Nursing Staff Insight about Modifiable Risk Factors of Cardiovascular Diseases in a Multicultural Setting, Saudi Arabia

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Abstract. *Objective:* Cardiovascular diseases (CVDs) are a group of disorders of the heart and blood vessels that occur due to different risk factors. studies had shown that controlling these factors can result in lower mortality rate. Therefore, the objective of this study was **t**o investigate the attitude, knowledge, and practice regarding cardiovascular modifiable risk factors among nursing staff in a tertiary hospital in Riyadh. *Materials and methods:* A cross-sectional study was conducted between January 2020 − October 2020 in King Salman Heart Center at King Fahad Medical City (KFMC). Data were obtained utilizing a self-administered questionnaire completed by 121 nurses. Analysis of the data was done using IBM SPSS version 26 (IBM Corp., Armonk, NY, USA). *Results:* The majority of the participants did not have any CVDs' risk factors. However, physical inactivity, obesity, unhealthy eating, and smoking were frequent in a substantial number of the participants. It was found that 71.07% of nurses had good knowledge, a positive attitude (61.98%), and most of them were following a fair nursing practice (67.77%). *Conclusion:* Overall, we found that the participating nurses had a good knowledge, fair attitude and good practice about the modifiable risk factors of CVD which urges launching initiatives for CVD risk prevention in KFMC, however, awareness campaigns are recommended to educate the nurses more with the state-of-the-art knowledge in this area.

Keywords: Modifiable Risk Factors, knowledge, attitude, practice, cardiovascular disease, preventive medicine, nurses.

Introduction

Cardiovascular diseases (CVDs) are a group of disorders of the heart and blood vessels that occur due to different risk factors (1). In 2003, the Canadian Heart and Stroke Foundation identified nine major modifiable risk factors for CVDs, namely, tobacco smoking, alcohol consumption, physical inactivity, malnutrition, obesity, high blood pressure (BP), high concentrations of cholesterol and triglycerides, and diabetes (2). It is estimated that up to 90% of CVDs

may be preventable if the modifiable risk factors are addressed. However, knowledge of modifiable risk factors can vary from one region to another (3). A notable decline in cardiovascular deaths has been shown as a result of controlling modifiable risk factors, which apparently emphasize the role of preventive medicine (4). Controlling modifiable risk factors can also be supported by in-depth exploration of factors that can substantially influence the relationship between cardiovascular mortality and modifiable risk factors. Sajid and colleagues argued that urbanization, if measured

objectively, can affect a range of modifiable risk factors preventing cardiovascular mortality in low-middle-income countries (5). The central role in preventing and minimizing the risks of CVDs complications and deaths is patients' ability to recognize the signs and prompt health-seeking behavior. In Brazil, knowledge of modifiable risk factors for CVDs has been studied among participants regardless of their background and most of them were unaware of the risk factors that lead to CVDs (6). A study done by Basubrain and his colleagues found that the general healthy population in Saudi Arabia has inadequate knowledge about the risk factors and their relationship with CVDs regardless of their workplace whether medical or non-medical (7).

CVDs pose a major public health concern and are one of the leading causes of death worldwide. The World Health Organization (WHO) considered CVDs as t major death threat with an estimation of 18 million deaths annually representing 31% of all global deaths (8). According to the Saudi Ministry of Health (MOH), CVDs are the cause of 42% of the Kingdom's non-communicable disease mortalities[9]. In 2030, it is predicted that 23 million may die worldwide from CVDs, mainly from heart disease and stroke, unless effective interventions are taken (9).

Although it is usually presumed by the public that healthcare providers have a high awareness of CVDs' symptoms and risk factors, there is no evidence-based data to support this assumption. Moreover, there is a gap in the literature from Saudi Arabia reporting studies on the importance of having adequate knowledge about CVDs' modifiable risk factors, which in turn will inform the decision-makers in planning and implementing proper interventions and strategies if needed. Therefore, this study was conducted to investigate the role of demographic variables of nurses in KAP scores. We also sought to explore the attitude, knowledge, and practice regarding modifiable risk factors of CVDs among nursing staff in a tertiary hospital in Riyadh.

Material and Methods
Study design

After obtaining approval from the Institutional Review Board at King Fahad Medical City (KFMC);

Riyadh, Saudi Arabia (Institutional Review Board approval number IRB00010471), a cross-sectional study was conducted between January 2020 and October 2020. KFMC is a tertiary-care hospital with a specialized heart center, King Salman Heart Center, that was established in 2005.

