



Association between Life's Simple 7 and Menopause in a Community-based Population

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Background: In 2010, the American Heart Association defined a new concept of ideal cardiovascular health (CVH) called Life's Simple 7, which comprises seven parts, including smoking status (nonsmoking), body mass index (BMI) ($<25 \text{ kg/m}^2$), healthy diet, physical activity, total cholesterol ($<200 \text{ mg/dL}$), blood pressure ($<120/<80 \text{ mmHg}$), and fasting serum glucose ($<100 \text{ mg/dL}$). **Aim:** Menopause is related to an increased risk of cardiovascular disease. We aimed to determine associations between Life's Simple 7 and menopause in postmenopausal women. **Methods:** The cross-sectional data were obtained from the MJ Health Management Institution from 2000 to 2016. CVH metrics included smoking status, BMI, healthy diet, physical activity, total cholesterol, blood pressure, and fasting blood glucose. Multiple logistic regression analysis was used to examine the associations among CVH metrics, menopausal status, age at menopause, and duration of menopause. **Results:** When the nonmenopausal group was used as the reference, the odds ratio (OR) for having 5–7 ideal CVH metrics in the postmenopausal group was 0.72 (95% confidence interval [CI], 0.67–0.77). Decreased odds for having ideal blood pressure and total cholesterol were observed (OR, 0.92; 95% CI, 0.87–0.98 and OR, 0.62; 95% CI, 0.59–0.66, respectively). **Conclusion:** Our results suggest significantly fewer ideal CVH metrics among menopausal individuals, mainly due to nonideal blood pressure, total cholesterol, and fasting glucose values. These findings highlight the need for appropriate approaches to address the risk of multiple conditions in menopause associated with loss of the protective effects of estrogen.

Key words: Cardiovascular disease, cardiovascular health metrics, life's simple 7, menopause, risk factor

INTRODUCTION

Menopause is defined as permanent amenorrhea for 12 months due to the cessation of ovulation.¹ The mean age of menopause for ordinary women is 50 years old.² The symptoms include hot flashes, urinary incontinence, vaginal atrophy, reduced sexual function, and depression. Menopause causes metabolic and cardiovascular changes due to decreasing estrogen levels and increasing androgen levels. Increases in testosterone levels promote fat and visceral fat accumulation and then enhance the risk of atherosclerosis, the leading cause of death in women.³ A decrease in estrogen levels after menopause changes eating habits and causes

obesity in women.⁴ This decrease is related to an increased risk of metabolic syndrome, especially abdominal obesity and hypertension.⁵ Another study confirmed that the transition to menopause, in the few years before menopause, is a period during which coronary heart disease risk rapidly increases.⁶ However, little is known regarding whether menopause is associated with ideal cardiovascular health (CVH).

In 2010, the American Heart Association defined a new concept of ideal CVH called Life's Simple 7, which comprises seven parts, including smoking status (nonsmoking), body mass

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index (BMI) (<25 kg/m²), healthy diet, physical activity, total cholesterol (<200 mg/dL), blood pressure (<120/<80 mmHg), and fasting serum glucose (<100 mg/dL).⁷ Having fewer ideal CVH metrics is associated with all-cause and cardiovascular disease-related mortality risk.⁸ The prevalence of having 5–7 ideal CVH metrics was reported to be 40.4% in the Chinese female population⁹ and 14.8% in the French female population.¹⁰

Professor Simon proposed that ideal health management for menopausal women, which includes stopping smoking, maintaining a healthy blood pressure, establishing a healthy diet, and participating in physical activity and is the same concept as CVH, is the key to preventing cardiovascular diseases.¹¹ However, no studies have investigated the association between CVH metrics and menopause. If we consider the individual components of CVH, we find a negative relationship between menopause and hypertension,¹² total cholesterol,¹³ and fasting serum glucose.¹⁴ Previous studies have rarely investigated the relationship between menopause and the other four components of ideal health behaviors, including smoking, BMI, healthy diet, and physical activity. To further investigate these areas, we aimed to conduct research on the association of ideal CVH with menopause. In addition, we hypothesized that menopausal status decreased the number of ideal CVH components in the Asian population.

