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KNOWLEDGE, ATTITUDE, AND PRACTICE OF CARDIOMETABOLIC DISEASES AMONG THE GENERAL POPULATION IN SAUDI ARABIA.

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Abstract

Background: Cardiometabolic syndrome (CMS) refers to coronary artery disease, cerebrovascular disease, and diabetes mellitus. CMS is known to be the world's leading cause of mortality and morbidity. Many factors contribute to the development of CMS, lifestyle has the most significant effect. The study aims to assess knowledge, attitude, and practice of cardiometabolic diseases among the public in Saudi Arabia. **Methodology:** This is a cross-sectional study carried out in Saudi Arabia, utilizing an online survey. The research involved Saudi adults aged 18 and above from all regions of the country. Participant recruitment between July 2024 and January 2025 via questionnaire distribution. **Results**: Among 461 participants in Saudi Arabia, findings reveal a high educational level among respondents, with 64.6% holding at least a bachelor's degree. Despite 97.6% recognizing high blood pressure, only 18.2% understood its severity. Alarmingly, 77.2% were unaware of hyperlipidemia, indicating significant knowledge gaps. While 70.9% acknowledged the importance of lifestyle changes for managing fatty liver disease, only 39.3% demonstrated high practice levels in disease management. Statistically significant correlations were found between knowledge and factors like weight, education, and family history, highlighting areas for targeted public health interventions. **Conclusion:** The findings of this study underscore the urgent need for targeted public health initiatives aimed at improving knowledge and awareness of cardiometabolic diseases among the Saudi population.

Keywords: Cardiometabolic syndrome, knowledge, attitude, and practice, Saudi Arabia.

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Introduction:

Cardiometabolic syndrome (CMS) is a term referring to coronary arteries disease, cerebrovascular disease, and diabetes mellitus [1,2]. Although many factors contribute to the development of CMS, lifestyle has the most significant effect. CMS is known to be the world's leading cause of mortality and morbidity [3]. Hence comes the need to measure the level of awareness about the risk factors among the general population.

In Saudi Arabia, coronary artery disease (18%), hypertension (16%), stroke (14%), peripheral artery disease (11%), and congenital heart disease (10%) were the most common cardiovascular disease (CVD). Still, most CVs may have been avoided by managing the several risk factors linked to the prevalence of CVDs [4]. With that CVA is a leading cause of death and disability in Saudi Arabia, accounting for around 6.4% of total mortality rates [5]. Atherosclerosis in the coronary arteries, which is the hallmark of CAD, can occur asymptomatically and is typically utilized to indicate or confirm CAD. Several risk factors can be classified as either non-modifiable risk factors (old age, male gender, family history of CAD, and certain ethnicities) or modifiable risk factors (such as hypertension, smoking, hypercholesterolemia, diabetes mellitus, lack of physical activity, obesity, and psychological stress) [6]. One of the most common risk factors is HTN, which is a major public health concern and a leading cause of death. A recent national survey found that 31.4% of Saudis have HTN, with 57.8% uninformed of their illness. Additionally, 25% of individuals aged 15-64 have been diagnosed with HTN [5]. A study conducted in Jeddah, Saudi Arabia, published in 2021 showed that the participants strongly understood the risk factors associated with CVD. The vast majority (82.3% to 90.6%) recognized smoking, positive family history of CVD, high low-density lipoprotein cholesterol levels, obesity, low physical inactivity, and unhealthy dietary habits as risk factors. On the other hand, there were areas of relative uncertainty including the associations of diabetes (56.2%) and stress (69.4%) with CVD. Overall, when considering all aspects of CVD knowledge, participants achieved a mean score of 16.33 out of a possible 25, suggesting that there is still room for improvement in CVD awareness [4]. Another study with participants from the whole western region of Saudi Arabia in 2021 reported that the risk factors most frequently identified were lack of exercise, stress, and obesity. The majority (60%) could identify the preventable risk factors of CVD, including smoking cessation (92.2%), a high level of cholesterol (88.6%), and hypertension (78.7%) [7]. In 2022, research has been conducted on Korean adults CVD risk and prevention awareness and the result has shown that few respondents were aware of the details of the recommendations for CVD prevention. Even among respondents with cardiometabolic disease, who should be most informed, only 10.7% of individuals were familiar with the details [8]. For years, cardiovascular diseases (CVDs), such as coronary heart disease and cerebrovascular disease, have been leading causes of death globally. The prevalence of metabolic diseases such as DM, HTN, and Dyslipidemia has drastically increased in the past decade. Due to that our research aim is to measure the knowledge and awareness of the Saudi population about cardiometabolic disease and its relation. To the best of our knowledge, no available studies assess knowledge, awareness, and practice of cardiometabolic diseases among the public in Saudi Arabia. Therefore, we aim to fill this gap by assessing knowledge, awareness, and practice of cardiometabolic diseases among the public in Saudi Arabia.

Objectives:

This study aim to assess knowledge, attitude, and practice of cardiometabolic diseases among the public in Saudi Arabia.

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Materials and Methods:

Study design:

This is a cross-sectional study conducted in Saudi Arabia, using an online questionnaire, data collected from Saudi populations.

Study setting: Participants, recruitment, and sampling procedure:

The study's population consisted of Saudi adults over 18, from all regions of Saudi Arabia. participants recruited from July 2024 to January 2025 from people receiving the questionnaire.

Inclusion and Exclusion Criteria:

The study population Saudi people aged 18 years and older. Both genders invited to participate voluntarily. Healthcare professionals, medical students, and the non-Saudi population excluded from the study.

Sample size:

The sample size estimated using the Qualtrics calculator with a confidence level of 95%, and a margin of error of 5 %; the minimum sample size was 385.

Method for data collection and instrument (Data collection Technique and tools):

For the KAP assessment, an online questionnaire created by Google Forms used to collect data. Building upon a prior Singapore study published in 2023 with similar objectives [9], we used the same questionnaire and applied some modifications and additional questions to fit our study objectives.

The questionnaire includes 3 sections, the first section is for the socio-demographic and lifestyle characteristics of the participants such as age, gender, and educational level, and questions related to lifestyle factors, including physical activity, smoking status, and dietary habits, which are relevant to metabolic risk factors (MFs). The second section investigates the knowledge and awareness of various cardiometabolic diseases, including hypertension, hyperlipidemia, diabetes mellitus, non-alcoholic fatty liver disease, and cardiovascular diseases. Participants asked to answer questions related to the causes, symptoms, risk factors, complications, and preventive measures for each of these conditions. The third section assesses the actions taken by participants toward the prevention and management of cardiometabolic diseases, with eight questions requiring responses. The questionnaire was reviewed by experts for content validity.