Study population

Participants were nursing staff from different cardiac departments working in King Salman Heart Center at King Fahad Medical City.. A total of 300 registered nurses were selected to participate. The sample size of 169 was calculated using the level of precision formula $n=z^2 p (1-p)/d^2$; where $z=1.96$, $p=0.5$, $1-p=0.5$, $d=0.05$, adjusted for population size of 300. Simple random sampling was used to collect the data over a period of 9 months. Fourty-eight nurses were shifted to the emergency COVID-19 ward, therefore the sample size was reduced to 121. Moreover, any nurse who was not working at the center were excluded. Nurses who agreed to take part in this study have provided written informed consent.

Data collection

Data collection was accomplished using a pre-validated questionnaire which was adopted from (14). The questionnaire consisted of 43 statements divided into 4 sections that cover the research question of this study. The first section is comprised of questions related to socio-demographic characteristics such as the nurses, gender, age, and nationality, risk factors and family history of CVDs. section B, C, and D comprised of questions related to knowledge, attitude, and practice.

KAP Scoring

The knowledge regarding CVDs risk factors was assessed using 12 questions. Each correct answer was given a code 1, whereas wrong answers were coded as 0. The median knowledge score was calculated. The quantitative knowledge score was then categorized into 3 categories: good ($\geq$75%), fair (50%-74%), and poor knowledge (<50%) (10). The attitude section was

composed of 10 questions and the overall mean attitude was calculated. Using the mean score as a cutoff, the attitude was further categorized into positive and negative (11). Practices regarding CVDs were assessed using 10 questions. The median practice score was calculated and then categorized into having good (≥75%), fair (50%-74%) and poor practice (<50%) (9).

Statistical Analysis

IBM Statistical Package for the Social Sciences (SPSS) version 26 (IBM Corp., Armonk, NY, USA) was used to analyze the data. The normality of the data was checked using the Kolmogorov-Smirnov test. Qualitative data are expressed as frequencies and percentages, whereas non-normally distributed variables are reported as median (min, max). One-sample Wilcoxon-signed rank was applied to evaluate participants' knowledge and practice scores with the threshold value

of 50%. A One-sample Chi-square test was also applied to observe the difference of equality of categories in attitude. Pearson-Chi-square and Fisher Exact tests were applied to observe associations between the categorized knowledge, attitude, and practice scores with socio-demographic variables. A p-value of less than 0.05 was considered statistically significant.

Results

The data was collected from 121 participants. The majority of them were females (88.4%) as compared to males (11.6%). Most of them were married (70.2%) and (29.8%) were single. Two-third of the participants belonged to the age group of 30-40 years, followed by >40 years 21 (17.4%) and 21-29 years 19 (15.7%). Most of the participants 76 (62.8%) had more than 10 years of experience, followed by 4-6 years 21 (17%), 7-10 years 15 (12.4%), 1-3 years 6 (5%) and 2.5% had

Table 1. Nurses Socio-demographic Characteristics, Risk Factors and Family History (n=121)

		n (%)		n (%)
	Gender		**Years of Experience**	
	Male	14 (11.6)	<1 year	3 (2.5)
	Female	107 (88.4)	1-3 years	6 (5.0)
	Marital Status		4-6 years	21 (17.0)
Socio-demographic	Married	85 (70.2)	7-10 years	15 (12.4)
Characteristics	Single	36 (29.8)	>10 years	76 (62.8)
	Age		**Education Level**	
	21-29 years	19 (15.7)	Diploma holders	45 (37.2)
	30-40 years	81 (66.9)	Bachelor's degree	64 (52.9)
	> 40 years	21 (17.4)	Master's degree	5 (4.1)
			Higher Degree	7 (5.8)
	Smoking		**Diabetes Mellitus**	
	Non-Smoker	112 (92.6)		
	Smoker	4 (3.3)	No	118 (97.5)
	Passive Smoker	5 (4.1)	Yes	3 (2.5)
Risk Factors	**Hypertension**		**Ischemic Heart Disease**	
	No	115 (95.0)	No	118 (97.5)
	Yes	6 (5.0)	Yes	3 (2.5)
	Hyperlipidemia		**Obesity**	
	No	112 (92.6)	No	116 (95.9)
	Yes	9 (7.4)	Yes	5 (4.1)
	Heart Disease		**Diabetes Mellitus**	
	Yes	16 (13.2)	Yes	31 (25.6)
First Degree Family	No	105 (86.8)	No	90 (74.4)
History	**Hypertension**		**History**	
	Yes	32 (26.4)	Yes	79 (65.28)
	No	89 (73.6)	No	42 (34.72)

experience <1 year. Slightly more than 50% of the participants had bachelor's degrees, 45 (37.2%) were diploma holders, those with a higher degree were 7 (5.8%), and only 5 (4.1%) had master's degrees.