MATERIALS AND METHODS

Study population and study design

The data for this study came from the MJ Health Management Institution and were obtained from 2000 to 2016. The MJ Health Management Institution, a private institute with four branches (Taipei, Taoyuan, Taichung, and Kaohsiung) in Taiwan, provides cyclical health examinations. All branches used the same scanning protocols and analysis machines. The sample size was 75,372 participants. This study used a cross-sectional design and included participants between the ages of 30 and 70 years. To assess the primary preventive influence of CVH metrics, only individuals without cardiovascular disease were included in this study. All the participants completed physical examinations (height, weight, and blood pressure), blood tests (glucose and total cholesterol), and self-administered questionnaires (lifestyle, medical history, and medications). All the participants provided informed consent for the use of anonymized private data for the study purposes. The study was conducted in accordance with the Declaration of Helsinki and approved by the Institutional Review Board (or Ethics Committee) of Tri-Service General Hospital, and the approval number was B202205092.

Cardiovascular health metrics

CVH metrics included smoking status, BMI, healthy diet, physical activity, total cholesterol, blood pressure, and fasting blood glucose based on a definition modified from the AHA Guidelines.⁷ We classified the CVH metrics as ideal, intermediate, and poor. Each CVH metric that was classified as ideal received one point. Higher CVH scores indicate a healthier status.

Menopause definition

The STRAW criteria were adopted for the definition of menopause. Menopause is defined as permanent amenorrhea for 12 months, which complies with STRAW stage +1a, because there is no other clear pathological or physiological marker.¹ We asked participants whether they were menopausal (amenorrhea for more than a year) and classified them into nonmenopausal and postmenopausal groups. In the postmenopausal group, participants were subdivided into four groups according to the number of years since they experienced menopause: 5 years or fewer, 6–10 years, 11–15 years, and 16 years or more. In addition, we subdivided the participants into three groups according to the age at onset of menopause: 41–45 years, 46–50 years, and 51–60 years.

Statistical analysis

The features of participants are summarized as the mean (standard deviation) for continuous variables and frequency (%) for categorical variables. We used a *t*-test for continuous variables and the Chi-square test for categorical variables to compare the features of the study population according to CVH status. Multiple logistic regression analysis was used to examine the associations among CVH metrics, menopausal status, duration of menopause, and age at menopause.

Further adjustment models were corrected for age, education, and family income. Education was separated into two groups: Below or equivalent to high school and beyond high school. Family income was calculated as individual annual income and used New Taiwan dollars (NTDs) as currency. A cutoff point of 1.2 million NTDs was used to divide the participants into two groups.

All statistical tests were two-tailed with $P < 0.05$. All statistical analyses were performed using the Statistical Package for the Social Sciences version 18.0 (SPSS, Inc., Chicago, IL, USA).

RESULTS

The characteristics of the participants in this study are displayed in Table 1. The mean age of the participants was

Table 1: Characteristics of the study participants ($n=75,372$)

Variables	Overall	Nonmenopausal group ($n=55,861$; 74.1%)	Postmenopausal group ($n=19,511$; 25.9%)	<i>P</i>
Continuous variables*				
Age (years)	44.37±10.29	39.50±6.23	58.31±5.96	<0.001
BMI (kg/m^2)	22.41±3.49	21.94±3.37	23.75±3.50	<0.001
SBP (mmHg)	111.98±17.47	108.10±14.63	123.37±19.96	<0.001
DBP (mmHg)	68.41±10.72	66.82±10.10	73.06±11.12	<0.001
Total cholesterol (mg/dL)	195.21±34.81	189.03±32.17	212.91±35.99	<0.001
Fasting sugar (mg/dL)	98.91±18.49	96.15±14.24	106.81±25.62	<0.001
Categorical variables†				
Hypertension				
Intermediate and poor	25,994 (34.5)	14,599 (26.1)	11,395 (58.4)	<0.001
Ideal	49,378 (65.5)	41,262 (73.9)	8116 (41.6)	
Total cholesterol				
Intermediate and poor	31,308 (41.5)	18,951 (33.9)	12,357 (63.3)	<0.001
Ideal	44,064 (58.5)	36,910 (66.1)	7154 (36.7)	
Fasting glucose				
Intermediate and poor	25,357 (33.6)	14,391 (25.8)	10,966 (56.2)	<0.001
Ideal	50,015 (66.4)	41,470 (74.2)	8545 (43.8)	
BMI				
Intermediate and poor	14,666 (19.5)	8576 (15.4)	6090 (31.2)	<0.001
Ideal	60,706 (80.5)	47,285 (84.6)	13,421 (68.8)	
Exercise				
Intermediate and poor	69,040 (91.6)	53,071 (95.0)	15,969 (81.8)	<0.001
Ideal	6332 (8.4)	2790 (5.0)	3542 (18.2)	
Diet				
Intermediate and poor	73,382 (97.4)	54,724 (98.0)	18,658 (95.6)	<0.001
Ideal	1990 (2.6)	1137 (2.0)	853 (4.4)	
Smoking				
Intermediate and poor	5243 (7.0)	4556 (8.2)	687 (3.5)	<0.001
Ideal	70,129 (93.0)	51,305 (91.8)	18,824 (96.5)	
Education				
Below or equivalent to high school	27,508 (37.4)	13,959 (25.0)	13,549 (69.4)	<0.001
Beyond high school	45,963 (62.6)	40,601 (75.0)	5362 (30.6)	
Individual annual income (TWD, thousand)				
≤1,200,000	48,327 (73.4)	34,469 (74.0)	13,858 (71.0)	<0.001
>1,200,000	17,526 (26.6)	14,547 (26.0)	2979 (39.0)	
Ideal CVH metrics (LS7 metrics)				
Poor (0–2)	12,003 (15.9)	5729 (10.3)	6274 (32.2)	<0.001
Intermediate (3–4)	40,327 (53.5)	29,510 (52.8)	10,817 (55.4)	
Ideal (5–7)	23,042 (30.6)	20,622 (36.9)	2420 (12.4)	