Scoring system:

Knowledge subsection score

Prompted responses of section 2 on knowledge of five diseases were considered for calculating

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knowledge scores. The total score on knowledge was calculated by combining scores of the below-mentioned knowledge of five diseases: Hypertension, Hyperlipidemia, Diabetes mellitus, Non-alcoholic fatty liver disease (NAFLD), and cardiovascular diseases (CVD) knowledge. The maximum possible score for the Knowledge part was thus 12+11+12+34+26= 95.

The Hypertension Knowledge Assessment subsection contains four questions that were given to measure the knowledge of hypertension. Two of them were yes or no questions and two agreement questions, Maximum possible score was 12 points. Hyperlipidemia knowledge was evaluated by three questions, one yes or no question, and two agreement questions, The Maximum possible score was 11 points. Four questions were used to evaluate Diabetes mellitus knowledge, two yes or no questions, and two agreement questions, the Maximum possible score was 12 points. Ten questions were used to assess the knowledge of Non-alcoholic fatty liver disease (NAFLD), four yes or no questions, six agreement questions, and the Maximum possible score was 34 points. The Knowledge of Cardiovascular Diseases subsection contains six questions, one yes or no question six agreement questions, The Maximum possible score was 26 points. Score 1 was given if the answer was 'yes'. negative marking was given for 'no' or 'don't know' responses. Each knowledge question scored on a Likert scale as follows: Strongly Agree 5 points, agree 4 points, Neutral 3 points, disagree 2 points, Strongly Disagree 1 point, Maximum score possible for the section was 12 points.

Attitude subsection score

In All five subsections, each respondent was asked 10-item questions related to his/her attitude towards cardio-metabolic disease. Responses were recorded as very important or somewhat important, Neutral or not very important, or not important at all. by using a 5-point Likert scale. A score of '1' was given for Not Important at all, Not Very Important 2 points, Neutral 3 points, Somewhat Important 4 points, and Very Important 5 points, The Maximum possible score for the attitude section was 10x5=50 points.

Practice section score

This section assesses participants' engagement in health-promoting behaviors. It contains eight questions including six behavioral questions: Each behavioral response scored on a Likert scale, similar to the attitude section, Strongly Agree 5 points, Agree 4 points, Neutral 3 points, Disagree 2 points, Strongly Disagree 1 point, and two exercise questions: Points assigned based on the reported amount of exercise: The total score for actions the sum of all points from this subsection.

This KAP study employed the original Bloom's cut-off values, 80.0%-100.0%, 60.0%-79.0%, and ≤59.0%. KAP was categorized using them into three different levels. With a total score of 145, the knowledge and attitude scores were divided into three levels, which are as follows: There are three levels of scoring: high (116–145), moderate (87–114.55), and low (0-85.55). In the practice part there are eight questions, six questions with a total score of 30 points, and two questions Points assigned based on the reported amount of exercise.

Pilot test:

The questionnaire was distributed to 20 individuals and they were asked to fill it out. This was done to test the simplicity of the questionnaire and the feasibility of the study. The data of the pilot study was excluded from the final data of the study.

Analyzes and entry method:

To perform statistical analysis, the collected data entered into the Microsoft Excel 2016 program for

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Windows. After that, data transferred to the Statistical Package of Social Science Software (SPSS, version 25.0). We measure the p-value and the 95% confidence intervals. The P-value < 0.05 taken as the fixed point for statistical significance.

Results:

Table (1) displays various demographic parameters of the participants with a total number of (461). Our participants have a mean age of 38.4 years, with 28.6% aged 35–49 and proportion of 22.6% aged 23 or less and 24–34 respectively. The sample is skewed in gender distribution, since there are 67.9% more females than males with the sample consisting of 812 and 464 respectively. The participants' level of educational attainment is generally high, with 64.6 percent having at least a bachelor's degree, and may in turn affect their health literacy and health actions. Of notable interest, 71.6% have a family history of cardiometabolic disease, suggesting a genetic predisposition within this population. The frequency with which exercise is being skipped is something to be worried about – only occasionally, 42.5 per cent do physical activity; and 70.5 per cent say their food habits aren't quite healthy.

Table (1): Sociodemographic characteristics of participants (n=461)

Parameter		***No.***	***Percent (%)***
Age (Mean:38.4, STD:14.4)	23 or less	104	22.6
	24 to 34	104	22.6
	35 to 49	132	28.6
	50 or more	121	26.2
Gender	Female	313	67.9
	Male	148	32.1
Nationality	Saudi	461	100.0
	Non-Saudi	0	0
Height (Mean:163.1, STD:8.8)	156 cm or less	126	27.3
	157 to 165 cm	166	36.0
	166 to 170 cm	82	17.8
	171 cm or more	87	18.9
Weight (Mean:71.0, STD:17.7)	60 kg or less	129	28.0
	61 to 70 kg	118	25.6
	71 to 80 kg	106	23.0
	81 kg or more	108	23.4
Educational level	Primary school	5	1.1
	Middle school	3	.7
	High school	64	13.9
	Diploma	37	8.0
	Bachelor's degree	298	64.6
	Postgraduate degree	45	9.8
	Uneducated	9	2.0
Occupation	Student	93	20.2
	Employed	189	41.0

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	Freelancer	20	4.3
	Unemployed	91	19.7
	Retired	68	14.8
Marital status	Single	159	34.5
	Married	284	61.6
	Divorced	11	2.4
	Widowed	7	1.5
Residential region	Northern region	12	2.6
	Southern region	22	4.8
	Central region	299	64.9
	Eastern region	51	11.1
	Western region	77	16.7
How often do you exercise per week?	Daily	41	8.9
	3-4 times a week	72	15.6
	1-2 times a week	82	17.8
	Sometimes	196	42.5
	Never do physical activity	70	15.2
Eating habits	Healthy	66	14.3
	Somewhat Healthy	325	70.5
	Not Healthy at all	70	15.2
Smoking?	Yes	39	8.5
	Ex-Smoker	19	4.1
	No	403	87.4
Does your family have a history of cardiometabolic diseases?	No	131	28.4
	Yes	330	71.6
Have you ever been diagnosed with any cardiometabolic disease?	No	336	72.9
	Yes	125	27.1
If yes, what is the diagnosis? * (n=125)	Prediabetes	46	36.8
	Diabetes	81	64.8
	Hypertension	53	42.4
	Hyperlipidaemia	31	24.8
	Non-alcoholic fatty liver disease	9	7.2
	Cardiovascular disease	12	9.6

Results may overlap

As shown in figure 1, Data drawn from the total sample of 461 participants is also presented, and provides implications for perceptions between the connection of high blood pressure and fatty liver disease. A little 68 respondents (bit more than 14.7%) said they strongly agree that one is seeing an increased risk and additionally 140 respondents 30.4% agreed cumulatively meaning 45.1% respondents acknowledge that there is an increased risk. In contrast, 30 people (6.51%) disagreed but only 9 individuals (1.91%) strongly disagreed. Additionally, a substantial number of respondents, that is 214 (46.4%) were ambiguous or neutral on this health association.