Regarding the risk factors, more than 90% of the participants were non-smokers, (2.5%) had diabetes mellitus, (5%) were hypertensive, (2.5%) had heart disease, (7.4%) were hyperlipidemic and (4.1%) were considered obese as their body mass index (BMI) was over 30.. Pertaining to diseases present in first-degree family 79 (65.28%) had a history of illnesses of which (13.2%) had heart disease, diabetes mellitus (25.6%), and hypertension (26.4%). Results are presented in table 1.

The median knowledge score was 10, where 3 being the minimum and 11 was the maximum score. Overall, the majority of the participants had good knowledge (71.07%) about CVDs, (14.05%) had fair knowledge and (14.88%) had poor knowledge (Figure 1). The result of a one-sample Wilcoxon-signed rank test also confirmed that the participants had overall significant-good knowledge about CVDs (p<0.001). Regarding individual questions, "CVDs is the disease of women only", was correctly answered by most of the participants (93.4%), whereas "most CVDs cases are hereditary", majority of the participants (74.4%) got it wrong.

The correct and incorrect numbers and corresponding percentages for each question are presented in Table 2. The categorized knowledge (poor, fair, and good), when compared with the socio-demographic variables, showed no significant association with gender (p=0.215), marital status (p=0.937), age (p=0.230), and education level (p=0.259). However, nurses with
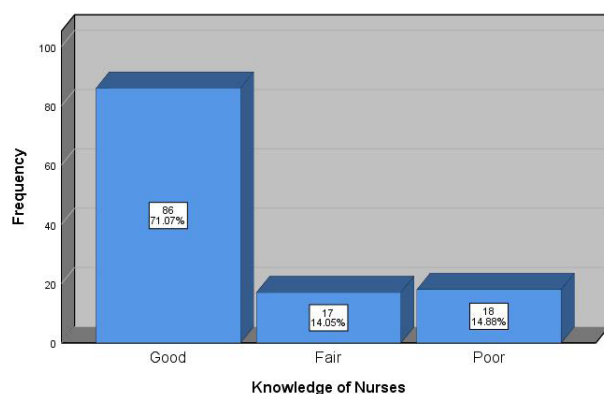
>10 years of experience had significantly good knowledge (p=0.042). Results are presented in table 5.

The overall mean attitude score was 3.89 ± 0.40. Based on the mean score the attitude was further categorized into positive and negative. Majority of the nurses had a positive attitude (61.98%) and (38.02%) had a negative attitude (Figure 2). The result of the one-sample chi-square test showed that the overall attitude of nurses was significantly positive (x^2 = 6.95 (1), p = 0.008). The highest positive attitude of nurses (98.4%) was reported for the question "smoking is bad for health". The positive and negative attitudes when compared with the socio-demographic variables showed no significant association, gender (p=0.692), marital status (p=0.898), age (p=0.507), years of experience (p=0.536), an education level (p=0.883). Results are presented in Tables 3 and 5.

Overall, the majority of the nurses accounting for (67.77%) were following a fair practice, whereas (32.23%) showed good practice in managing CVDs (Figure 3), and none of the nurses depicted poor practice. The median practice score was 28, where 23 being

Table 2. Knowledge of the Nurses regarding CVDs (n=121)

No	Statement	Correct	Incorrect
1	CVDs is related to heart and blood vessels?	106 (87.6)	15 (12.4)
2	Most CVDs cases are hereditary?	31 (25.6)	90 (74.4)
3	CVDs is the leading cause of death?	95 (78.5)	26 (21.5)
4	CVDs is the disease of women only?	113 (93.4)	8 (6.6)
5	CVDs can occur to young people?	92 (76.0)	29 (24.0)
6	Smoking is the risk factor of CVDs?	102 (84.3)	19 (15.7)
7	Doing housework as exercise is enough for a day?	95 (78.5)	26 (21.5)
8	If you have a slim body, you do not need to exercise?	107 (88.4)	14 (11.6)
9	Eating fruits or vegetables can prevent CVDs?	67 (55.4)	54 (44.6)
10	Irregular eating patterns have no harm to health?	90 (74.4)	31 (25.6)
11	High-density lipoprotein (HDL) is a good type of cholesterol?	88 (72.7)	33 (27.3)
12	Prayer can help to reduce stress?	98 (81.0)	23 (19.0)