*Values are expressed as the mean±SD; †Values of the categorical variables are expressed as n (%). BMI=Body mass index; SBP=Systolic blood pressure; DBP=Diastolic blood pressure; CVH=Cardiovascular health; TWD=Taiwan dollar; LS7=Life's simple 7; SD=Standard deviation

44.37 ± 10.29 years. Overall, 25.9% of the participants were defined as menopausal. In the postmenopausal group, the mean menopausal duration and age at onset were 8.23 ± 6.05 years and 50.07 ± 3.84 years, respectively. Most participants had

been in menopause for <5 years (40.2%) and were 51–60 years of age at onset (46.0%). Among all women in both the nonmenopausal group and the postmenopausal group, the ideal smoking metric was the most prevalent (93.0%), and the ideal physical activity metric (8.4%) and the ideal healthy diet score metric (2.6%) were the least prevalent. A total of 30.6% of participants had more than 5 CVH metrics with ideal status, while 15.9% of participants had fewer than 2 CVH metrics with poor status. The prevalence of having more than five ideal CVH metrics was higher in the nonmenopausal group than in the postmenopausal group (36.9% and 12.4%, respectively). Figure 1 shows the prevalence of each component of the ideal CVH metric in the analyzed population. The values of clinical parameters, including blood pressure, total cholesterol, fasting blood sugar, and BMI, were lower among individuals in the nonmenopausal group than among those in the postmenopausal group.

The odds ratios (ORs) for ideal CVH between the postmenopausal and nonmenopausal groups in the adjusted model are shown in Table 2. When the nonmenopausal group was used as the reference, the OR of having 5–7 ideal CVH metrics in the postmenopausal group was 0.72 (95% confidence interval [CI], 0.67–0.77). After adjustment for age, education, and family income, this relationship remained significant. For the relationship of menopausal status with the individual ideal CVH

metrics, the postmenopausal group had decreased odds of having ideal blood pressure and ideal total cholesterol statuses (OR, 0.92; 95% CI, 0.87–0.98 and OR, 0.62; 95% CI, 0.59–0.66, respectively) but increased odds of having ideal physical activity status (OR, 1.26; 95% CI, 1.14–1.40) after adjustment for age, education, and family income. If we compare the duration of menopause with the individual ideal CVH metrics, the subgroup with a menopause duration <5 years was less likely to have ideal fasting glucose (OR, 0.93; 95% CI, 0.87–0.99). However, for ideal smoking status, ideal BMI, and ideal healthy diet, the differences were not statistically significant.

The OR for ideal CVH metrics among the different subgroups of age at menopause onset in the adjusted model is shown in Table 3. When menopause at the age of 41–45 years was used as the reference group, the ORs of having 5–7 ideal CVH metrics for the menopause at age 46–50 and menopause at age 51–70 groups were not significant after adjustment for age, education, and family income. To investigate the relationship with the individual ideal CVH metrics, lower odds of having ideal total cholesterol were found among women aged 51–70 years than among women aged 41–45 years (OR, 0.89; 95% CI, 0.80–0.98), while increased odds of having ideal fasting glucose (OR, 1.12; 95% CI, 1.12–1.30 and OR, 1.11; 95% CI, 1.00–1.22, respectively) and ideal BMI (OR, 1.20; 95% CI, 1.08–1.33 and OR, 1.15; 95% CI, 1.03–1.27, respectively) were observed for menopause in the 46–50 and 51–70 groups after adjustment for age, education, and family income.