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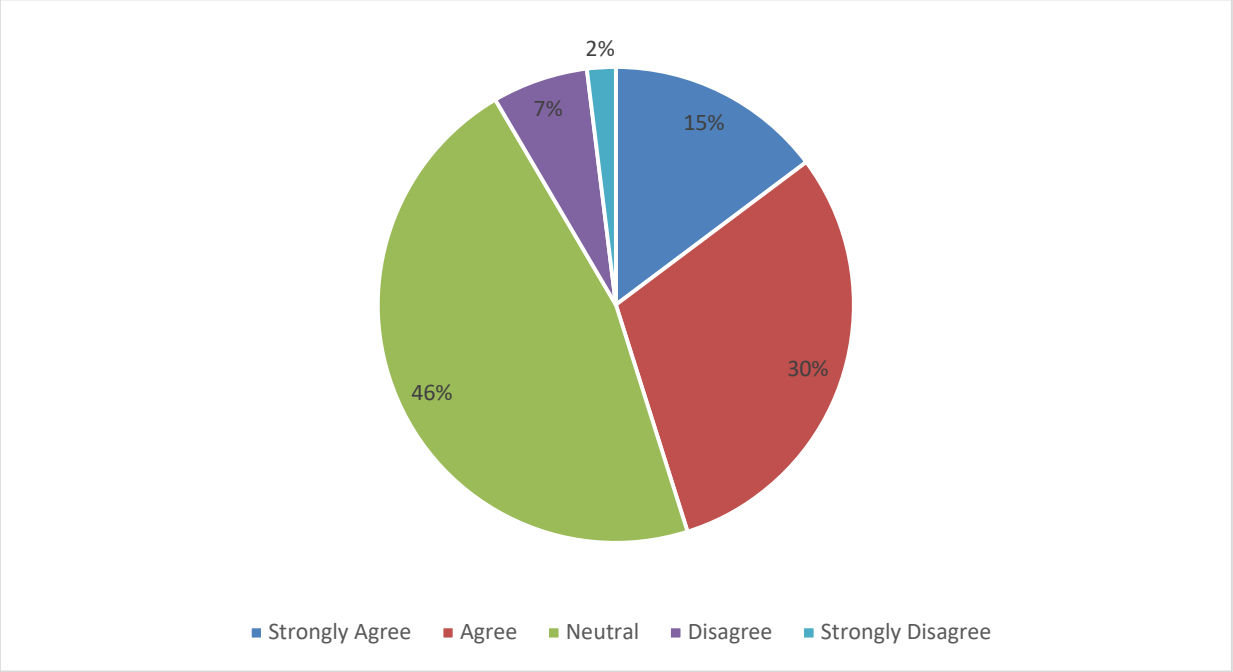
Figure (1): Illustrates if high blood pressure would increase risk of fatty liver disease among participants.



As illustrated in Table 2, data presented offers some interesting revelations regarding a sample population of 461 respondents and their awareness and understanding of cardiometabolic diseases. An interesting finding is that 97.6 percent of people know they have high blood pressure; but it doesn't mean they know how serious it is, with 18.2 percent believing they don't know. This uncertainty could present challenges for how best to manage disease and how best to generate public health strategies. Similar to this, a majority (79.6%) see lifestyle changes including diet and exercise as important for blood pressure management — yet there is a disparity in the perception of high cholesterol. However, this is a concerning 77.2% of those people who have never heard of hyperlipidemia, which means that there is a huge gap in knowledge and could affect prevention efforts. Additionally, with regard to diabetes, 74.2% state that it is a chronic condition, however, there seems to be deficiencies of knowledge on relationship between diabetes and fatty liver disease as only 41.4% stated that diabetes was a disease of fatty liver disease.

Table (2): Parameters related to knowledge level regarding cardiometabolic diseases (n=461).

Parameter		***No.***	***Percent (%)***
Have you heard of high blood pressure?	No	11	2.4
	Yes	450	97.6
Do you think high blood pressure is a lifelong disease?	No	70	15.2
	Yes	307	66.6
	I don't know	84	18.2
High blood pressure is likely to increase your risk of fatty liver disease.	Strongly Agree	68	14.8
	Agree	140	30.4
	Neutral	214	46.4

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	Disagree	30	6.5
	Strongly Disagree	9	2.0
High blood pressure is likely to increase the risk of coronary artery disease and stroke.	Strongly Agree	193	41.9
	Agree	202	43.8
	Neutral	55	11.9
	Disagree	4	.9
	Strongly Disagree	7	1.5
How important are lifestyle changes (diet and exercise) for controlling blood pressure?	Very important	367	79.6
	Somewhat important	63	13.7
	Neutral	21	4.6
	Not very important	9	2.0
	Not at all important	1	.2
How important is it for patients to take prescribed medications to control blood pressure?	Very important	389	84.4
	Somewhat important	45	9.8
	Neutral	16	3.5
	Not very important	8	1.7
	Not at all important	3	.7
Have you ever heard of hyperlipidemia?	No	356	77.2
	Yes	105	22.8
High cholesterol levels are likely to increase your risk of fatty liver disease.	Strongly Agree	152	33.0
	Agree	182	39.5
	Neutral	113	24.5
	Disagree	6	1.3
	Strongly Disagree	8	1.7
High cholesterol levels are likely to increase the risk of coronary artery disease and stroke.	Strongly Agree	212	46.0
	Agree	166	36.0
	Neutral	69	15.0
	Disagree	7	1.5
	Strongly Disagree	7	1.5
How important is lifestyle change (diet and exercise) for cholesterol levels?	Very important	372	80.7
	Somewhat important	60	13.0
	Neutral	24	5.2
	Not very important	2	.4
	Not at all important	3	.7
How important is it for patients to take prescribed medications to control high cholesterol?	Very important	339	73.5
	Somewhat important	81	17.6
	Neutral	31	6.7
	Not very important	6	1.3
	Not at all important	4	.9
Have you ever heard of diabetes?	No	3	.7
	Yes	458	99.3
Do you think diabetes is a lifelong disease?	No	119	25.8
	Yes	342	74.2
Diabetes is likely to increase your risk of	Strongly Agree	88	19.1

