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# Mind–body therapy for cardiometabolic risk in U.S. middle-aged Black adults: a scoping review

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**Background:** In the U.S., Black adults do not achieve the same life expectancy as their White counterparts, and this is attributable in large part to the development of cardiovascular disease (CVD). Mind–body therapy (MBT) interventions demonstrate improvements in cardiometabolic risk (CMR) factors that promote CVD, with increased feasibility and acceptability in the general population. Less known is the feasibility, acceptability, and evidence of reduction in CMR factors in the U.S. Black population with MBT.

**Purpose:** This study aimed to synthesize the current state of research regarding MBT on CMR factors in middle-aged U.S. Black adults and identify gaps in the literature. Research Question 1: What types of studies have been conducted (study design, theoretical framework, and cultural relevance)? and Research Question 2: What is the feasibility and acceptability and effectiveness of MBT in Black adults for CMR reduction?

**Methods:** Following PRISMA-ScR guidelines, a review of three databases was conducted. Our inclusion criteria were articles that (1) describe empirical research; (2) assessed a MBT intervention in middle-aged (35–64) adults with a minimum of 60% Black adult participants for CMR reduction; and (3) written in English. Independent reviewers selected articles for inclusion and data extraction, with a third reviewer providing consensus.

**Results:** Fourteen articles met the eligibility criteria ( $n = 14$ ). Characteristics included randomized controlled trials (8, 57.1%); single-arm (3, 21.0%); mixed methods (3, 21.0%); sample size (17–375); mean age range 43–64; female (6, 42.8%); theoretical framework (4, 28.6%); culturally adapted (7, 50.0%); and studies demonstrating feasibility and/or acceptability (7, 50.0%). Of the seven articles assessing CMR physiologic factors, five studies observed significant improvement. For the 11 studies assessing CMR psychological factors, 6 studies had statistically significant results and 3 studies identified trends toward positive statistical outcomes.

**Implication:** A growing body of literature across research stages demonstrating acceptability, and feasibility, and evidence of effectiveness for selected outcomes of MBT in middle-aged Black adults with CMR factors shows promise. Future research recommendations include greater recruitment of Black men for MBT studies, larger sample sizes, and utilizing culturally adapted interventions for engaging Black adults in MBT for reduced CMR factors.

## KEYWORDS

scoping review, mind–body therapy, cardiometabolic risk factors, middle-aged black adults, psychosocial stress

## 1 Introduction

U.S. Black adults do not achieve the same life expectancy as their white counterparts by an average of 4.1 years, primarily due to the higher incidence of cardiovascular disease (CVD) (1). While the rate of CVD, coronary artery disease, stroke, and peripheral vascular disease is decreasing in the overall population, the rate of decrease is not commensurate among Black adults. As of 2019, Black adults have a significantly higher risk of mortality (30%) compared to their White counterparts (2). Despite identification of this disparity and subsequent development of risk factor treatment protocols, CVD deaths in the Black population remained 30% higher than non-Hispanic Whites as of 2019 at last calculation according to the National Vital Statistics Reports (1). Earlier age of CVD diagnosis (50 years  $\pm$  15 years) in Black adults has been self-reported compared to their White counterparts (3). It is, therefore, imperative to identify effective interventions for CVD and CVD prevention in the Black middle-age population.

Cardiometabolic diseases comprise the primary contributors to CVD (4). To prevent CVD effectively, it is crucial to reduce cardiometabolic risk (CMR) factors. These factors include obesity (specifically central adiposity) (5), diabetes, and sedentary lifestyle which are associated with altered inflammatory profiles, dyslipidemia, and hypertension, known precursors to coronary artery disease and stroke (6). Psychological stress is another significant CMR (6, 7). Psychosocial stressors for Blacks, in addition to universal life stressors, also include environmental stressors such as stereotyping, exposure to racial violence, effects of day-to-day discrimination, and socioeconomic status (6, 8, 9). All CMR factors can be potentially amenable through intervention.

