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Cardiovascular Risk Reduction in Middle-Aged Women: A Cross-Sectional Analysis of Conventional and Complementary Medicine

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Abstract
Cardiovascular disease (CVD) is a global health concern. Complementary and alternative medicine (CAM) modalities are increasingly used for their potential role in CVD risk reduction. Aim: This study examined the integration of conventional medications with CAM approaches among middle-aged women. Methods: A cross-sectional design was used, involving 120 women aged 40–65 years attending Jazan healthcare facilities in Saudi Arabia. Data were collected through structured surveys and analyzed using IBM SPSS Statistics version 25. Results: CAM users were more likely to have higher high-density lipoprotein levels (Cohen's d= .74, p-value < .001), higher perceived stress level (Cohen's d= .64, p-value < .001), and slightly higher systolic blood pressure (Cohen's d= .31, p-value = .047) and diastolic blood pressure (Cohen's d= .34, p-value = .034). A univariate analysis of variance showed that CAM use was significantly associated with HDL levels ($F = 17.84$; $p < 0.001$) and perceived stress scores ($F = 14.16$; $p < 0.001$) even after controlling for confounders such as BMI and smoking. Conclusions: Integrating CAM with conventional medicine was associated with differences in cardiovascular risk indicators among middle-aged women. Increasing public health awareness of CAM may be linked to greater utilization and accessibility of CAM therapies.

Keywords: complementary medicine, alternative therapies, heart health, midlife women, cardiovascular risk

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1. Background

Cardiovascular disease (CVD) is a significant global health concern [1, 2]. In 2019, 17.9 million (%32) people worldwide died as a result of CVD [1]. The cost of CVD is approximately $237 billion per year, and half of this burden occurs in Asia [3]. The INTERHEART study found that nine modifiable risk factors, including smoking, dyslipidemia, hypertension, diabetes, abdominal obesity, and lifestyle choices, account for %90 of the risk of the first myocardial infarction [2]. Additionally, smoking is responsible for %36 of the myocardial infarction risk. Other high-profile risk factors include hypertension, tobacco use, and high cholesterol levels [3].

Emerging risk factors such as obesity, hypertension, diabetes, and high cholesterol levels are linked and increase the risk of CVD. Approximately %70 of patients have multiple risk factors that increase the risk of CVD from four-fold to 60-fold. Age is another significant cardiovascular risk factor, and hypertension, dyslipidemia, and left ventricular hypertrophy are more prevalent in those of advanced age [4]. Women who experience menopause at age 50 years or younger are at increased risk for CVD and mortality. Smoking, which has antiestrogenic effects, can also contribute to all-cause mortality in women because low estrogen levels can affect lipid profiles, thus leading to endothelium dysfunction and atherosclerotic plaque formation [5]. Middle-aged women may also be at increased risk for CVD because of psychosocial stress attributable to childhood abuse, intimate partner violence, and caregiving [6].

CVD prevention and management involve lifestyle modifications such as diet, exercise, and cardiac rehabilitation. Public health initiatives increase awareness and promote healthy living. Effective management of medications, such as statins, can control symptoms, prevent disease progression, and reduce complications such as heart attack and stroke [7]. Anticoagulants, such as warfarin and rivaroxaban, prevent blood clots associated with arterial fibrillation and deep vein thrombosis [8], whereas antiplatelet agents, such as aspirin and clopidogrel, prevent blood clotting during acute coronary syndrome management [9].

Several herbal medicinal plants and their extracts have been shown to be beneficial for CVD. For example, *Digitalis purpurea* has been extensively used because of its profound effects on cardiac functions [10]. *Allium sativum* (garlic) has been shown to be associated with improvements in hypertension, oxidative stress, inflammation, and hyperlipidemia [11]. *Astragalus membranaceus* is highly beneficial for ischemic-associated CVD [12]. The bioactive compounds of *Crocus sativus* (saffron), such as crocin and safranal, exhibit significant cardioprotective effects [13]. The cardiovascular protective effects of *Camellia sinensis* (green tea) are primarily attributable to its rich polyphenol and flavonoid contents [14]. In addition to herbal medicines, alternative therapies are becoming more commonly used to manage the CVD risk. Such therapies, which include acupuncture, yoga, meditation, and "point needling," may reduce the CVD risk and blood pressure. These therapies are commonly used by middle-aged women with incomes and education levels that are higher than those of their male counterparts [15].