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developing fatty liver disease.	Agree	119	25.8
	Neutral	191	41.4
	Disagree	50	10.8
	Strongly Disagree	13	2.8
Diabetes is likely to increase the risk of coronary artery disease and stroke.	Strongly Agree	126	27.3
	Agree	152	33.0
	Neutral	119	25.8
	Disagree	54	11.7
	Strongly Disagree	10	2.2
How important is lifestyle change (diet and exercise) in controlling blood sugar levels?	Very important	385	83.5
	Somewhat important	55	11.9
	Neutral	17	3.7
	Not very important	2	.4
	Not at all important	2	.4
How important is it for patients to take prescribed medications to control blood sugar levels?	Very important	393	85.2
	Somewhat important	43	9.3
	Neutral	20	4.3
	Not very important	3	.7
	Not at all important	2	.4
Have you ever heard of fatty liver disease?	No	230	49.9
	Yes	231	50.1
Do you think fatty liver disease can be treated in its early stages?	No	22	4.8
	Yes	246	53.4
	I don't know	193	41.9
Do you think that fatty liver can cause serious health problems?	No	15	3.3
	Yes	340	73.8
	I don't know	106	23.0
Can fatty liver disease lead to liver failure?	No	12	2.6
	Yes	249	54.0
	I don't know	200	43.4
A family history of fatty liver disease increases your risk.	Strongly Agree	94	20.4
	Agree	142	30.8
	Neutral	197	42.7
	Disagree	20	4.3
	Strongly Disagree	8	1.7
Smoking increases the risk of fatty liver disease.	Strongly Agree	158	34.3
	Agree	142	30.8
	Neutral	145	31.5
	Disagree	8	1.7
	Strongly Disagree	8	1.7
Obesity increases the risk of fatty liver disease.	Strongly Agree	224	48.6
	Agree	161	34.9
	Neutral	65	14.1
	Disagree	5	1.1

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	Strongly Disagree	6	1.3
Type 2 diabetes increases the risk of fatty liver disease.	Strongly Agree	77	16.7
	Agree	129	28.0
	Neutral	218	47.3
	Disagree	21	4.6
	Strongly Disagree	16	3.5
Physical inactivity increases the risk of fatty liver disease.	Strongly Agree	120	26.0
	Agree	162	35.1
	Neutral	137	29.7
	Disagree	19	4.1
	Strongly Disagree	23	5.0
Fatty liver disease may increase the risk of coronary artery disease and stroke.	Strongly Agree	114	24.7
	Agree	138	29.9
	Neutral	174	37.7
	Disagree	24	5.2
	Strongly Disagree	11	2.4

As shown in figure (2), According to the 461 surveyed sample, data presented shows the influence that lifestyle changes, especially a healthy diet and exercise, have in the management of fatty liver disease. The majority 71 per cent(327 respondents) said lifestyle changes were " very important " for effective disease treatment. In addition, 16% (75 respondents) thought lifestyle modifications were ‘somewhat important’, which means that a conspicuous number of participants realize the advantages which are not so dominant, however. Conversely, only 1% (2 respondents each) were deemed by only 'not very important" or 'not at all important," suggesting a very minimal dissenting viewpoint.

Figure (2): Illustrates effect of lifestyle change on fatty liver disease among participants.

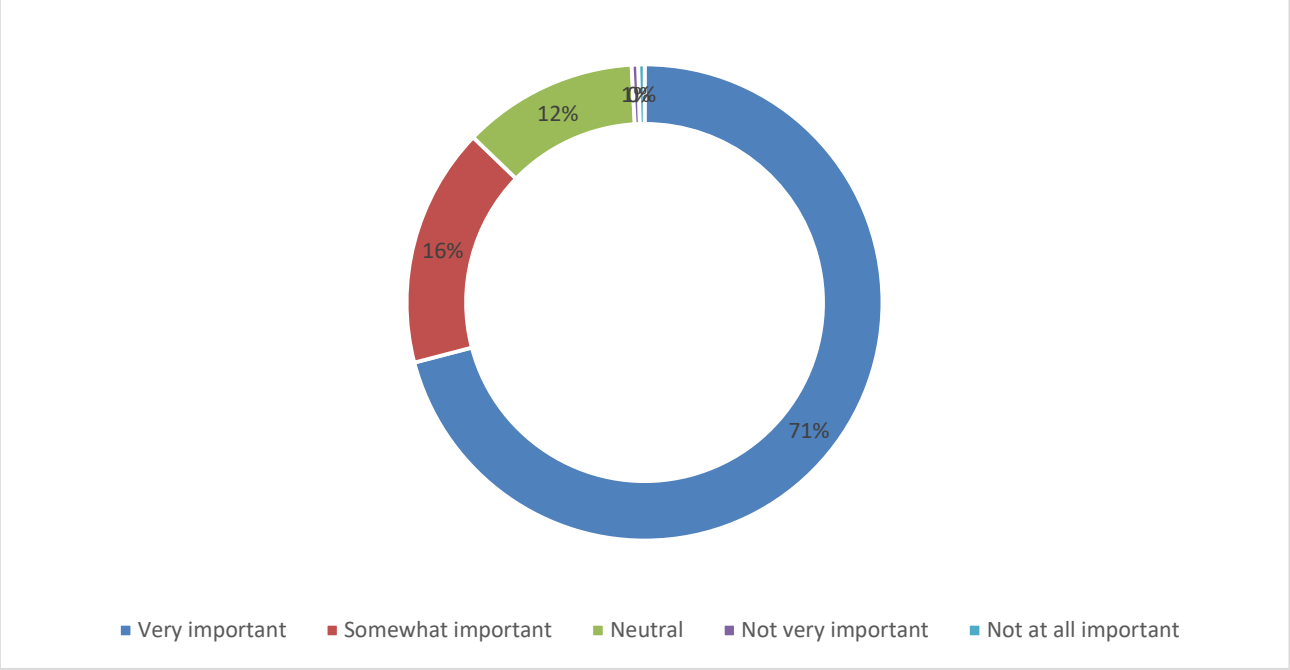

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Table 3 depicts situations in which cardiometabolic diseases are presented as something that can be changed through lifestyle changes and medication. Over three quarters (70.9%) view that lifestyle change including dietary and exercise habits is crucial in the treatment of fatty liver disease, a demonstration of an increased recognition of preventive health approaches. In addition, greater proportions (72.9%) place strong weight on regular medication for diseases of the metabolism, such as diabetes or high cholesterol, when it comes to the treatment of fatty liver disease, showing that a dual approach is needed in the treatment strategy. Surprisingly, participants are quite aware (88.7%) of cardiovascular disease, implying effective public health messaging. In addition, respondents overwhelmingly agree (90.7%) that high blood pressure and high cholesterol are major risk factors (90.7%) of cardiovascular problems. Yet there is a vast difference in how one recognizes symptoms of a heart attack only 46.6 percent strongly agree or agree.