Research on mind–body therapies (MBTs) has demonstrated the feasibility and acceptability in the general population, showing improvements in the modifiable CMR factors: body weight, blood pressure, smoking reduction, and a decrease of psychosocial stress (7, 10). The American Heart Association has acknowledged one such mind–body therapy, meditation, as a “reasonable adjunct” to established CMR reduction protocols (11). However, the body of literature regarding MBT specifically for Black midlife adults is in various stages of progress, providing limited knowledge about feasibility, acceptability, and effectiveness of this intervention. Addressing the potential of cultural impact on uptake and effects of such programs is also of concern. The purpose of this review is to review the scope (types of studies, trends in outcomes achieved, and cultural frameworks) of published research addressing feasibility and effectiveness of mind–body therapies on CMR factors in middle-aged Black adults.

Mind–body therapies (MBTs) encompass interventions that generally focus on present moment awareness, incorporate breathing techniques, and may include movement (12). MBTs fall under the category of intervention known as “complementary and alternative medicine” (13). Examples of MBT include mindfulness, meditation, and meditative movement practices such as yoga, tai chi, or qigong (13). Systematic reviews have shown the potential of these practices in improving blood glucose levels, reducing waist circumference (an index of adiposity in body composition) and body weight, and lowering blood pressure as well as alleviating psychosocial stress and or improving resiliency (10, 12, 14). The National Center for Complementary and Integrative Health’s statistics has indicated a 3-fold increase in MBT of meditation practices by American adults over the 5-year period between 2012 and 2017 alone (10).

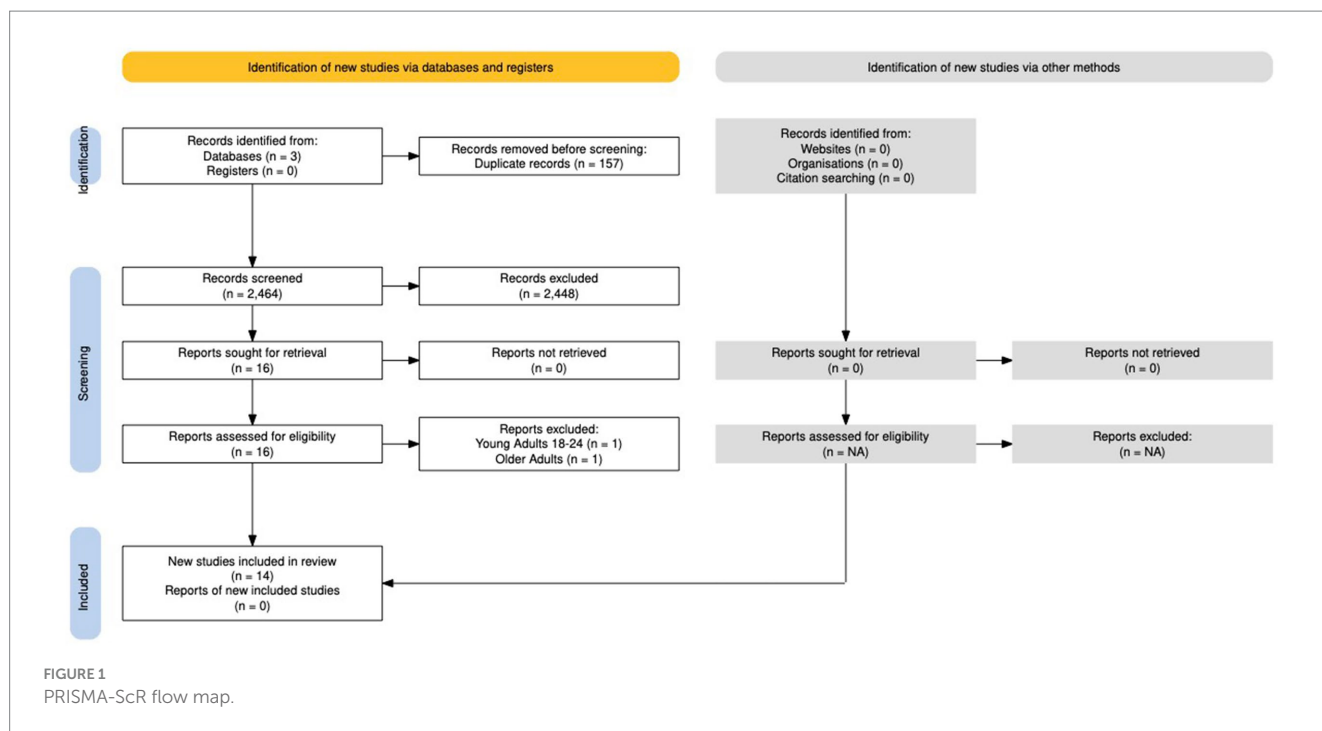
There are only two previous systematic reviews of mind–body therapies focused specifically on Black women, reporting on RCTs or pilot studies. One review focused only on hypertension (15), and the other focused on chronic disease, metabolic syndrome, and CMR factors (16). Given the limited attention and comprehensiveness of this research, we provide a scoping review to more broadly examine the types of studies, progress toward a more robust body of literature in this area, and the current body of evidence in these MBT interventions. The goal of this review is to synthesize the current body of literature for MBT feasibility/acceptability in Black participants and determine potential effectiveness for CMR factor reduction to identify gaps for future work. Given the diversity of study design, MBT interventions, and CMR outcomes related to the MBT intervention, authors conducted a scoping review as the most suitable approach for this study. Through this process, we describe the state of the current published research and examine the feasibility and acceptability of the MBT interventions (and whether those criteria are tied to cultural adaptations of interventions, if any), and the current evidence for these interventions in reducing CMR factors in Black adults. The primary purpose of this study is to identify gaps in the literature and propose future research directions for both researchers and practitioners. Research Question 1: What is the current state of research on MBT interventions for CMR reduction among Black Adults? Research Question 2: What is known about the feasibility/acceptability and effectiveness of this research (and if/how related to cultural fit)? and Research Question 3: What is known about the MBT in Black adults for CMR reduction?