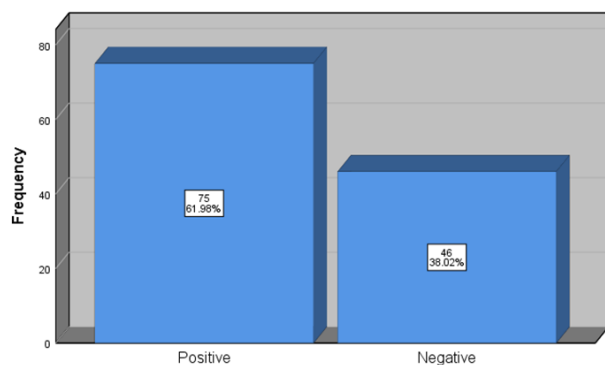**Figure 1.** Nurses' Knowledge about CVD.
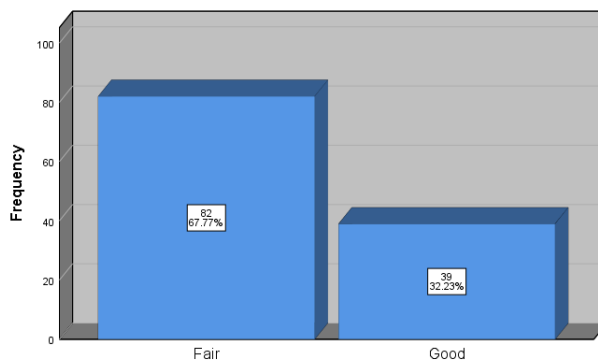
Figure 2. Nurses Attitude towards CVD

Figure 3. Nurses Practice about CVD

the minimum and 35 being the maximum score. The result of a one-sample Wilcoxon-signed rank test also confirmed that the participants had overall significant good practice about CVDs (p<0.001).

The number and corresponding percentage for each practice question are presented in Table 4. The categorized practice (fair and good) when compared with the socio-demographic variables showed no significant association with gender (p=0.508), age (p=0.728), an education level (p=0.270), and years of experience (p=0.862). However, married nurses depicted a significantly good practice as compared to singles (p=0.042) Results are presented in table 5.

Discussion

A deep insight into nurses' perception about CVDs modifiable risk factors is essential for providing accurate medical care and preventing in-hospital CVDs' related deaths. Measuring the risk factors is significant to quantify their magnitudes in order to improve the existent cardiac programs or augment the efforts further. Therefore, we investigated the attitude, knowledge, and practice of nursing staff in the tertiary hospital regarding the modifiable risk factor of CVDs in Saudi Arabia.

The findings of this study revealed that a vast majority of the participants do not have any signs of

Table 3. The attitude of Nurses regarding CVDs (n=121)

Items	Strongly Agree	Agree	Undecided	Disagree	Strongly Disagree	Mean Score
	n (%)	n (%)	n (%)	n (%)	n (%)	Mean±SD
Smoking is bad for health.	105 (86.8)	14 (11.6)	0 (0.0)	1 (0.8)	1 (0.8)	4.83±0.54
Do exercise to maintain a healthy lifestyle.	96 (79.3)	21 (17.4)	0 (0.0)	0 (0.0)	4 (3.3)	4.69±0.78
Prefer to play with a laptop instead of doing exercise	80 (66.1)	22 (18.2)	5 (4.1)	4 (3.3)	10 (8.3)	4.30±0.87
Walking a lot can give benefits to my health.	65 (53.7)	49 (40.5)	2 (1.7)	2 (1.7)	3 (2.5)	4.41±0.82
Take fruits or vegetables in the diet for maintaining health.	77 (63.6)	40 (33.1)	2 (1.7)	0 (0.0)	2 (1.7)	4.57±0.69
Avoid drinking carbonated drinks.	65 (53.7)	37 (30.6)	5 (4.1)	6 (5.0)	8 (6.6)	4.20±1.15
Sometimes eating super late at night is good.	58 (47.9)	36 (29.8)	11 (9.1)	8 (6.6)	8 (6.6)	4.15±0.47
Take less oily food for a healthy lifestyle.	73 (60.3)	35 (28.9)	4 (3.3)	2 (1.7)	7 (5.8)	4.36±1.04
Controlling stress can avoid getting any disease.	61 (50.4)	45 (37.2)	5 (4.1)	5 (4.1)	5 (4.1)	4.26±1.01
I can manage my stress.	31 (25.6)	67 (55.4)	16 (13.2)	6 (5.0)	1 (0.8)	4.00±0.81

Table 4. The practice of Nurses regarding CVDs (n=121)