DISCUSSION

Principal findings

Our findings indicate that menopause is associated with fewer ideal CVH metrics than nonmenopause. Ideal blood pressure and ideal total cholesterol are more frequently observed among nonmenopausal women, while ideal physical activity is more frequently observed among menopausal women. In addition, compared to early age at menopause, later age at menopause had increased odds of having ideal fasting glucose and ideal BMI.

Results in the context of what is known

In our study, the overall prevalence of having 5–7 ideal CVH metrics was 30.6%. Zeng *et al.* reported the prevalence of having ideal CVH metrics in the Chinese female population, and they showed that 40.4% had 5–7 ideal CVH metrics.⁹ This result was higher than that of research on women in France (14.8%).¹⁰ We found that different ages at onset and CVH metric definitions might contribute to this difference.

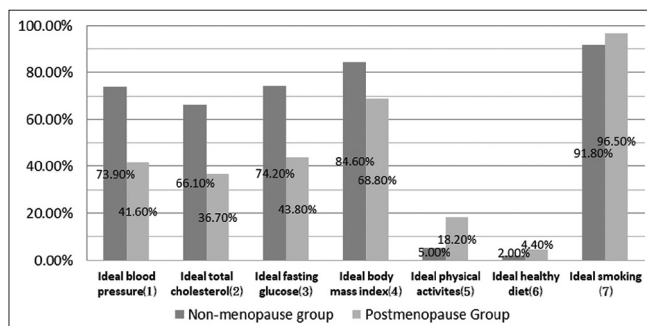


Figure 1: Prevalence of each component of the ideal cardiovascular health metric in the study population (postmenopausal group vs. nonmenopausal group). (1) Ideal, intermediate, poor BP were defined as SBP <120 mmHg and DBP <80 mmHg, SBP 120–139 mmHg or DBP 80–89 mmHg or treated to goal, and SBP ≥140 mmHg or DBP ≥90 mmHg, respectively. (2) Ideal intermediate, poor total cholesterol were defined as <200 mg/dL, 200–239 mg/dL or treated to goal, and 240 mg/dL, respectively. (3) Ideal intermediate, poor fasting glucose were defined as <100 mg/dL, 100–125 mg/dL, and ≥126 mg/dL, respectively. (4) Ideal intermediate, poor body mass index (BMI) were defined as <25 kg/m², 25–29.9 kg/m², and ≥30 kg/m², respectively. (5) Ideal intermediate, and poor physical activity were defined as <210 min/week, 60–210 min/week, and <60 min/week, respectively. (6) Ideal intermediate, and poor healthy diet scores were defined as 4–5 components, 2–3 components, and 0–1 components, respectively. (7) Ideal intermediate, poor smoking status were defined as never smokers, past smokers, and current smokers, respectively. BP: Blood pressure, SBP: Systolic blood pressure, DBP: diastolic blood pressure, BMI: Body mass index

Table 2: The odds ratios for Ideal cardiovascular health metrics between the postmenopausal and nonmenopausal groups in the adjusted model. ($n=75,372$)