Table (3): participants' attitude regarding cardiometabolic diseases (n=461).

Parameter		***No.***	***Percent (%)***
How important is lifestyle change (diet and exercise) in treating fatty liver disease?	Very important	327	70.9
	Somewhat important	75	16.3
	Neutral	55	11.9
	Not very important	2	.4
	Not at all important	2	.4
How important is regular medication for metabolic diseases (such as diabetes and high cholesterol) in treating fatty liver disease?	Very important	336	72.9
	Somewhat important	64	13.9
	Neutral	55	11.9
	Not very important	4	.9
	Not at all important	2	.4
Have you ever heard of cardiovascular disease?	No	52	11.3
	Yes	409	88.7
High blood pressure/high cholesterol are major risk factors for cardiovascular disease.	Strongly Agree	284	61.6
	Agree	134	29.1
	Neutral	41	8.9
	Strongly Disagree	2	.4
I can recognize the common symptoms of a heart attack if it happens to someone in front of me.	Strongly Agree	90	19.5
	Agree	125	27.1
	Neutral	146	31.7
	Disagree	79	17.1
	Strongly Disagree	21	4.6
It is important to monitor blood pressure, cholesterol and blood sugar levels regularly to avoid cardiovascular diseases.	Strongly Agree	286	62.0
	Agree	124	26.9
	Neutral	41	8.9
	Disagree	7	1.5
	Strongly Disagree	3	.7
A family history of cardiovascular disease greatly increases a person's risk of developing these conditions.	Strongly Agree	177	38.4
	Agree	153	33.2
	Neutral	108	23.4

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	Disagree	19	4.1
	Strongly Disagree	4	.9
Cardiovascular disease can be fatal or life-threatening.	Strongly Agree	234	50.8
	Agree	153	33.2
	Neutral	69	15.0
	Disagree	3	.7
	Strongly Disagree	2	.4
How important is lifestyle change (diet and exercise) in the treatment of cardiovascular disease?	Very important	344	74.6
	Somewhat important	68	14.8
	Neutral	42	9.1
	Not very important	5	1.1
	Not at all important	2	.4
How important is regular medication for metabolic diseases (such as diabetes, high cholesterol, and high blood pressure) in the treatment of cardiovascular disease?	Very important	377	81.8
	Somewhat important	44	9.5
	Neutral	34	7.4
	Not very important	2	.4
	Not at all important	4	.9

Table 4 presents a compelling overview of participants' cardiometabolic health exercise and dietary practices using a sample size of 461 individuals. More notably, 82 percent of participants are not meeting minimum recommendations for physical activity at 150 minutes per week, amounting to 90 minutes per week or less of moderate intensity exercise. In addition, an astounding 85 percent admitted to less than 30 minutes of vigorous exercise, which suggests a disconnect from more intense workouts that can make a huge difference to cardiovascular health. A significant portion of respondents were taking some sort of proactive steps to cut down on the amount of fat, sugar, and salt they consume: 37.3% described themselves as very determined to lower such thumbs, while 35.6% and 26.5% said they strongly wanted to cut down on fat, sugar, and salt intake, respectively. Even so, only 26.2 percent strongly agreed that they don't go over recommended caloric intakes when eating, a sign of incoherent dieting.

Table (4): Participants' practice regarding cardiometabolic diseases (n=461).

Parameter		***No.***	***Percent (%)***
In a typical week, how many minutes of moderate-intensity exercise do you do? (That is, you exercise enough to get your heart rate up and sweat. At moderate-intensity exercise, you will be able to talk, but not sing a song.)	150 minutes (2 1/2 hours) or more	25	5.4
	91-149 minutes or less	58	12.6
	90 minutes or less (1 1/2 hours or less)	378	82.0
In a typical week, how many minutes of vigorous exercise do you do? (i.e. you breathe fast and hard / at vigorous exercise you can't say more than a few words without pausing for a breath)	30 minutes or less (half an hour or less)	392	85.0
	31-74 minutes	51	11.1
	75 minutes (an hour and a quarter) or more	18	3.9
[I try to reduce the amount of fat in my diet.]	Strongly Agree	172	37.3
	Agree	193	41.9

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	Neutral	49	10.6
	Disagree	25	5.4
	Strongly Disagree	22	4.8
I try my best not to exceed the recommended calories in my diet (2200 calories for males and 1800 calories for females).	Strongly Agree	121	26.2
	Agree	167	36.2
	Neutral	102	22.1
	Disagree	36	7.8
	Strongly Disagree	35	7.6
I try to reduce the amount of sugar in my diet (less than 10 teaspoons of sugar per day).	Strongly Agree	166	36.0
	Agree	177	38.4
	Neutral	61	13.2
	Disagree	35	7.6
	Strongly Disagree	22	4.8
I try to reduce the amount of salt in my diet (less than 2 grams of salt per day/do not add extra salt to meals).	Strongly Agree	126	27.3
	Agree	184	39.9
	Neutral	82	17.8
	Disagree	43	9.3
	Strongly Disagree	26	5.6
I try to reduce my consumption of red meat and processed meats (sausages, shawarma, mortadella, hot dogs, cold cuts, salami, pepperoni, etc.).	Strongly Agree	151	32.8
	Agree	173	37.5
	Neutral	78	16.9
	Disagree	36	7.8
	Strongly Disagree	23	5.0
I try to eat at least two servings of fruit and two servings of vegetables daily (one serving is equal to one cup).	Strongly Agree	153	33.2
	Agree	160	34.7
	Neutral	86	18.7
	Disagree	45	9.8
	Strongly Disagree	17	3.7

Table 5 shows a detailed account of the knowledge and attitude levels about the cardiometabolic diseases as half of the respondents were surveyed. Very high proportions of respondents (only 13.9% had <50% high knowledge and positive attitudes) showed to have sufficient knowledge and positive attitudes (69,8%) for these health conditions indicating successful health education and awareness. Additionally, 29.1% of subjects with moderate level indicate that a fair number of the population deserve extra educational resources to help them in their understanding, as well as their management of their cardiometabolic risks. On the contrary, the very low representation (1.1%) in low knowledge and attitudes stands out as a very good result in the delivery of information.

Table (5): Shows knowledge and attitude level of cardiometabolic diseases score results.

	Frequency	**Percent**
High knowledge attitude level	322	69.8
Moderate knowledge and attitude	134	29.1
Low knowledge attitude level	5	1.1
Total	461	100.0

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Table (6) provides the distribution of practice levels in terms of cardiometabolic disease management practice among the surveyed population and contains some of the health behavior insights. For example, a fairly high proportion (39.3%) of the entire population was found to be performing in a higher level of practice, and 43.6% became moderate level of practice participants. While the low practice level was found in 17.1% of the study individuals, this has concerns about their preparedness and approach in managing these diseases.