Items	Never n (%)	Seldom n (%)	Frequently n (%)	Always n (%)
How often do you smoke?	110 (90.9)	3 (2.5)	5 (4.1)	3 (2.5)
Does your daily activity involve vigorous activity?	22 (18.2)	56 (46.3)	35 (28.9)	8 (6.6)
Do you walk for 10minutes daily?	5 (4.1)	22 (18.2)	31 (25.6)	63 (52.1)
Do you spend your leisure time to exercise at least 20 minutes?	18 (14.9)	50 (41.3)	36 (29.8)	17 (14.0)
How often do you take fruits in your diet?	1 (0.8)	26 (21.5)	62 (51.2)	32 (26.4)
How often do you take vegetables in your diet?	1 (0.8)	20 (16.5)	56 (46.3)	44 (36.4)
How often do you eat fast food?	2 (1.7)	74 (61.2)	40 (33.1)	5 (4.1)
Do you like to eat in between the main meals? e.g., snaking	5 (4.1)	57 (47.1)	41 (33.9)	18 (14.9)
Do you eat fried food as your main course?	10 (8.3)	58 (47.9)	39 (32.2)	14 (11.6)
Do you lead a stressful life?	12 (9.9)	42 (34.7)	52 (43.0)	15 (12.4)

Table 5. Association of socio-demographic characteristics with nurses , knowledge, attitude, and practice (n = 121)

	Knowledge Score			Attitude		Practice	
	Poor	Fair	Good	Positive	Negative	Fair	Good
Gender							
Male	2 (11.1%)	4 (23.5%)	8 (9.3%)	8 (10.7%)	6 (13.0%)	10 (12.2%)	4 (10.3%)
Female	16 (88.9%)	13 (76.5%)	78 (90.7%)	67 (89.3%)	40 (87.0%)	72 (87.8%)	35 (89.7%)
p-value		0.215			0.692		0.508
Marital Status							
Married	12 (66.7%)	12 (70.6%)	61 (70.9%)	53 (70.7%)	32 (69.6%)	53 (64.6%)	32 (82.1%)
Single	6 (33.3%)	5 (29.4%)	25 (29.1%)	22 (29.3%)	41 (30.4%)	29 (35.4%)	7 (17.9%)
p-value		0.937			0.898		**0.048***
Age							
21-29 years	5 (27.8%)	4 (23.5%)	10 (11.6%)	14 (18.7%)	5 (10.9%)	14 (17.1%)	5 (12.8%)
30-40 years	11 (61.1%)	12 (70.6%)	58 (67.4%)	48 (64.0%)	33 (71.7%)	55 (67.1%)	26 (66.7%)
> 40 years	2 (11.1%)	1 (5.9%)	8 (20.9%)	13 (17.3%)	8 (17.4%)	13 (15.9%)	8 (20.5%)
p-value		0.230			0.507		0.728
Years of Experience							
<1 year	1 (5.6%)	1 (5.9%)	1 (1.2%)	3 (4.0%)	0 (0.0%)	3 (3.7%)	0 (0.0%)
1-3 years	3 (16.7%)	0 (0.0%)	3 (0.0%)	5 (3.5%)	1 (2.2%)	4 (4.9%)	2 (5.1%)
4-6 years	3 (16.7%)	3 (17.6%)	15 (17.4%)	14 (18.7%)	7 (15.2%)	13 (15.9%)	8 (20.5%)
7-10 years	0 (0.0%)	5 (29.4%)	10 (11.6%)	9 (12.0%)	6 (13.0%)	10 (12.2%)	5 (12.8%)
>10 years	11 (61.1%)	8 (47.1%)	57 (66.3%)	44 (58.7%)	32 (69.6%)	52 (63.4%)	24 (61.5%)
p-value		**0.042***			0.536		0.862
Education Level							
Diploma	13 (72.2%)	7 (41.2%)	44 (51.2%)	41 (54.7%)	23 (50.0%)	43 (54.7%)	21 (50.0%)
Bachelor's	0 (0.0%)	1 (5.9%)	4 (4.7%)	3 (4.0%)	2 (4.3%)	3 (4.0%)	2 (4.3%)
Master's	3 (16.7%)	8 (47.1%)	34 (39.5%)	26 (34.7%)	19 (41.3%)	29 (34.7%)	16 (41.3%)
Higher Degree	2 (11.1%)	1 (5.9%)	4 (4.7%)	5 (6.7%)	2 (4.3%)	7 (6.7%)	0 (4.3%)
p-value		0.259			0.883		0.270

* significant at 5% level of significance

CVDs' risk factors. However, a substantial number of the participants had some risk factors notably hyperlipidemia (7%) and obesity (4%) are not large values.