			OR (95% CI)			
			Nonmenopausal group ($n=55,861$)	Postmenopausal group ($n=19,511$)	Years since menopause	
					≤ 5 years ($n=7846$)	≥ 16 years ($n=2704$)
Blood pressure						
Model 1	1 (reference)	0.88 (0.83–0.93)	0.89 (0.84–0.95)	0.89 (0.82–0.96)	0.77 (0.70–0.84)	0.79 (0.71–0.88)
Model 2	1 (reference)	0.92 (0.87–0.98)	0.93 (0.87–0.99)	0.93 (0.85–1.01)	0.81 (0.73–0.90)	0.82 (0.73–0.93)
Total cholesterol						
Model 1	1 (reference)	0.64 (0.60–0.67)	0.58 (0.54–0.61)	0.71 (0.66–0.77)	0.95 (0.87–1.04)	1.23 (1.11–1.37)
Model 2	1 (reference)	0.62 (0.59–0.66)	0.57 (0.53–0.61)	0.69 (0.63–0.75)	0.91 (0.83–1.01)	1.16 (1.03–1.30)
Fasting glucose						
Model 1	1 (reference)	0.93 (0.88–0.98)	0.92 (0.86–0.97)	0.95 (0.88–1.03)	1.01 (0.93–1.11)	1.11 (1.00–1.24)
Model 2	1 (reference)	0.94 (0.88–1.00)	0.93 (0.87–0.99)	0.96 (0.88–1.04)	0.99 (0.90–1.10)	1.08 (0.96–1.22)
BMI						
Model 1	1 (reference)	0.94 (0.88–1.00)	0.93 (0.87–1.00)	0.96 (0.88–1.05)	0.94 (0.85–1.04)	0.94 (0.84–1.06)
Model 2	1 (reference)	1.01 (0.94–1.09)	1.01 (0.93–1.08)	1.03 (0.93–1.13)	1.02 (0.91–1.14)	1.01 (0.89–1.15)
Physical activities						
Model 1	1 (reference)	1.26 (1.15–1.38)	1.24 (1.12–1.36)	1.28 (1.14–1.44)	1.22 (1.06–1.39)	1.15 (0.98–1.34)
Model 2	1 (reference)	1.26 (1.14–1.40)	1.24 (1.11–1.38)	1.29 (1.13–1.47)	1.26 (1.08–1.46)	1.20 (1.01–1.43)
Diet						
Model 1	1 (reference)	1.12 (0.96–1.32)	1.09 (0.92–1.29)	1.18 (0.96–1.46)	1.29 (1.02–1.63)	1.23 (0.94–1.62)
Model 2	1 (reference)	1.06 (0.89–1.27)	1.02 (0.84–1.23)	1.15 (0.92–1.45)	1.17 (0.90–1.53)	1.15 (0.85–1.56)
Smoking						
Model 1	1 (reference)	1.09 (0.97–1.23)	1.11 (0.97–1.28)	1.01 (0.85–1.21)	1.23 (0.97–1.56)	0.98 (0.75–1.28)
Model 2	1 (reference)	1.14 (1.00–1.30)	1.18 (1.02–1.37)	1.04 (0.86–1.26)	1.26 (0.97–1.63)	0.99 (0.73–1.34)
Ideal LS7*						
Model 1	1 (reference)	0.72 (0.67–0.77)	0.69 (0.64–0.74)	0.76 (0.69–0.84)	0.72 (0.63–0.82)	0.86 (0.74–1.00)
Model 2	1 (reference)	0.74 (0.69–0.79)	0.72 (0.66–0.78)	0.78 (0.70–0.87)	0.73 (0.64–0.85)	0.85 (0.72–1.02)

*Ideal LS7=5–7 ideal CVH metrics. Adjusted covariates: Model 1=Age; Model 2=Model 1 + (education and family income). Bold= $P<0.05$. CI=Confidence interval; OR=Odds ratio; BMI=Body mass index; LS7=Life's simple 7; CVH=Cardiovascular health

We included participants between 30 and 70 years (average age, 44.37) to assess the different individual CVH metrics compared with subjects between 20 and 85 years (average age, 44.2) included in Zeng's *et al.* study and those between 50 and 75 years (average age, 60.35) included in Simon *et al.*'s study. The ideal smoking metric was the most common metric (93.0%) in our population, which was similar to their findings.^{9,10} However, the two least common metrics, the ideal physical activity metric (8.4%) and ideal healthy diet score metric (2.6%), were much lower in our study than those in Zeng's *et al.*⁹ study (16.3% and 22.2%) and Simon *et al.*'s¹⁰ study (47.4% and 8.9%). Populations with older average ages and more rigorous CVH metrics might lead to underestimation of the prevalence of ideal CVH metric percentages, particularly ideal healthy diet and physical activity. There are some

discussions on the interpretation of the different distributions of CVH metrics. First, the prevalence of smoking was 17% for women worldwide in 2020. Europe has the highest prevalence of immigrant smokers, followed by Asia.¹⁵ Second, a prospective cohort study showed that one-third of the American adult population and less than one-fifth of the adult population in East Asian countries, such as China, Japan, and Taiwan, met the 2008 physical activity guidelines for Americans and the World Health Organization 2010 Global Recommendations on Physical Activity for Health.¹⁶ Third, the healthy diet metric was poorly met and may be due to few ideal components, including sodium, fruits, vegetables, fish, and whole grains.¹⁷

Our study involved a comprehensive assessment that revealed fewer ideal CVH metrics among menopausal individuals than

Table 3: The odds ratio for ideal cardiovascular health metrics among the different subgroups of age at menopause onset in the adjusted model ($n=19,511$)