Table (6): Shows practice level of cardiometabolic diseases score results.

	Frequency	**Percent**
High level of practice	181	39.3
Moderate practice	201	43.6
Low practice level	79	17.1
Total	461	100.0

Table (7) shows that knowledge attitude level towards cardiometabolic diseases has statistically significant relation to weight (P value=0.006), educational level (P value=0.024), residential region (P value=0.0001), and family history (P value=0.002). It also shows statistically insignificant relation to gender, age, height, occupation, marital status, rate of exercise, eating habits, smoking status, and personal history of cardiometabolic diseases. Participants weighing 71 to 80 kg, holding a bachelor's degree, residing in western region, and having a positive family history of cardiometabolic diseases were found to have higher levels of knowledge and attitude regarding cardiometabolic diseases.

Table (7): Relation between knowledge attitude level towards cardiometabolic diseases and sociodemographic characteristics.

Parameters		***Knowledge Attitude level***		***Total (N=461)***	***P value****
		High knowledge attitude level	**Moderate or low knowledge attitude level**		
Gender	Female	211	102	313	0.097
		65.5%	73.4%	67.9%	
	Male	111	37	148	
		34.5%	26.6%	32.1%	
Age	23 or less	73	31	104	0.273
		22.7%	22.3%	22.6%	
	24 to 34	73	31	104	
		22.7%	22.3%	22.6%	
	35 to 49	99	33	132	
		30.7%	23.7%	28.6%	
	50 or more	77	44	121	
		23.9%	31.7%	26.2%	
Height	156 cm or less	83	43	126	0.220
		25.8%	30.9%	27.3%	
	157 to 165 cm	112	54	166	
		34.8%	38.8%	36.0%	

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	166 to 170 cm	59	23	82	
		18.3%	16.5%	17.8%	
	171 cm or more	68	19	87	
		21.1%	13.7%	18.9%	
Weight	60 kg or less	76	53	129	0.006
		23.6%	38.1%	28.0%	
	61 to 70 kg	83	35	118	
		25.8%	25.2%	25.6%	
	71 to 80 kg	84	22	106	
		26.1%	15.8%	23.0%	
	81 kg or more	79	29	108	
		24.5%	20.9%	23.4%	
Educational level	Primary school	2	3	5	0.024
		0.6%	2.2%	1.1%	
	Middle school	1	2	3	
		0.3%	1.4%	0.7%	
	High school	40	24	64	
		12.4%	17.3%	13.9%	
	Diploma	19	18	37	
		5.9%	12.9%	8.0%	
	Bachelor's degree	221	77	298	
		68.6%	55.4%	64.6%	
	Postgraduate degree	32	13	45	
		9.9%	9.4%	9.8%	
	Uneducated	7	2	9	
		2.2%	1.4%	2.0%	
Occupation	Student	62	31	93	0.150
		19.3%	22.3%	20.2%	
	Employed	144	45	189	
		44.7%	32.4%	41.0%	
	Freelancer	14	6	20	
		4.3%	4.3%	4.3%	
	Unemployed	57	34	91	
		17.7%	24.5%	19.7%	
	Retired	45	23	68	
		14.0%	16.5%	14.8%	
Marital status	Single	104	55	159	0.244
		32.3%	39.6%	34.5%	
	Married	203	81	284	
		63.0%	58.3%	61.6%	
	Divorced	10	1	11	
		3.1%	0.7%	2.4%	
	Widowed	5	2	7	
		1.6%	1.4%	1.5%	

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Residential region	Northern region	6	6	12	0.0001
		1.9%	4.3%	2.6%	
	Southern region	12	10	22	
		3.7%	7.2%	4.8%	
	Central region	195	104	299	
		60.6%	74.8%	64.9%	
	Eastern region	46	5	51	
		14.3%	3.6%	11.1%	
	Western region	63	14	77	
		19.6%	10.1%	16.7%	
How often do you exercise per week?	Daily	29	12	41	0.578
		9.0%	8.6%	8.9%	
	3-4 times a week	51	21	72	
		15.8%	15.1%	15.6%	
	1-2 times a week	63	19	82	
		19.6%	13.7%	17.8%	
	Sometimes	133	63	196	
		41.3%	45.3%	42.5%	
	Never do physical activity	46	24	70	
		14.3%	17.3%	15.2%	
Eating habits	Healthy	39	27	66	0.100
		12.1%	19.4%	14.3%	
	Somewhat Healthy	235	90	325	
		73.0%	64.7%	70.5%	
	Not Healthy at all	48	22	70	
		14.9%	15.8%	15.2%	
Smoking?	Yes	32	7	39	0.197
		9.9%	5.0%	8.5%	
	Ex-Smoker	14	5	19	
		4.3%	3.6%	4.1%	
	No	276	127	403	
		85.7%	91.4%	87.4%	
Does your family have a history of cardiometabolic diseases?	No	78	53	131	0.002
		24.2%	38.1%	28.4%	
	Yes	244	86	330	
		75.8%	61.9%	71.6%	
Have you ever been diagnosed with any cardiometabolic disease?	No	228	108	336	0.127
		70.8%	77.7%	72.9%	
	Yes	94	31	125	
		29.2%	22.3%	27.1%	

P value was considered significant if ≤ 0.05.

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Table (8) shows that practice level regarding cardiometabolic disease has statistically significant relation to gender (P value=0.007), height (P value=0.0001), marital status (P value=0.005), residential region (P value=0.0001), rate of exercise (P value=0.0001), and eating habits (P value=0.0001). It also shows statistically insignificant relation to age, weight, educational level, occupation, smoking status, and personal history or family history of cardiometabolic diseases. Participants of female gender, married, residing in central region, exercising 3 to 4 times per week and with healthy eating habits were found to have higher levels of practice towards cardiometabolic diseases.

Table (8): Practice level regarding cardiometabolic disease in association with sociodemographic characteristics.