A 2020 Saudi Arabian population-based study found that complementary and alternative medicine (CAM) is prevalent, and that herbal products, acupuncture, bloodletting, honey, cauterization, medical massage, and bone manipulation are the most commonly used CAM modalities. Adults in rural areas use CAM 2.92-times more frequently than adults in urban areas [16].

The current literature regarding CVD risk management relies heavily on the evaluation of either conventional medicine or individual CAM therapies chosen by individuals. However, middle-aged women, who comprise the largest portion of the population at risk for CVD, and the use of CAM therapies have been neglected in various targeted studies [17]. Therefore, this study aimed to examine the associations between the use of conventional medicine with CAM therapies and cardiovascular risk among middle-aged women in Saudi Arabia, and to compare cardiovascular risk indicators between integrative approaches and conventional methods alone. The study did not aim to evaluate the effects of individual CAM modalities, but rather to explore CAM use as a whole within an integrative context. Additionally, specific cardiovascular risk factors such as blood pressure, cholesterol levels, blood glucose levels, body mass index (BMI), perceived stress levels, and exercise levels were compared to examine their associations with integrative approaches and conventional treatment alone.

2. Methods

2.1 Study design

This cross-sectional study examined the association between the use of conventional medicine combined with CAM therapies and cardiovascular disease risk among middle-aged women. In this study, conventional medicine refers to evidence-based medical practices commonly used in standard healthcare systems for the prevention and management of cardiovascular disease. Complementary and alternative medicine (CAM) refers to health practices, products, and therapies that are not considered part of conventional medical care for cardiovascular disease. In this study, CAM includes cupping, green tea, ginger, massage, fenugreek, cauterization, garlic, omega-3, yoga, najila, Acupuncture. Integrative medicine is defined as the concurrent use of conventional medical care and one or more CAM modalities. The cross-sectional design allowed a comparative analysis of health outcomes of

women who received conventional treatment alone and those of women used CAM in addition to the conventional medicine at specific time points.

2.2 Study population

The target population included middle-aged women 40 to 65 years of age who resided in Jazan region, Saudi Arabia. This demographic was chosen because of its increased susceptibility to CVD because of hormonal changes, lifestyle habits, and the onset of chronic health conditions.

2.3 Inclusion and exclusion criteria

Women were eligible for inclusion if they had complete cardiovascular-related biomarker data available in their medical records within the preceding six months. Women without available biomarker data during this period were excluded. In addition, women who had experienced major cardiovascular events, such as myocardial infarction or stroke, within the past year were excluded from the study. Pregnant women and those diagnosed with mental disorders or currently using psychiatric medications were also excluded.

2.4 Recruitment strategies

The participants were recruited by healthcare practitioners at Jazan Health Cluster Facilities. The purpose and procedures of the study were explained to potential participants. A structured interview was conducted to screen participant eligibility and to confirm that individuals classified in the conventional treatment group were not using any CAM modalities at the time of data collection. Those who agreed to participate completed the survey.

2.5 Sample size calculation

A power analysis indicated that 120 participants were necessary. The conventional and CAM treatment groups each comprised 60 participants. A 1:1 ratio was chosen to ensure balanced group sizes and comparable statistical power between the conventional and CAM groups. A hypothetical effect size was used to calculate the sample size (Cohen's d = 0.5) with a significance level of 0.05 and 85% power to ensure statistical robustness.

2.6 Data collection

Data were collected through structured interviews, standardized questionnaires, and medical record reviews. Women were interviewed using standard questionnaires to obtain demographic information, measure their CVD risk factors, and assess their current use of conventional medicine and CAM therapies. The Atherosclerotic Cardiovascular Disease (ASCVD) 10-year risk score was calculated using the pooled cohort equations recommended by the American College of Cardiology/ American Heart Association (ACC/AHA). This method incorporates age, sex, total cholesterol, HDL cholesterol, systolic blood pressure, treatment for hypertension, diabetes status, and smoking status to estimate the 10-year risk of atherosclerotic cardiovascular disease. Biomarker data were obtained from the medical records. Current smokers were defined as participants who had smoked at least 100 cigarettes during their lifetime and currently smoked cigarettes. This item was assessed using a dichotomized response (yes or no). The diabetes status was assessed based on the classification of diabetes mellitus [18]. Women with fasting plasma glucose values ≥126 mg/dL or HbA1c ≥6.5% or a random blood glucose ≥200 mg/dL in the presence of signs and symptoms of diabetes were considered to have diabetes.