## 2 Methods

### 2.1 Search methods

The Preferred Reporting Items for Systematic Reviews and Meta-Analyses for Scoping Reviews (PRISMA-ScR) guidelines were used to guide this review (17). The PRISMA-ScR flow diagram is included in Figure 1. Three English-language electronic databases (PubMed,

Abbreviations: CMR, cardiometabolic risk; CVD, cardiovascular disease; GRADE, Grade Assessment, Development, and Evaluation; MBSR, mindfulness-based stress reduction; MBT, mind–body therapy; DSM-5, Diagnostic and Statistical Manual of Mental Disorders.



CINAHL, and Scopus) were searched for articles published between 2012 and 2022, full text, and MeSH terms to identify mind–body therapy literature within the Black population. These databases were selected to capture the multidisciplinary nature of MBT studies.

The review time frame was chosen to identify changes in MBT use since 2012, extending the period examined by the American Heart Association for cardiovascular outcome disparities in Black adults. Prior to 2012, there was limited research on MBT within the Black community. This review looks to build on the prior literature, to also include Black men, and expand focus to include known psychosocial CMR factors.

Searches were conducted using the following search terms: African American, Black, Black American, cardiometabolic risk, cardiometabolic risk factors, heart disease, metabolic syndrome, meditative movement, breathing techniques, yoga, tai chi, qigong, meditation, breathing exercises, mindfulness-based stress reduction, mindfulness-based intervention, mind body therapies. Boolean terms AND OR were used in the search string. Reference lists of published systematic reviews were examined to identify additional sources not identified in the database searches. Studies targeting smoking were not sought because CVD, metabolic, and psychosocial CMR factors were the primary review interests.

### 2.1.1 Inclusion criteria

The inclusion criteria for this review were determined before the literature search was initiated. Articles were included in this review if they were (a) implementing a mind–body therapy intervention (e.g., meditation, yoga, breathing exercises, tai chi, and qigong), (b) described as experimental, quasi-experimental, or mixed methods with an experiment aspect, (c) published between 1 January 2012 and 31 July 2022, (d) participants must be middle-aged (45–64) adults who (e) self-identify as Black or had 60% or more Black participants, and (f) published in English and conducted in the U.S.

### 2.1.2 Exclusion criteria

Studies were excluded from this review if they were (a) systematic reviews, (b) observational studies, (c) qualitative only studies, (d) primary outcome was substance use, and (e) did not target any CMR factors or psychosocial stress (anxiety and depression) as outcomes.