Parameters		***Practice level***		***Total (N=461)***	***P value****
		High level of practice	**Moderate or low practice**		
Gender	Female	136	177	313	0.007
		75.1%	63.2%	67.9%	
	Male	45	103	148	
		24.9%	36.8%	32.1%	
Age	23 or less	40	64	104	0.071
		22.1%	22.9%	22.6%	
	24 to 34	30	74	104	
		16.6%	26.4%	22.6%	
	35 to 49	58	74	132	
		32.0%	26.4%	28.6%	
	50 or more	53	68	121	
		29.3%	24.3%	26.2%	
Height	156 cm or less	64	62	126	0.0001
		35.4%	22.1%	27.3%	
	157 to 165 cm	67	99	166	
		37.0%	35.4%	36.0%	
	166 to 170 cm	16	66	82	
		8.8%	23.6%	17.8%	
	171 cm or more	34	53	87	
		18.8%	18.9%	18.9%	
Weight	60 kg or less	53	76	129	0.379
		29.3%	27.1%	28.0%	
	61 to 70 kg	47	71	118	
		26.0%	25.4%	25.6%	
	71 to 80 kg	46	60	106	
		25.4%	21.4%	23.0%	
	81 kg or more	35	73	108	
		19.3%	26.1%	23.4%	
Educational level	Primary school	3	2	5	0.074
		1.7%	0.7%	1.1%	
	Middle school	1	2	3	

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		0.6%	0.7%	0.7%	
	High school	17	47	64	
		9.4%	16.8%	13.9%	
	Diploma	15	22	37	
		8.3%	7.9%	8.0%	
	Bachelor's degree	122	176	298	
		67.4%	62.9%	64.6%	
	Postgraduate degree	16	29	45	
		8.8%	10.4%	9.8%	
	Uneducated	7	2	9	
		3.9%	0.7%	2.0%	
Occupation	Student	32	61	93	0.147
		17.7%	21.8%	20.2%	
	Employed	67	122	189	
		37.0%	43.6%	41.0%	
	Freelancer	7	13	20	
		3.9%	4.6%	4.3%	
	Unemployed	41	50	91	
		22.7%	17.9%	19.7%	
	Retired	34	34	68	
		18.8%	12.1%	14.8%	
Marital status	Single	53	106	159	0.005
		29.3%	37.9%	34.5%	
	Married	124	160	284	
		68.5%	57.1%	61.6%	
	Divorced	0	11	11	
		0.0%	3.9%	2.4%	
	Widowed	4	3	7	
		2.2%	1.1%	1.5%	
Residential region	Northern region	1	11	12	0.0001
		0.6%	3.9%	2.6%	
	Southern region	7	15	22	
		3.9%	5.4%	4.8%	
	Central region	127	172	299	
		70.2%	61.4%	64.9%	
	Eastern region	8	43	51	
		4.4%	15.4%	11.1%	
	Western region	38	39	77	
		21.0%	13.9%	16.7%	
How often do you exercise per week?	Daily	26	15	41	0.0001
		14.4%	5.4%	8.9%	
	3-4 times a week	39	33	72	
		21.5%	11.8%	15.6%	
	1-2 times a	30	52	82	

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	week	16.6%	18.6%	17.8%	
	Sometimes	72	124	196	
		39.8%	44.3%	42.5%	
	Never do physical activity	14	56	70	
		7.7%	20.0%	15.2%	
Eating habits	Healthy	37	29	66	0.0001
		20.4%	10.4%	14.3%	
	Somewhat Healthy	131	194	325	
		72.4%	69.3%	70.5%	
	Not Healthy at all	13	57	70	
		7.2%	20.4%	15.2%	
Smoking?	Yes	11	28	39	0.072
		6.1%	10.0%	8.5%	
	Ex-Smoker	4	15	19	
		2.2%	5.4%	4.1%	
	No	166	237	403	
		91.7%	84.6%	87.4%	
Does your family have a history of cardiometabolic diseases?	No	53	78	131	0.741
		29.3%	27.9%	28.4%	
	Yes	128	202	330	
		70.7%	72.1%	71.6%	
Have you ever been diagnosed with any cardiometabolic disease?	No	135	201	336	0.509
		74.6%	71.8%	72.9%	
	Yes	46	79	125	
		25.4%	28.2%	27.1%	

P value was considered significant if ≤ 0.05.

Discussion:

In the present study we aimed to assess the knowledge, attitudes and practices (KAP) regarding cardiometabolic diseases in Saudi Arabia. This study is particularly important because cardiometabolic conditions are leading contributors of morbidity and mortality worldwide. This research finds that there is a complex interaction between awareness, behaviour, and health outcomes, all of which are important public health intervention targets. The findings reveal a high level of awareness with regard to some conditions, but there are substantial knowledge and practice gaps regarding the interrelated aspects of these conditions.

When comparing findings of this study with previous research, it is clear that levels of awareness of cardiometabolic diseases can be very varied amongst different populations. For instance, a Singapore study, showed that people with metabolic risk factors had lower knowledge scores in multiple cardiometabolic domains across the board, compared to individuals without such risk factors, indicating that higher baseline knowledge might allow for people to reduce their risk of developing these diseases [10]. Our results also demonstrate that 97.6 of participants recognized high blood pressure, however 18.2 don't know an it is serious. The fact that there is such a difference here is a pointer to how we need programs targeted to educate the public about the existence of these diseases as well as about their seriousness and the urgency of early intervention.

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Second, the study by Altman et al. found that improved knowledge and awareness can result in favorable lifestyle changes and decrease cardiometabolic risk factors [11]. This concurs with our findings, as 79.6% of participants admitted to the need of lifestyle change in blood pressure management. Although there was recognition of this, only 42.5 per cent got occasional exercise and a large amount practiced unhealthy eating habits. This paradox reveals an important discrepancy between knowledge and practice that has been described in many populations including young adults with intellectual disabilities, in whom knowledge of nutrition and physical activity is a powerful predictor of cardiometabolic health [12].

The current study showed that although diabetes awareness was high (74.2%), awareness of relationship with fatty liver disease was low (41.4%). This lack of understanding of the interrelation between cardiometabolic diseases is troubling because it could be an impediment to constructing effective prevention and management strategies. In previous research, it was shown that a holistic understanding of cardiometabolic health is important for effective disease management [13]. For example, Peña et al. pointed to the need to conceive of different metabolic conditions as integrated, and thus argue that an integrated approach to education has the potential to enhance public understanding and ultimately improve health outcomes [14].

Due to the fact that our study participants, mostly educated females, the demographic profile of our study subjects challenges the concept that education doesn't have an effect on health literacy and health behavior. A robust literature on the effect of higher educational attainment on better health outcomes and healthier lifestyle choices [15].

Related Topics Yet, irrelevant of the high educational backgrounds of our participants, the study showed alarming statistics about how our participants live their lives as 82% do not meet the recommended physical activity levels. The result of this finding is consistent with the results of a recent qualitative systematic review which suggests a multifaceted approach to increase physical activity in low to middle income countries and stresses the necessity of tailored interventions considering individual and contextual factors [13].