BMI was calculated based on the participant's body weight divided by height squared (kg/m^2). The Health Promoting Lifestyle Profile II, which is a subscale used to measure physical activity, was used to evaluate the physical activity status of the participants [19]. This physical activity subscale includes eight positively stated questions. Higher scores indicate greater participation in physical activity. The validity and reliability of this physical activity subscale among Saudi women have been confirmed by previous research [20].

Perceived stress was measured using the Perceived Stress Scale (PSS), which is the most widely used instrument for the personal perception of stress. The PSS measures the degree of individual stress [21] using questions about feelings and thoughts during the previous month. Each question asks how often the respondents felt a certain way. Total scores are determined by reversing the responses (e.g., 0 = 4, 1 = 3, 2 = 2, 3 = 1, and 4 = 0) to the four positively stated items (items 4, 5, 7, and 8) and summing all scale items. The reliability of the PSS among Saudi women has been established by several studies [22].

2.7 Data analysis

Data were analyzed using both descriptive and inferential statistical methods. Descriptive statistics comprised means and proportions of the baseline characteristics, CVD risk factors, and treatment modalities. Inferential statistics, including independent t tests and chi-square tests for categorical variables, were used to examine associations between treatment type and CVD risk. In addition, a univariate analysis of variance was conducted to assess the contribution of CAM to key cardiovascular and psychological metrics. Adjustments for confounders such as age and BMI were conducted.

2.8 Ethical considerations

This study was conducted in accordance with the principles outlined in the Declaration of Helsinki. Ethical approval was obtained from the Research Ethical Committee of Jazan Health Cluster Facilities (approval number: 2486). Participants were initially briefed about

the study goals, methods, and potential risks; thereafter, they provided informed consent. The confidentiality of all personal and medical data was ensured. Additionally, the data were stored securely and their access was restricted. This study involved minimal risk limited to emotional discomfort during discussions about personal health.

3. Results

3.1 Sociodemographic characteristics of the study population

The study population comprised 120 middle-aged women between 40 and 65 years of age (mean age, 47.92 ± 6.97 years). The enrolled participants were from diverse social backgrounds. Among them, %60 were married, %19.2 were single, %14.2 were divorced; the remaining participants were either separated or widowed. Variations in the education level were recorded; %45 completed high school, %37.5 had a bachelor's degree, and %17.5 had an elementary-level education or less. Most participants (%57.5) were unemployed; %37.5 were employed and %4.2 were retired. Only %13.3 perceived themselves as overweight or obese (Table 1).

Table 1. Sample Characteristics

Characteristics		Total, n (%)	Conventional medicine group,n (%)	CAM group, n(%)	p-value
Total participants		120 (100)	60 (50)	60 (50)	
Age	Mean (SD)	47.92 (6.97)	48.67 (7.41)	47.17 (6.48)	0.240
Social status	Single	23 (19.2)	15 (12.5)	8 (6.7)	0.268
	Married	72 (60)	30 (25)	42 (35)	
	Divorced	17 (14.2)	10 (8.4)	7 (5.8)	
	Separated	3 (2.5)	2 (1.7)	1 (0.8)	
	Widower	5 (4.2)	3(2.5)	2 (1.7)	
Employment status	Employed	45 (37.5)	15 (12.5)	30 (25)	0.024
	Unemployed	69 (57.5)	42 (35)	27 (22.5)	
	Retired	5 (4.2)	2 (1.7)	3 (2.5)	
	Business owner	1 (0.8)	1 (0.8)	0 (0)	
Educational status	Elementary school or less	21 (17.5)	11 (9.2)	10 (8.3)	0.638
	High school	54 (45)	29 (24.2)	25 (20.8)	
	Bachelor's degree	45 (37.5)	20 (16.7)	25 (20.8)	
Smoking status	Yes	6 (5)	3 (2.5)	3 (2.5)	1.000
	No	114 (95)	57 (47.5)	57 (47.5)	
Self-identify as overweight or obese	Yes	16 (13.3)	7 (5.8)	9 (7.5)	0.591
	No	104 (86.7)	53 (44.2)	51 (42.5)	
Hypertension	Yes	68 (56.7)	27 (22.5)	41 (34.2)	0.010
	No	52 (43.3)	33 (27.5)	19 (15.8)	
Diabetes	Yes	60 (50)	26 (21.7)	34 (28.3)	0.144
	No	60 (50)	34 (28.3)	26 (21.7)	
Dyslipidemia	Yes	35 (29.2)	22 (18.3)	12 (10.8)	0.071
	No	85 (70.8)	38 (31.7)	47 (39.2)	