These findings were similar to what was reported in a study by Qureshi and colleagues that physical inactivity, obesity, unhealthy eating, and smoking were

relatively more frequent in doctors among modifiable risks (12). Moreover, our data confirm what was suggested by Nam et al. that obesity and physical inactivity are higher among nurses in the State of California and it could be due to occupational factors (13). On the other hand, 65% of the participants had a history of cardiac illnesses and the highest incidence was recorded with high blood pressure (26.4%). Interestingly our findings were slightly different than a study by WHO which revealed that the overall prevalence of raised blood pressure in adults aged 25 years and over was around 40% in 2008 globally and this is also supported by findings of a number of studies (14-17). Our study suggests that there is a good level of knowledge about the modifiable risk factor of CVDs in 71% of the nurses we studied, unlike other studies (18-19). Previous studies assessed level of knowledge in nursing students whereas most of our study population was of senior nurses. Therefore, the increase in nurses' knowledge of CVDs risk factors in our study is believed to be associated with higher experience and this was statistically significant.

In this study, the majority of the nurses had a positive attitude (61.98%) towards modifiable risk factors in comparison to (38.02%) who had a negative attitude. Although the percentage of nurses with a negative attitude is low almost third, yet this indicates the lack of structured training program and insufficient awareness about CVDs risk factors. This finding imposes an extra burden on the hospitals to promote health education through structured educational programs and awareness campaigns. Dr. Muhihi and her co-workers studied the role of training through awareness campaigns and other educational activities. They reach a conclusion that spreading awareness and increasing knowledge helped in the reduction of CVDs risk factors (20).

Nurses' practice in managing CVDs risk factors was fair representing two-thirds of the participants. Showing fair practice is expected as the majority of them have good knowledge that has been translated into proper behaviors and practice. Our result was contradicting to the existing literature which reported an urgent need to initiate comprehensive health promotion and CVDs prevention programs at the healthcare workplace (21,22). It was not unexpected that married nurses depicted a significantly good practice as compared to singles, which could be explained as married nurses are more dedicated to a healthy lifestyle for themselves and their family (23). As our research study has shown, the majority of the nurses have a high level of attitude, knowledge, and practice, thus it is incorrigible for nurses to help in the prevention of CVDs and the risk factors that can lead to CVD. Nurses are ideal health care workers to direct the CVDs risk reduction and to deliver multifactorial risk reduction in hospitals and significant evidence exists supporting a systematic approach (24-27). Another evidence showed a positive reduction in CVDs risk and improves cardiovascular risk factors, lifestyle, and, outcomes through management programs held by professional nurses (28-32). Oxidative Stress usually start to function in in postmenopausal women mostly over 40 years old. Klisic et.al reported the overall oxidative stress and the antioxidant status was independently associated with increased CVD risk in postmenopausal women in Montenegro (33). Although the vast majority of the nurses are women under the age 40 that can explain the reason for low CVD risk has not been associated with a favorable increase as it has been shown in other studies (34-36). Future studies should include measuring the levels total bilirubin serum which is considered to be scavenge reactive oxygen species (ROS) and to suppress the oxidation of lipids and lipoproteins (37).

Strengths and Limitations

The strength of this study was that this is the first research that studies cardiovascular modifiable risk factors among nursing staff at tertiary hospitals in Riyadh Saudi Arabia. Moreover, our results show the positive and have a high level of attitude, knowledge, and practice are in a tertiary hospital where there is a high number of ethnic diversity and a wide range of interests, backgrounds, experiences. Accordingly, this will promote the Saudi authorities to start CVDs prevention and reducing programs. Whereas the study's limitation was that this study was conducted at a single institution, thus the probability for generalizing the findings among all nurse's practitioners in Riyadh is limited.

Conclusion

We investigated the attitude, knowledge, and practice of nursing staff in the tertiary hospital regarding the modifiable risk factor of CVDs in Saudi Arabia. Overall, our 121 nurses showed good knowledge in 71% of nurses, a positive attitude 61.98%, and 67% were following a fair nursing practices.

Our results point out that awareness campaigns are recommended to overcome the observed lack of knowledge.

For further investigation, we highly recommend large-scale studies to help obtain more representative data and impose national awareness programs.