Also the study's findings showed that attitudes and knowledge of cardiometabolic diseases were generally positive; 69.8 percent respondents scored above the minimal cut off. Nevertheless, The 29.1 percent of the participants with moderate knowledge levels suggest that more educational resources are needed. This mirrors results from a study that found major knowledge gaps in populations at higher risk of cardiometabolic diseases, which the authors believe could be targeted in educational interventions to help increase awareness and support healthier behaviors [16].

Furthermore, the present study has limitations. Since the cross-sectional design prevents inference of causality among knowledge, attitudes and practices regarding cardiometabolic diseases, a longitudinal design is proposed. Furthermore, there is high reliance on self-reported data which can introduce bias if the data is self-reported and participants may over report their knowledge and their compliance with healthy practices. Additionally, healthcare professionals and non-Saudis may have been excluded, limiting the generalizability of the findings. Future studies should examine methodology using longitudinal designs, that employ diverse populations, to better understand the dynamics of cardiometabolic disease awareness and management.

Conclusion:

The findings of this study emphasize the vital importance of developing targeted public health measures to enhance medical awareness about cardiometabolic diseases among the Saudi population. There's a good awareness of certain diseases, but a number of gaps remain about the interrelated nature of these

diseases and how they are managed. Comprehensive education programmes and community engagement strategies are necessary in addressing these gaps and will help reduce the growing burden of cardiometabolic diseases in Saudi Arabia and improving overall public health outcomes.

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Ethical approval

An informed consent was obtained from each participant after explaining the study in full and clarifying that participation is voluntary. Data collected were securely saved and used for research purposes only.

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Conflict of interests

The authors declare that there are no conflicts of interest.

Informed consent:

Written informed consent was obtained from all individual participants included in the study.

Data and materials availability

All data associated with this study are present in the paper.

References:

1. Ramadan A, Aboeldahab H, Bashir MN, Belal MM, Wageeh A, Atia A, et al. Evaluating knowledge, attitude, and physical activity levels related to cardiovascular disease in Egyptian adults with and without cardiovascular disease: a community-based cross-sectional study. BMC Public Health. 2024 Dec 1;24(1).
2. Ferreira PL, Morais C, Pimenta R, Ribeiro I, Amorim I, Alves SM, et al. Knowledge about type 2 diabetes: its impact for future management. Front Public Heal. 2024;12.
3. Adelowo AB. A Scoping Review of Cardio-Metabolic Syndrome: A Critical Step in Mitigating the Rising Global Burden of Cardiovascular Diseases and Diabetes Mellitus. Int J Diabetes Metab Disord [Internet]. 2022 Jan 31;7(2). Available from: https://opastpublishers.com/open-access/a-scoping-review-of-cardio-metabolic-syndrome-a-critical-step-in-mitigatingrnthe-rising-global-burden-of-cardiovascular-diseases-and-diabetes-mellitus.pdf

ISSN:1624-1940
http://magellanes.com/

4. Ghamri RA. Knowledge of cardiovascular diseases and associated risk factors in the general adult population of Jeddah, Saudi Arabia A cross-sectional study examining gender disparities. Med (United States). 2024;103(24).
5. Alhowaymel FM, Abdelmalik MA, Mohammed AM, Mohamaed MO, Alenezi A. Knowledge, Attitudes, and Practices of Hypertensive Patients Towards Stroke Prevention Among Rural Population in Saudi Arabia: A Cross-Sectional Study. SAGE Open Nurs. 2023 Jan 1;9.
6. Ahmad F, Abazid RM, Allihimy AS, Aldrewesh DA, Alkuraydis SA, Alharb SA, et al. Awareness of Coronary Artery Disease among Population of Al-Qassim, Saudi Arabia: A Community-Based Study. J Clin Diagnostic Res. 2020;14(1):10–4.
7. Alghamdi A s, Alzahrani MS, Alsolami BM, Thabet SA, Alghamdi B s, Kinsara AJ. A Community-Based, Cross-Sectional Study Assessing the Level of Awareness and Insight Related to Cardiovascular Diseases. Cureus. 2021;(June):3–10.
8. Kim E, Jung CH, Rhee EJ, Noh J, Lee JH, Park HJ, et al. Public awareness of cardiovascular disease prevention in Korea. Cardiovasc Prev Pharmacother. 2022;4(4):149–57.
9. Anand VV, Goh RSJ, Nah B, Koh SWC, Lim J, Neo NWS, et al. General Public's knowledge, awareness, and perception of Cardiometabolic diseases: data from a Singapore study population. Front Med. 2023;10.
10. Anand, V., Goh, R., Nah, B., Koh, S., Lim, J., Neo, N., … & Chew, N. (2023). General public's knowledge, awareness, and perception of cardiometabolic diseases: data from a singapore study population. Frontiers in Medicine, 10. https://doi.org/10 .3389/fmed.2023.1193829
11. Altman, R., Ybarra, J., & Villablanca, A. (2014). Community-based cardiovascular disease prevention to reduce cardiometabolic risk in latina women: a pilot program. Journal of Women S Health, 23(4), 350-357. https://doi.org/10.1089/jwh.2013.4570
12. Zwack, C., McDonald, R., Tursunalieva, A., Lambert, G., & Lambert, E. (2022). Exploration of diet, physical activity, health knowledge and the cardiometabolic profile of young adults with intellectual disability. Journal of Intellectual Disability Research, 66(6), 517-532. https://doi.org/10.1111/jir.12917
13. Heine, M., Badenhorst, M., Zyl, C., Ghisi, G., Babu, A., Buckley, J., … & Derman, W. (2021). Developing a complex understanding of physical activity in cardiometabolic disease from low-to-middle-income countries—a qualitative systematic review with meta-synthesis. International Journal of Environmental Research and Public Health, 18(22), 11977. https://doi.org/10.3390/ijerph182211977
14. Peña, M., Swett, K., Schneiderman, N., Spevack, D., Ponce, S., Talavera, G., … & Rodríguez, C. (2018). Cardiac structure and function with and without metabolic syndrome: the echocardiographic study of latinos (echo-sol). BMJ Open Diabetes Research & Care, 6(1), e000484. https://doi.org/10.1136/bmjdrc-2017-000484
15. Kivimäki, M., Kuosma, E., Ferrie, J., Luukkonen, R., Nyberg, S., Alfredsson, L., … & Jokela, M. (2017). Overweight, obesity, and risk of cardiometabolic multimorbidity: pooled analysis of individual-level data for 120 813 adults from 16 cohort studies from the usa and europe. The Lancet Public Health, 2(6), e277-e285. https://doi.org/10.1016/s2468-2667(17)30074-9
16. Petter, J., Rooijen, M., Korevaar, J., & Nielen, M. (2015). Willingness to participate in prevention programs for cardiometabolic diseases. BMC Public Health, 15(1). https://doi.org/10.1186/s12889-015-1379-0