SD = standard deviation

Usage and perception of CAM

Half of the participants (n = 60) reported using CAM. Commonly used CAM therapies included cupping (%32.5), green tea (%22.5), and ginger (%16.7). Other forms of CAM, such as acupuncture, yoga, and other herbal remedies, were underutilized. However, % 43.3 of respondents rated CAM as ineffective, % 42.5 rated it as somewhat effective, and % 8.3 rated it as very effective. Furthermore, only % 32.5 endorsed integrating CAM with conventional therapy, suggesting skepticism regarding the effectiveness of combined approaches (Table 2).

Table 2. Usage and Perception of CAM

Variable	Frequency	Percentage
Used CAM	60	50.0
Cupping	39	32.5
Green tea	27	22.5
Ginger	20	16.7
Massage	14	11.7
Fenugreek	10	08.3
Cauterization	04	3.3
Garlic	03	2.5
Omega-3	02	1.7
Yoga	1	0.8
Najila	1	0.8
Acupuncture	1	0.8
Frequency of CAM use		
Never	60	50
Rarely	32	26.7
Monthly	4	3.3
Weekly	8	6.7
Daily	16	13.3
Perception of CAM effectiveness		
Not effective	52	43.3
Neutral	07	5.8
Somewhat effective	51	42.5
Very effective	10	8.3
Perceived integrating conventional and CAM therapies as effective for improving cardiovascular health		
No	81	67.5
Yes	39	32.5
Recommended an integrative approach for others at risk for CVD		
No	63	52.5
Yes	57	47.5

CAM = complementary and alternative medicine; CVD, cardiovascular disease.

3.2 Clinical characteristics of the study population

Clinical characteristics in terms of the CVD risk associated with smoking were relatively uncommon because only 5% identified as smokers. The average BMI was 26.96 ± 4.21, which indicated a slight shift toward an overweight status among those in the overall cohort. The mean PSS score was 17.73 ± 3.07, indicating moderate levels of perceived stress. The recorded physical activity during this study was limited; the mean exercise score was 1.61 ± 0.83 according to a scale ranging from 1 (low activity) to 4 (high activity). The average systolic blood pressure (SBP) was 134.09 mmHg, and the average diastolic blood pressure (DBP) was 81.78 mmHg, indicating moderate, but not optimal, control. The average cholesterol level was 204.33 mg/dL, whereas the average low-density lipoprotein (LDL) level was 112.71 mg/dL and the average high-density lipoprotein (HDL) level was 52.35 mg/dL (Table 3).

3.3 Comparative analysis of conventional medicine users and CAM approach users

The association between CAM use and CVD risk was examined through a comparative analysis of conventional medicine users (non-CAM users) and integrative approach users (CAM users). Independent t tests revealed significant differences between these groups. CAM users reported stress levels (mean, 18.67 ± 2.37) that were higher than those of non-CAM users (mean, 16.68 ± 3.40). The HDL levels of CAM users (mean, 58.32 ± 20.92) were strikingly higher than those of non-CAM users (mean, 46.39 ± 8.87). The SBP of CAM users was slightly higher (mean, 136.12 mmHg) than that of non-CAM users (mean, 132.07 mmHg). The DBP of CAM users was marginally higher (mean, 83.23 mmHg) than that of non-CAM users (mean, 80.33 mmHg) (Table 3). No significant differences in BMI, cholesterol, or LDL were observed. Furthermore, the trend regarding higher HDL levels among CAM users was notable because HDL plays a protective role in cardiovascular health.