References

1. Mensah GA, Roth GA, Fuster V. The global burden of cardiovascular diseases and risk factors: 2020 and beyond. J Am Coll Cardiol 2019; 74: 2529–2532.
2. Thomas H, Diamond J, Vieco A, Chaudhuri S, Shinnar E, Cromer S, Perel P, Mensah GA, Narula J, Johnson CO, Roth GA. Global atlas of cardiovascular disease. Global Heart 2018; 13: 143-163.
3. Buttar HS, Li T, Ravi N. Prevention of cardiovascular diseases: Role of exercise, dietary interventions, obesity and smoking cessation. Exp Clin Cardiol 2005; 10: 229-249.
4. Patel SA, Winkel M, Ali MK, Narayan KV, Mehta NK. Cardiovascular mortality associated with 5 leading risk factors: national and state preventable fractions estimated from survey data. Ann Intern Med 2015; 163: 245-253.
5. Sajid, M. R., Muhammad, N., Zakaria, R., & Bukhari, S. A. C. (2020). Modifiable risk factors and overall cardiovascular mortality: Moderation of urbanization. *Journal of Public Health Research*, *9*(4).
6. Bonotto GM, Sassi MR, Susin LR. Knowledge of modifiable risk factors for cardiovascular disease among women and the associated factors: A population-based study. Cien

Saude Colet 2016; 21: 293-302.
7. Basubrain MS, Basubrain ES, Elessawi LR, Bafarat OA, Baflah RA, Srouji RM, Basubrain OS, Dammas HO. Knowledge, attitude, and practice of general population towards CVD in Saudi Arabia. Diabetes 2017; 36: 15087-15092.
8. World Health Organization (WHO). Cardiovascular diseases (CVDs). Available at: https://www.who.int/en/news-room/fact-sheets/detail/cardiovascular-diseases-(cvds) Cited date Jan 10, 2021.
9. Ministry of Health (MOH). Cardiovascular Diseases Cause 42% of Non-Communicable Diseases Deaths in the Kingdom. Available at: https://www.moh.gov.sa/en/Ministry/MediaCenter/News/Pages/News-2013-10-30-002.aspx Cited date December 19, 2020.
10. Sami W, Alabdulwahhab KM, Ab Hamid MR, Alasbali TA, Alwadani FA, Ahmad MS. Dietary knowledge among adults with type 2 diabetes—kingdom of Saudi Arabia. International journal of environmental research and public health. 2020 Jan;17(3):858
11. Sami W, Alabdulwahhab KM, Hamid MR, Alasbali TA, Alwadani FA, Ahmad MS. Dietary Attitude of Adults with Type 2 Diabetes Mellitus in the Kingdom of Saudi Arabia: A Cross-Sectional Study. Medicina 2020; 56: 1-8.
12. Qureshi MS, Fawad A, Rafiullah M, Khan MK, Gul AM, Hafizullah M. Frequency of Cardiovascular Disease Risk Factors among Low Income Group. Pak Heart J 2012; 45: 166-173.
13. Nam S, Lee SJ. Occupational factors associated with obesity and leisure-time physical activity among nurses: A cross sectional study. Int J Nurs Stud 2016; 57: 60-69.
14. Ibrahim MM, Rahman NA, Rahman NI, Haque M. Knowledge, Attitude and Practice of Malaysian public university students on risk factors for cardiovascular diseases. J Appl Pharm Sci 2016; 27: 56-63.
15. Khan SB, Hafizullah M, Gul AM, Rehman H, Ali J, Qureshi MS, Shah ST, Jan H, Shah SF. Frequency of coronary heart disease risk factors among nurses. J Postgrad Med Inst 2012; 26: 1-8.
16. Ali D. How Aware are the Educators of Cardiovascular Risk Factors? Pak Heart J. 2012; 42: 3-4.
17. Jahromi MK, Hojat M, Koshkaki SR, Nazari F, Ragibnejad M. Risk factors of heart disease in nurses. Iran J Nurs Midwifery Res 2017; 22: 332-337.
18. Wu Y, Deng Y, Zhang Y. Knowledge, attitudes, and behaviors of nursing professionals and students in Beijing toward cardiovascular disease risk reduction. Res Nurs Health. 2011; 34: 228-240.
19. Nurten KA, Turan N, Aydin GO, Hatice KA, lkay ER, Pinar IL. Cardiovascular Disease Risk Factors and Knowledge Level in Nursing Students. Clin Exp Health Sci 2018; 9: 195-201.
20. Muhihi AJ, Urassa DP, Mpembeni RN, Leyna GH, Sunguya BF, Kakoko D, Kessy AT, Njelekela MA. Effect of training community health workers and their interventions on cardiovascular disease risk factors among adults in Mo-

rogoro, Tanzania: Study protocol for a cluster randomized controlled trial. Trials 2018; 19: 1-2.

21. Sharma D, Vatsa M, Lakshmy R, Narang R, Bahl VK, Gupta SK. Study of cardiovascular risk factors among tertiary hospital employees and their families. Indian Heart J 2012; 64: 356-363.