## 2.2 Screening process

Articles found during our search process were initially screened by title and subsequently screened by abstract for eligibility by the first and second authors using Rayyan, “an intelligent research collaborative platform” (18).<sup>1</sup> Articles that were potentially eligible were read in full and carefully examined by both authors independently to determine whether a given study met our predetermined eligibility criteria. Any discrepancies were reviewed together until consensus was reached. Any disagreements were resolved by additional authors for final decision.

## 2.3 Data extraction

A data extraction form was created to include study design, theoretical framework or conceptual model, cultural adaptation (if any), participant characteristics (i.e., age and gender), sample size, cardiometabolic outcome assessed, mode of mind–body therapy used, survey or instruments used, statistical analysis, and main results.

1 <https://www.rayyan.ai/>

## 2.4 Reliability and quality assessment

The Grade Assessment, Development, and Evaluation (GRADE) criteria were used to assess each outcome across studies (19). For each study included in this review, two authors (DAM and JH) separately assessed for the included studies employing the GRADE assessment to determine evidence quality. The quality of evidence is ranked high, moderate, low, and very low based on initial assessment of study design (randomized control trial = high and non-randomized begin as a low rating due bias potential). Studies can be down- or upgraded based on the analysis of bias risk, inconsistency (heterogeneity), indirectness of evidence, impression in results, and high risk of bias in publication (19).

## 3 Search results

### 3.1 Selection of articles to include

This scoping review search results identified 2,621 records from CINAHL, PubMed, and Scopus. Duplicate studies ( $n = 157$ ) were removed. DAM and JH conducted initial title and abstract screening of 2,464 studies. Common reasons for rejection included (1) population age not within eligibility range (2), outcomes assessed, and (3) not including mind–body therapy in intervention. There were 16 studies reviewed in full for final selection. Two articles were removed for the following reasons: (1) the study participants were young adults 18–24 and (2) the study participants were older adults 74+ years. After full text review, 14 articles met inclusion criteria and were included in the review (see PRISMA-ScR Figure 1). Data extracted from selected articles included in review are shown in Table 1.

### 3.2 Study characteristics

Study characteristics of the eligible studies are presented in Table 2. The included studies were published between 2012 and 2022. All studies took place in the United States. Five (35.7%) were conducted in a health center, four (28.6%) were conducted on a university campus, two (14.3%) were conducted at a local church, other study locations included a local public school, online delivery ( $N = 1$ , 7.14% each), and a final study left location unspecified. The studies utilized several different designs to assess the effects of MBT interventions. Three studies (21.4%) were mixed methods utilizing an experimental arm to the design, four studies were single-arm/quasi-experimental (28.6%), and seven studies (50%) were randomized controlled trials. Four studies (28.6%) indicated the use of a theoretical framework or model in their study design which included Laters Model (20), Social Constructivist theory and Pender's Health Promotion Model (21), Typology of Adaptation (22), social cognitive theory and theory of planned behavior (23) (Table 2).

### 3.3 Participant characteristics

Participant characteristics are shown in the extraction table (Table 2). All participants were middle-age ranging from 43 to 64 years and had existing CMR factors. Across the 14 studies, 11 (78.5%)

consisted of 100% Black participants, with 3 studies (21.4%) having 60% or more Black participants included. The sample size of participants in the 14 studies ranged from 17 to 375. All results of all participants were included in this review. Six studies (40%) included only women. In two studies, the participants currently had coronary heart disease (24) or the risk factor hypertension (25). In five studies, participants were identified as overweight/obese, one focused only on BMI (23), with two including women participants (26, 27), two including prediabetes (27, 28), three including stress/trauma (26, 28, 29), and one including low physical activity (22). In two studies, participants were Black women with depressive symptoms (30, 31). In one study, participants were Black women at risk for metabolic syndrome (21). In one study, participants were recruited from the longitudinal Jackson Heart Study (JHS) (32). The final two studies described participants as middle-aged and older Blacks (20) and inner-city adults (33).