Table 3. Descriptive and Inferential Statistics of CVD Risk Factors

Characteristics	Minimum	Maximum	Total sample mean (SD)	Conventional medicine group mean (SD)	CAM group mean (SD)	Effect size Cohen's d	p-value
SBP	100	175	134.09 (13.22)	132.07 (15.25)	136.12 (10.56)	0.31	0.047
DBP	60	100	81.78 (8.72)	80.33 (9.28)	83.23 (7.93)	0.34	0.034
Total cholesterol	128	317	204.33 (33.36)	199.80 (34.62)	208.87 (31.68)	0.27	0.137
LDL	100	205	112.71 (36.28)	116.56 (34.26)	108.86 (38.10)	−0.21	0.247
HDL	20	126	52.35 (17.08)	46.39 (8.87)	58.32 (20.92)	0.74	<0.001
HbA1c	4	12.7	6.45 (1.78)	6.23 (1.72)	6.66 (1.83)	0.24	0.186
BMI	19.74	38.02	26.96 (4.21)	27.10 (4.48)	26.82 (3.97)	−0.07	0.713
10-year CVD risk	.20	21.90	3.58 (3.68)	3.72 (4.31)	3.44 (2.95)	−0.08	0.670
Exercise behaviors	1	4	1.61 (0.83)	1.64 (.72)	1.59 (.93)	−0.06	0.742
Perceived stress	8	26	17.73 (3.07)	16.68 (3.40)	18.67 (2.37)	0.64	<0.001

BMI = body mass index; CVD = cardiovascular disease; DBP = diastolic blood pressure; HbA1c = glycated hemoglobin; HDL = high-density lipoprotein cholesterol; LDL = low-density lipoprotein cholesterol; SBP = systolic blood pressure; SD = standard deviation.

3.4 Analysis of variance results

A univariate analysis of variance was conducted to examine the associations between CAM use and key cardiovascular and psychological metrics. CAM use was significantly associated with HDL levels ($F = 17.84$; $p < 0.001$), even after controlling for confounders such as BMI and smoking. There was also a significant association between CAM use and stress scores ($F = 14.16$; $p < 0.001$), with CAM users reporting higher stress levels. Additionally, CAM use showed a modest but significant association with DBP ($F = 4.66$; $p = 0.033$) (Table 4).

Table 4. ANOVA Results					
Dependent variable: Diastolic blood pressure measure R^2 = 0.221 (adjusted R^2 = 0.187)					
Source	Type III sum of squares	df	Mean square	F	p-value
Corrected model	1996.973	5	399.395	6.459	<0.001
Intercept	5549.662	1	5549.662	89.747	<0.001
Age	115.792	1	115.792	1.873	0.174
Smoking	363.230	1	363.230	5.874	0.017
Total exercise	663.882	1	663.882	10.736	0.001
BMI	573.568	1	573.568	9.276	0.003
CAM	288.524	1	288.524	4.666	0.033
Error	7049.393	114	61.837		
Total	811,668.000	120			
Corrected total	9046.367	119			
Dependent variable: HDL (mg/dL) R^2 = 0.212 (adjusted R^2 = 0.178)					
Source	Type III sum of squares	df	Mean square	F	Sig.
Corrected model	7366.574[a]	5	1473.315	6.142	<0.001
Intercept	2166.736	1	2166.736	9.032	0.003
Age	146.157	1	146.157	.609	0.437
Smoking	105.459	1	105.459	.440	0.509
Total exercise	2163.557	1	2163.557	9.019	0.003
BMI	420.717	1	420.717	1.754	0.188
CAM	4279.577	1	4279.577	17.840	<0.001
Error	27347.091	114	239.887		
Total	363615.315	120			
Corrected Total	34713.665	119			
Dependent variable: Total PSS score R^2 = 0.198 (Adjusted R^2 = 0.163)					
Source	Type III sum of squares	df	Mean square	F	Sig.
Corrected model	221.252[a]	5	44.250	5.626	<0.001
Intercept	278.162	1	278.162	35.365	<0.001
Age	17.835	1	17.835	2.267	0.135
Smoking	1.394	1	1.394	.177	0.675
Total exercise	67.677	1	67.677	8.604	0.004
BMI	8.933	1	8.933	1.136	0.289
CAM	111.384	1	111.384	14.161	<0.001
Error	896.673	114	7.866		
Total	38,819.000	120			
Corrected total	1117.925	119			

ANOVA = analysis of variance; BMI = body mass index; CAM = complementary and alternative medicine; df = degrees of freedom; HDL = high-density lipoprotein; PSS = Perceived Stress Scale.