22. Miller SK, Alpert PT, Cross CL. Overweight and obesity in nurses, advanced practice nurses, and nurse educators. J Am Assoc Nurse Pract 2008; 20: 259-265.

23. Kolbe-Alexander T, Phiri L, Draper C, Lambert E. Nurses' lifestyle behaviours, health priorities and barriers to living a healthy lifestyle. J Sci Med Sport 2014; 18: e98.

24. Haskell WL, Alderman EL, Fair JM, Maron DJ, Mackey SF, Superko HR, Williams PT, Johnstone IM, Champagne MA, Krauss RM. Effects of intensive multiple risk factor reduction on coronary atherosclerosis and clinical cardiac events in men and women with coronary artery disease. The Stanford Coronary Risk Intervention Project (SCRIP). Circulation 1994; 89: 975-990.

25. DeBusk RF, Miller NH, Superko HR, Dennis CA, Thomas RJ, Lew HT, Berger WE, Heller RS, Rompf J, Gee D, Kraemer HC. A case-management system for coronary risk factor modification after acute myocardial infarction. Ann Intern Med 1994; 120: 721-729.

26. Wood DA, Kotseva K, Connolly S, Jennings C, Mead A, Jones J, Holden A, De Bacquer D, Collier T, De Backer G, Faergeman O. Nurse-coordinated multidisciplinary, family-based cardiovascular disease prevention programme (EUROACTION) for patients with coronary heart disease and asymptomatic individuals at high risk of cardiovascular disease: a paired, cluster-randomised controlled trial. Lancet. 2008; 37: 1999-2012.

27. Fonarow GC, Gawlinski A, Moughrabi S, Tillisch JH. Improved treatment of coronary heart disease by implementation of a Cardiac Hospitalization Atherosclerosis Management Program (CHAMP). Am J Cardiol 2001; 87: 819-822.

28. Clark AM, Hartling L, Vandermeer B, McAlister FA. Meta-analysis: secondary prevention programs for patients with coronary artery disease. Ann Intern Med 2005; 143: 659-672.

29. Xian Y, Pan W, Peterson ED, Heidenreich PA, Cannon CP, Hernandez AF, Friedman B, Holloway RG, Fonarow GC; GWTG Steering Committee and Hospitals. Are quality improvements associated with the Get with the Guidelines-Coronary Artery Disease (GWTG-CAD) program sustained over time? A longitudinal comparison of GWTG-CAD hospitals versus non-GWTG-CAD hospitals. Am Heart J. 2010; 159: 207-214.

30. Berra K, Miller NH, Fair JM. Cardiovascular disease prevention and disease management: a critical role for nursing. J Cardiopulm Rehabil 2006; 26: 197-206.

31. Fair JM, Gulanick M, Braun LT. Cardiovascular risk factors and lifestyle habits among preventive cardiovascular nurses. J Cardiovasc Nurs 2009; 24: 277-286.

32. Tan SM, Han E, Quek RY, Singh SR, Gea Sánchez M, Legido Quigley H. A systematic review of community nursing interventions focusing on improving outcomes for individuals exhibiting risk factors of cardiovascular disease. J Adv Nurs 2020; 76: 47-61.

33. Klisic A, Kavaric N, Vujcic S, Spasojevic-Kalimanovska V, Kotur-Stevuljevic J, Ninic A. Total oxidant status and oxidative stress index as indicators of increased Reynolds Risk Score in postmenopausal women. European Review for Medical and Pharmacological Sciences. 2020 Oct 1;24(19):10126-33.

34. Castelao JE, Gago-Dominguez M. Risk factors for cardiovascular disease in women: relationship to lipid peroxidation and oxidative stress. Medical hypotheses. 2008 Jan 1;71(1):39-44.

35. Fearon IM. Risk factors, oxidative stress, and cardiovascular disease. Systems biology of free radicals and antioxidants. Berlin-Heidelberg: Springer. 2014:765-90.

36. Anderson C, Milne GL, Park YM, Sandler DP, Nichols HB. Cardiovascular disease risk factors and oxidative stress among premenopausal women. Free Radical Biology and Medicine. 2018 Feb 1;115:246-51.

37. Klisic A, Kavaric N, Soldatovic I, Bjelakovic B, Kotur-Stevuljevic J. Relationship between cardiovascular risk score and traditional and nontraditional cardiometabolic parameters in obese adolescent girls. Journal of medical biochemistry. 2016 Sep;35(3):282.

38. Lin JP, Vitek L, Schwertner HA. Serum bilirubin and genes controlling bilirubin concentrations as biomarkers for cardiovascular disease. Clinical chemistry. 2010 Oct 1;56(10):1535-43.

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