (91.3%), identified with the middle class, and a smaller fraction of 4 (2.0%) belonged to the lower class. Education-wise, a significant portion of the participants, 174 (88.8%), were pursuing a Bachelor of Science degree, 11 (5.6%) were enrolled in master's programs, and 11 (5.6%) were pursuing higher degrees. Out of the entire sample, the majority, 182 (92.9%), were students, while 12 (6.1%) were employed and 2 (1.0%) were self-employed. In terms of marital status, 21 individuals (10.7%) were married, whereas the larger proportion, 175 (89.3%), were single. Approximately two-thirds (66.3%) of the participants reside in urban regions, while about one-third (33.7%) are from rural areas. Inquiries regarding the respondents' personality types revealed that 54.6% identified as introverts, while 45.4% identified as extroverts. Among the sampled group, 33.2% reported a familial background of chronic disease, while 7.7% disclosed a personal history of chronic disease.

Table 4: Correlation, Mean and Standard Deviation of the Study Variables (N=196)

Construct	1	2	3	4	5
1. Gender	1				
2. Knowledge	.399**	1			
3. Attitude	.362**	.756**	1		
4. Physical Activity	-.142*	-.125	-.138	1	
5. Nutrition and Smoking Behavior	-.114	-.015	.020	.448**	1
M		30.09	39.15	2.18	6.01
SD		5.00	8.30	1.37	2.37

*P<.001****

The correlation between study variables is illustrated in table 4. There was a positive correlation between gender and knowledge (r=.399, p<.001), and attitude(r=.362, p<.001), but negatively correlated with physical activity behavior (r=-.142, p<.05). However, gender is not associated with nutrition and smoking behavior (r=-.114, p=0.113). Knowledge is correlated positively with attitude(r=.756, p<.001), however there is a non-significant but negative relationship between physical activity (r=.125, p=0.08), and smoking and nutrition behavior (r=-.015, p=.832). Attitude is associated with practice, physical activity behavior (r=-.138, p=0.05) but not associated with smoking and nutrition behavior (r=.020, p=.776). Moreover, there is a statistically significant positive correlation between physical activity behavior and smoking and nutrition behavior

(r=.448, p<.001).

Table 5: Knowledge of Cardiovascular Disease (n=196)

Statements	Frequencies		
	NO	I DON'T KNOW	YES
	N (%)	N (%)	N (%)
1.K-CVD	37(18.9)	39(19.9)	**120(61.2)**
2.K-CVD	20(10.2)	34(17.3)	**142(72.4)**
3. K-CVD	19(9.7)	17(8.7)	**160(81.6)**
4. K-CVD	57(29.1)	50(25.5)	**89(45.4)**
5. K-CVD	16(8.2)	42(21.4)	**138(70.4)**
6. K-CVD	18(9.2)	27(13.8)	**151(77.0)**
7. K-CVD	20(10.2)	28(14.3)	**148(75.5)**
8. K-CVD	20(10.2)	52(26.5)	**124(63.3)**
9. K-CVD	30(15.3)	43(21.9)	**123(62.8)**
10. K-CVD	39(19.9)	45(23.0)	**112(57.1)**
11. K-CVD	36(18.4)	60(30.6)	**100(51.0)**
12. K-CVD	20(10.2)	67(34.2)	**109(55.6)**

The average total knowledge score, accompanied by its standard deviation, stands at 30.04±4.95, while the median score is 31. The spectrum of total knowledge scores spanned from 12 to 36. The highest proportion was observed in the statement of "Yes" responses is "Daily eating of fruits and vegetables has a beneficial effect on cardiovascular health." (81.9%, 160) followed by "Using tobacco (cigarettes, hookah, pipe, etc.) can increase the risk of cardiovascular disease." (77%, 151) and "Consumption of salty and canned foods increases the risk of rising blood pressure." (75.5%, 148). However, only 45.4% (89) respondents answered "Yes" as for "The history of cardiovascular disease in the family (father, mother, sister, or brother) can increase the risk of cardiovascular disease.", while 51% (100) answered "yes" for "Feeling of pain or sudden discomfort in the jaw, neck, between the two shoulders, or arms and stomach area can be a symptom of a heart attack.". Again, 55.6% (109) responded yes for "Sudden numbness or weakness in the face, arms, or legs muscles can be signs of a stroke." The details are shown in Table 5.