According to the data, CAM use was associated with elevated HDL levels and minimal changes in blood pressure; however, the association between CAM use and overall CVD risk reduction appears limited. Psychosocial stress is a challenge for CAM users, thus highlighting the need for integrated stress management interventions and medical treatment.

4. Discussion

This study provides a distinctive understanding of the patterns of CAM use and their associations with cardiovascular health indicators among middle-aged women in Jazan region, Saudi Arabia. CAM use was associated with elevated HDL levels, although no substantial relationship was observed with overall cardiovascular risk. These findings highlight the need to consider CAM in the context of conventional medical practices when exploring integrative approaches to cardiovascular health.

One of the most interesting findings of this study was the statistically significant elevated HDL levels among CAM users ($p < 0.001$). HDL is recognized for its role in facilitating the removal of cholesterol from the bloodstream and reducing the risk of atherosclerosis. Koo and Noh reported that herbal remedies such as green tea are abundant in polyphenols and flavonoids and can lower LDL and increase HDL levels [23]. The observed associations between CAM use and lipid profiles are particularly notable. Green tea, which was one of the most widely used CAM modalities among the study participants, contains catechins and epigallocatechin gallate, which have been associated with favorable changes in lipid metabolism and reductions in oxidative stress. [14]. Similarly, Alizadeh-Navaei et al. observed an association between ginger use, a popular CAM choice, and more favorable lipid profiles, including lower LDL and triglyceride levels and higher HDL levels [24]. These results align with the observed association between CAM use and higher HDL levels in this study.

The association between CAM use and higher stress levels, as quantified by the PSS, was another striking finding. The stress levels of CAM users were higher than those of non-CAM users ($p < 0.001$). This finding may imply that individuals with increased stress may seek alternative therapies and contemplate them as integrated solutions that enable physical and emotional well-being. Langhorst et al. also observed similar trends and reported that perceived stress was significantly correlated with increased CAM use among patients with chronic diseases [25]. However, it is equally plausible that the stress-relieving benefits of CAM are insufficient. The integration of mindfulness-based stress reduction techniques and cognitive–behavioral therapy with CAM protocols may result in more robust integration of psychological interventions. Gosain et al. found that mindfulness-based stress reduction was associated with reductions in perceived stress among patients with breast cancer, thus implying its potential applicability in the management of CVD-related stress [26].

Higher SBP ($p = 0.047$) and DBP ($p = 0.034$) were observed among CAM users; this unanticipated association may reflect underlying health issues in CAM users, variability in CAM practices, or potential interactions with conventional medications. For instance, cupping therapy, which was a common CAM modality in this study, has been linked with temporary physiological stress responses that could lead to increased blood pressure. Additionally, certain herbal products, such as garlic and ginger, may interact with medications including anticoagulants and antihypertensive drugs, potentially affecting their efficacy or adherence [27]. Dependency on CAM without sufficient compliance with conventional medications, such as nonadherence to prescribed antihypertensive therapy, may also contribute to blood pressure control issues. These findings underscore the importance of monitoring medication adherence and potential drug-herb interactions, as well as standardizing CAM practices to reduce adverse effects and better understand their associations with cardiovascular outcomes [9, 15].

The absence of a notable association between CAM use and the 10-year CVD risk score suggests that CAM alone may have a limited relationship with overall CVD risk. This finding was also reported by Yeh et al., who suggested that CAM modalities, such as yoga and acupuncture, may offer cardiovascular benefits only when integrated with conventional treatments [28]. For example, integrating dietary supplements such as Omega-3 with statins or antihypertensive medications could enhance lipid-lowering effects while maintaining blood pressure control. This was also supported by Rabito and Kaye, who reported that CAM modalities such as acupuncture were associated with favorable changes in endothelial function and reductions in arterial stiffness, thus contributing to better cardiovascular outcomes [29].