	Age at menopause onset		
	41–45 ($n=2860$), OR (95% CI)	46–50 ($n=7681$), OR (95% CI)	51–70 ($n=8970$), OR (95% CI)
Blood pressure			
Model 1	1 (reference)	1.10 (1.01–1.20)	1.01 (0.92–1.10)
Model 2	1 (reference)	1.10 (0.99–1.21)	0.99 (0.90–1.09)
Total cholesterol			
Model 1	1 (reference)	0.93 (0.84–1.01)	0.84 (0.77–0.92)
Model 2	1 (reference)	0.94 (0.86–1.04)	0.89 (0.80–0.98)
Fasting glucose			
Model 1	1 (reference)	1.10 (1.01–1.21)	1.09 (0.99–1.19)
Model 2	1 (reference)	1.12 (1.12–1.30)	1.11 (1.00–1.22)
BMI			
Model 1	1 (reference)	1.19 (1.08–1.31)	1.13 (1.03–1.24)
Model 2	1 (reference)	1.20 (1.08–1.33)	1.15 (1.03–1.27)
Physical activities			
Model 1	1 (reference)	0.99 (0.88–1.11)	1.00 (0.89–1.12)
Model 2	1 (reference)	0.95 (0.83–1.08)	0.98 (0.86–1.11)
Diet			
Model 1	1 (reference)	1.01 (0.81–1.27)	1.05 (0.85–1.31)
Model 2	1 (reference)	0.95 (0.74–1.22)	1.04 (0.82–1.33)
Smoking			
Model 1	1 (reference)	1.16 (0.94–1.43)	1.48 (1.18–1.85)
Model 2	1 (reference)	1.12 (0.89–1.41)	1.42 (1.12–1.81)
Ideal LS7*			
Model 1	1 (reference)	1.12 (0.99–1.27)	1.03 (0.90–1.17)
Model 2	1 (reference)	1.15 (0.99–1.32)	1.03 (0.89–1.20)

*Ideal LS7=5–7 ideal CVH metrics. Adjusted covariates: Model 1=Age; Model 2=Model 1 + (education and family income). Bold= $P<0.05$. CI=Confidence interval; OR=Odds ratio; BMI=Body mass index; LS7=Life's simple 7; CVH=Cardiovascular health

among nonmenopausal individuals in Taiwan. Moreover, we assessed seven completely modified CVH metrics defined by the AHA and included an adequate sample size for the analysis. Although there are no studies that discuss the association between CVH metrics and menopause, previous studies confirmed that postmenopausal women have a higher risk of metabolic syndrome. Our result is compatible with those studies. In a cross-sectional study by Jouyandeh *et al.*, menopause was related to an increased risk of metabolic syndrome, especially abdominal obesity and hypertension.⁵ Interestingly, menopause was found to be associated with increased total body fat and abdominal fat, while visceral fat accumulation is thought to be the major cause of metabolic abnormalities.¹⁸

Strengths and limitations

We recognize several limitations of our study. First, although the study population was similar to the general population in Taiwan, our results may deviate from other countries due to different lifestyles. Second, menopause hormone use was unknown in our population. The use of estrogen alone has a favorable effect on glycemia, insulin, lipoprotein levels, and CVD risk for postmenopausal women,¹⁹ which may increase ideal CVH scores in the postmenopausal group. However, we can still see a significant difference in even possible hormone use. Third, we used STRAW criteria stage +1a to define menopause as permanent amenorrhea for 12 months. The exact menopause time may be a discrepancy with reality, yet the trend was the same learning from results about menopause above 6 years. Fourth, because of the cross-sectional design of this study, this analysis lacked the current relationship, and follow-up data could not be confirmed.

The strengths of our study include an ideal novelty, a representative and adequate sample size, and adjustments for important confounders. The potential clinical significance of our findings is that appropriate approaches to address the risk of multiple conditions in menopause associated with loss of the protective effects of estrogen.

CONCLUSION

Our results suggest significantly fewer ideal CVH metrics among menopausal individuals, mainly due to the lack of ideal blood pressure, total cholesterol, and fasting glucose. Menopausal duration and age at menopause may also have conclusive effects on CVH metrics. These findings highlight the need for appropriate approaches to address the risk of multiple conditions in menopause associated with loss of the protective effects of estrogen. More well-designed biological studies will help prove the mechanism of menopause and promote women's health.

Data availability statement

The datasets generated during and/or analyzed during the current study are available from the corresponding author on reasonable request.

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Nil.

Conflicts of interest

There are no conflicts of interest.

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