Table 6: Attitude toward Cardiovascular Disease (n=196)

Statements	Frequencies				
	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
	N (%)	N(%)	N(%)	N(%)	N(%)
13.A-CVD	17(8.7)	17(8.7)	11(5.6)	58(29.6)	**93(47.4)**
14. A-CVD	4(2.0)	14(7.1)	29(14.8)	63(32.1)	**86(43.9)**
15. A-CVD	25(12.8)	4(2.0)	14(7.1)	41(20.9)	**112(57.1)**
16. A-CVD	7(3.6)	27 (13.8)	19 (9.7)	70(35.7)	**73(37.2)**
17. A-CVD	6(3.1)	17(8.7)	32(16.3)	65(33.2)	**76(38.8)**
18. A-CVD	18(9.2)	12(6.1)	28(14.3)	64(32.7)	**77(37.8)**
19. A-CVD	7(3.6)	19(9.7)	**57(29.1)**	**57(29.1)**	56(28.6)
20. A-CVD	9(4.6)	19(9.7)	30(15.3)	**73(37.2)**	65(33.2)
21. A-CVD	7(3.6)	12(6.1)	27(13.8)	**76(38.8)**	74(37.8)

22. A-CVD	8(4.1)	14(7.1)	54(27.6)	**60(30.6)**	**60(30.6)**

The cumulative attitude scores averaged at 39.15±8.30, showcasing a median value of 41. The comprehensive attitude score spans from 10 to 50 as minimum to maximum, respectively. The item with the upmost proportion of positive attitude was "I believe that using any tobacco (cigarette, hookah, pipe, etc.) is harmful to health." (57.1%, 112) and "I believe that I should have physical activity to have a healthy life." (47.4%, 93). The statement received one of the lowest responses among all answers provided were "I believe that uncontrolled blood glucose in diabetic patients can cause myocardial infarction." (28.6%, 56), "I believe that consuming fish meat at least two times a week is beneficial for cardiovascular health." (30.6%, 60) and also "I believe that I should control my stress and mental pressure to prevent myocardial infarction. " (33.2%, 65). The details are shown in Table 6.

Table 7: Practice of Cardiovascular Disease (n=196)

Statement	**Frequencies**		
	Rarely	**Occasionally**	**Frequently**
	N (%)	**N (%)**	**N (%)**
23.P-CVD	72(36.7)	**86(43.9)**	38(19.4)
24. P-CVD	49(25.0)	**80(40.8)**	67(34.2)
25. P-CVD	61(31.1)	**70(35.7)**	65(33.2)
26. P-CVD	22(11.2)	70(35.7)	**104(53.1)**
27. P-CVD	18(9.2)	69(35.2)	**109(55.6)**
28. P-CVD	56(28.6)	61(31.1)	**79(40.3)**
29. P-CVD	**140(71.4)**	42(21.4)	14(7.1)

In this research study, the average total scores for practicing healthy behaviors in terms of physical activity were recorded at 1.92±1.14, with a median score of 2 and a range spanning from 0 to 5. Meanwhile, the scores for practicing healthy nutrition and abstaining from smoking were observed at 5.37±1.77, with a median score of 5.5 and a range from 0 to 10. It was evident from the findings that the level of adherence to healthy lifestyle practices among the participants was suboptimal. Out of the total participants in the study, a mere 11.2% (22 individuals) incorporate olive oil into their cooking routines, with only 9.2% (18 individuals) utilizing it for frying purposes. Furthermore, a noteworthy 19.4% (38 individuals) engage in regular physical activities, dedicating at least 30 minutes to such endeavors. Approximately a quarter, specifically 25% (49 individuals), of the study's participants conscientiously include a range of 2 to 4 servings of fruits and vegetables in their daily dietary intake. It was observed that a significant proportion, precisely 40.3% (79 individuals), habitually add salt to their meals at the table. Additionally, a smaller yet concerning percentage, standing at 7.1% (14 individuals), are regular consumers of tobacco products. Among them, approximately 42% (21.4 individuals) specifically partake in practices involving cigarettes, hookahs, or pipes. Table 7 presents the details.