This study also revealed significant underutilization of certain CAM modalities such as yoga and acupuncture. Despite their well-established cardiovascular benefits, including improved blood pressure, heart rate variability, and stress reduction, these therapies were minimally adopted by the study population. Yeh et al. reported similar findings, indicating low utilization rates because of cultural barriers, limited awareness, and accessibility hindrances [28]. Public health initiatives that promote culturally adapted CAM practices could address these limitations. Additionally, improving the evidence base through rigorous clinical trials may minimize skepticism about the efficacy of CAM, which was also reflected by the decreased endorsement of integrative approaches by the participants in this study.

These findings also underscore the unique cardiovascular risk profiles of middle-aged women, particularly those experiencing menopause. Hormonal changes during menopause exacerbated by reduced estrogen levels critically increase the risks of dyslipidemia, hypertension, and atherosclerosis. Agrinier et al. emphasized that the cardioprotective effects of estrogen are diminished after menopause, thus highlighting the need for targeted interventions [30]. For example, green tea and ginger, which were popular CAM choices in this study, may reduce lipid abnormalities in relation to menopause. However, these benefits should be investigated within a vast integrative framework of pharmacological and lifestyle modifications.

4.1 Study limitations and future recommendations

The cross-sectional design of this study limits the ability to draw causal inferences between CAM use and cardiovascular risk factors, as only associations at a single point in time can be observed. Consequently, it is not possible to determine whether CAM use influenced cardiovascular health or whether women with certain cardiovascular profiles were more likely to use CAM. The relatively small sample size and the recruitment of participants from a single region may limit the generalizability of the findings to other populations of middle-aged women in Saudi Arabia or globally. Additionally, the reliance on self-reported CAM use introduces the potential for recall bias, where participants may not accurately remember their CAM practices, and social desirability bias, where participants may overreport or underreport use to align with perceived expectations. The use of hospital records as a data source may also introduce limitations, including incomplete or missing data and potential selection bias, as the sample may not fully represent the broader population. Other unmeasured confounding factors, such as dietary patterns, physical activity, or adherence to conventional medications, may also influence observed associations. Future research using longitudinal cohort studies and randomized controlled trials is needed to more rigorously evaluate the temporal relationships and potential effects of CAM on cardiovascular risk, while more comprehensively controlling for confounding factors. Additionally, further studies should investigate specific complementary and alternative medicine (CAM) modalities individually, using larger sample sizes and more rigorous designs to more clearly determine their effectiveness in reducing cardiovascular risk.

5. Conclusions

Although CAM approaches were associated with higher HDL levels, their overall relationship with cardiovascular risk management appears limited. The observed association between CAM use and elevated blood pressure and stress levels underscore the importance of considering how CAM interacts with conventional practices to support both physical and psychosocial well-being. These results also suggest that adherence to conventional medications should be carefully monitored when CAM modalities are used. Overall, the findings highlight that exploring integrative approaches may help healthcare practitioners better understand patterns of CAM use alongside conventional medicine in middle-aged women. Public health efforts could focus on improving awareness and accessibility of underutilized CAM modalities, such as yoga and acupuncture, to support informed use. Further research using longitudinal designs is needed to better assess the relationships between CAM use and cardiovascular risk factors. Additionally, randomized controlled trials comparing integrative approaches with conventional care may help clarify the potential role of CAM modalities in cardiovascular risk management.

5.1 List of abbreviations

BMI, body mass index; CAM, complementary and alternative medicine; CVD, cardiovascular disease; DBP, diastolic blood pressure; HDL, high-density lipoprotein; LDL, low-density lipoprotein; PSS, Perceived Stress Scale; SBP, systolic blood pressure

5.2 Declarations

- **Ethics approval and consent to participate**: The study was approved by the Research Ethical Committee of Jazan Health Cluster Facilities (Approval number: No. 2486, dated November 24, 2024).
- **Consent for publication**: Not applicable
- **Availability of data and materials**: The data that support the findings of this study are available from the corresponding author upon reasonable request.
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