Table 8: Comparison of Total Knowledge, Attitude, and Practice Score between Gender (n=196)

	Gender	**n**	**Mean(SD)**	**F-statistics (df)**	**p-value**
Knowledge	Male	78	27.64(5.38)	-5.99(1,194)	<.001
	Female	118	31.62(3.91)		
Attitude	Male	78	35.46(9.61)	-5.41(1,194)	<.001
	Female	118	41.59(6.24)		
Physical	Male	78	2.08(1.07)	.771(1,194)	0.09

Activities	Female	118	1.81(1.18)		
Nutrition and Smoking Behavior	Male	78	5.51(2.01)	4.68(1,194)	0.388
	Female	118	5.28(1.60)		

In comparison of total knowledge and attitude score, makes and female exhibit a statistically significant difference (p<.001). However, when it comes to physical activity behavior, nutrition and smoking behavior no substantial difference observed between males and females (p=0.09) and (p=0.388), respectively.

4 Discussion and Conclusion

All participants included in this survey fall within the adult age range, starting from 18 years old. In our study cohort, a prominent pattern became evident, there existed higher levels of knowledge and positive attitudes, contrasted with relatively lower levels of practice behavior. Additionally, notable associations were observed between the levels of knowledge, attitudes, and practices, unveiling distinct gender-based differences. In accordance with our research, a preponderance of the participants involved demonstrated a notably positive understanding and attitude towards cardiovascular diseases (CVDs). These outcomes align with findings from prior studies carried out in the provinces of Shiraz, Tabriz, and Tehran (Dash et al., 2020; Borhani Haghighi et al., 2010; Salahshoori et al., 2015). The research explored the correlation between cardiovascular disease knowledge, attitude, and practice among university students in Pakistan. The outcome revealed fascinating associations among gender, knowledge, attitude, and behaviors related to physical activity, smoking, and nutrition.

Gender emerged as a significant factor influencing knowledge, attitude, and certain behavioral patterns associated with CVD. Notably, the findings exhibit a positive relationship between gender and knowledge together with attitude, indicating that females inclined to manifest heightened levels of knowledge and greater positive attitudes towards CVD compared to males. The finding of the current study is consistent with previous study (Attarchi et al., 2012; Hassen et al., 2022). A feasible explanation behind the elevated knowledge and attitude scores could be ascribed to the proactive nature of women in seeking information related to health. A study conducted in Finland, emphasizing on gender differences in health information-seeking behavior, inferred that as compared to men, woman illustrated greater interest in and actively sought health-related information (Ek, S. 2015).

Nevertheless, in terms of physical activity behavior no association was observed. Remarkably, gender illustrated a negative relationship with physical activity, proposing that as compared to females, male might engage less in physical exercise related to CVD prevention or management. But no significant difference was found. A plausible rationale for this outcome is, there was a gradual decline in physical activity witnessed between the ages of 18 and 30, especially noticeable among males (Nagata et al., 2021). This pattern might be ascribed to conclusion from the Young Finns Study (YFS), which highlighted an increase in television viewing time among men as they aged, contrasting with a varied trends noted among women (Yang et al., 2017). In young adults (22 to 30 years) duration, being lived in a low- or lower middle-income country, skipping breakfast, and lacking social support were linked to a lack of physical activity. Being underweight or overweight, ignoring fat and cholesterol intake, encountering severe symptoms of depression, having minimal beliefs in the health advantages of being physically active, acquiring low personal control, and inadequate knowledge regarding the exercise-heart connection are basic factors related to physical inactivity among men. In the case of women, factors such as not making efforts to consume fiber, possessing minimal personal mastery, and moderate levels of personal control were additionally related to physical inactivity. The results indicate that four out of every ten

students exhibit physical inactivity. This highlights the urgent need for strategic interventions by professionals within higher educational institutions to address this issue effectively (Yost et al., 2020).

Furthermore, the research indicated that gender lacked substantial connections with nutrition and smoking. In spite that gender could influence knowledge and attitude, it might not directly affect lifestyle choices like dietary habits and smoking behaviors among university students in Pakistan. The results of this study are consistent with earlier research. For instance, studies on the knowledge, attitudes, and practices suggest that having extensive knowledge about a healthy lifestyle does not consistently translate into better practices (Sajwani et al., 2009). The population of students exhibits poor dietary habits characterized by insufficient consumption of essential foods like cereals, fruits, and vegetables, paired with extravagant intake of processed meats and unhealthy snacks. The frequency of daily meals was closely linked to overall dietary quality. Factors disturbing diet quality included physical activity, gender, age, and daily meal frequency. Among university students' unhealthy behaviors such as smoking, poor dietary choices, and physical inactivity were commonly clustered. Inclusive, their diet unabundant of recommended standards and moved away from the Mediterranean diet. To improve students' health, imperative nutritional education campaigns should report both diet and physical activity habits (Moreno-Gómez et al., 2012).

Moreover, the relationships between knowledge, attitude, and various behaviors associated with CVD were explored. The findings emphasized a positive relationship between knowledge and attitude, suggesting that individuals with higher knowledge tended to hold more positive attitudes toward CVD (Ras et al., 2022). However, an interesting non-significant but negative relationship was observed between knowledge and physical activity, smoking, and nutrition behavior. This suggests a need for further exploration to understand why despite possessing higher knowledge, individuals might not always translate this into positive health behaviors. Additionally, attitude was not found to be associated with practice and physical activity behavior. This indicates that individuals with more positive attitudes toward CVD were not likely to engage in preventive practices and physical activity (Williamson et al., 2021). Moreover, no significant associations were observed between attitude and smoking or nutrition behavior, indicating that attitude alone might not influence these behaviors directly.

In our current study, it was explored that approximately 29% of the participants revealed habitual consumption of tobacco and hookah. Amid this group, 55% of students incorporated vegetables and other oils in their daily diet, demonstrating poor dietary choices. In addition, a quarter of the students, accounting for 25%, confessed to never incorporating fruits and vegetables into their meals. A mere 19% of students reported engaging in 30 minutes of daily physical activity. Unexpectedly, despite a substantial understanding of cardiovascular diseases, 41% of students sustained to add salt to their meals at the table. These conclusions communally highlight a significant discrepancy between knowledge and attitude and actual behavioral practices among the participants. Of particular interest was the significant positive association between physical activity behavior and smoking and nutrition behavior. This proposes that individuals who engaged in higher levels of physical activity are inclined to exhibit additional favorable behaviors regarding smoking cessation and improved nutrition habits (Tsiampalis et al., 2023). This interrelation between these behaviors highlights the potential for all-inclusive health interventions directing on physical activity to positively impact other health-related practices among university students in Pakistan.

The correlation among adults' dietary intake, physical activity, cigarette smoking, and cardiovascular disease is widely recognized and established (Cleven et al., 2020; Fraser, 1986; Neaton & Wentworth, 1992). In a systematic review, approximately 60% of the articles

highlighted a clear negative association. Though, this connection inclined to weaken or reverse in cases involving adolescents, males, and when considering moderate exercise instead of vigorous exercise. The stages of change regarding smoking and physical activity showed relatively little correlation (Kaczynski et al., 2008; Lin et al., 2020). In conclusion, the study illuminates the complex interplay between gender, knowledge, attitude, and various behaviors associated with CVD among university students in Pakistan. Though gender seems to influence knowledge and attitude, its impact on specific health behaviors remains diverse. The results underscore the significance of tailored interventions that consider these multifaceted relations to efficiently endorse positive health behaviors among this demographic.

4.1 Limitations and Suggestions:

Contemporary study, though yielding insightful findings, is not without limitations. First of all, the data collected from participants relied chiefly on self-reported information, which might lead to response bias or imprecisions because of social desirability biases. In addition, the sample size may have been confined to demonstrating a broader population, thus affecting the generalizability of the results. Likewise, in present study unintentionally females' proportion was more than males that might influence the results of study. The study's cross-sectional nature limits the capability to establish connection between variables, warranting thoughtfulness in interpretation of the observed relations. Another limitation is the study was conducted in one district of Pakistan, limiting its generalizability to other districts.

To pave the way for future research endeavors, it is endorsed to include more diverse and larger sample sizes all-embracing varied demographics. For the understanding of the cause-effect relationships among the factors under investigation in depth longitudinal studies could be best alternatives. Integrating objective measures together with self-reported data could enhance the accuracy and reliability of the results. Additionally, exploring interventions or educational programs to bridge the gap between knowledge and behavior among study participants could be a valuable area for further investigation. Lastly, exploring cultural or regional influences on health behaviors associated to cardiovascular disease may offer inclusive visions into designing more targeted interventions.

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