### 3.4 Intervention and control group characteristics

Intervention and control group characteristics are summarized in Table 2. The length of mind–body therapy intervention duration varied across the 14 studies, ranging from 4 weeks (21, 33) to 24 weeks (32). A variety of delivery formats were trialed in the studies as shown in Table 2. The implementation of these interventions also varied, with involvement of different professionals. Three studies were guided by mental health professionals, specifically behavioral specialists (27), master's level counselors (26), and psychologists (23). One study was led by a trained qigong instructor (20), two by certified yoga instructors (22, 32), two by certified meditation instructors (24, 25), two by mindfulness instructors (28, 33), one by a health educator (29), one by the research principle investigator (31), and one by both the research principle investigator and health educator (30).

The types of MBT interventions spanned from breathing techniques to full mindfulness-based stress reduction programs (Table 2). Seven types of mind–body therapies were examined within the 14 studies. Of the seven mind–body therapies used in the interventions, meditation was the most frequently utilized, followed by yoga, breathing techniques, mind–body scanning, adapted MBSR, guided imagery, and qigong. Of the study control conditions, two studies provided a lifestyle behavior intervention (26, 28), three provided health education (24, 25, 32), one provided usual care (27), and the remaining eight studies provided either a waitlist intervention or no comparative intervention (20–23, 29–31, 33).

Seven studies incorporated models for theoretical frameworks or cultural tailoring to design the intervention. Of the studies guided by a framework, only one of them used the framework to directly adapt existing intervention protocols to address cultural concerns, Davidson et al.'s Typology of Adaptation (22). Others used theories/models such as Social Constructivist and Pender's Health Promotion Model (21), social cognitive theory, and theory of planned behavior (23) to guide and assess their interventions without directly referencing adaptations.

In terms of intervention modification, three studies (28, 30, 33) adjusted modified mindfulness-based stress reduction (MBSR) programs by reducing daily session duration, incorporating culturally relevant imagery, removing orientation and day-long retreats, and utilizing poetry from known Black women poets. In addition, two

TABLE 1 Extraction table MBT.

| Author, year                                | Purpose  | Model/<br>framework | Sample size,<br>mean age,<br>gender,<br>cardiometabolic<br>risk outcome<br>assessed (CMR)              | Study duration/<br>follow-up<br>period | Treatment type   |  | Instruments   | Main results   |
|---|--|---------------------|--|--|------------------|--|---|--|
|   |  |                     |  |  | Control<br>group | Experimental<br>group  |   |  |
| <b>Randomized control trials</b>            |  |                     |  |  |                  |  |   |  |
| Bernstein et al., 2014 <sup>a</sup><br>(27) | Determined adherence with program and if the program helps reduce weight and blood glucose | Not indicated       | Sample size, 27 (100% Black)<br>Mean age, 56<br>Gender, F<br>CMR, obesity, weight change, and diabetes | Intervention<br>6 weeks                | Usual care       | Lifestyle intervention<br>MBT: meditation and guided imagery | Biometrics<br>Waist circumference, weight, BMI,<br>Cardiovascular<br>BP, Framingham risk for 10-year risk of coronary disease, c-reactive protein<br>Diabetes<br>Fasting glucose, fasting plasma insulin, insulin resistance, A1c, HDL, LDL, total cholesterol, triglycerides<br>Psychosocial stress<br>PSS<br>Physical activity (PA)<br>Recent PA questionnaire<br>Quality of life<br>RAND SF-36<br>Dietary Habits<br>ASA24, PI created food preparation questionnaire | 92% class participation<br>Trends of improvements in healthy cooking and eating habits were observed<br>No statistically significant changes in weight, blood sugar, or other biometrics were observed |

(Continued)

TABLE 1 (Continued)

| Author, year                                      | Purpose  | Model/<br>framework | Sample size,<br>mean age,<br>gender,<br>cardiometabolic<br>risk outcome<br>assessed (CMR)                       | Study duration/<br>follow-up<br>period           | Treatment type   |   | Instruments  | Main results  |
|---|--|---------------------|---|--|------------------|---|--|---|
|   |  |                     |   |  | Control<br>group | Experimental<br>group   |  |   |
| Burnett-Zeigler et al.,<br>2019 <sup>b</sup> (29) | Examined distribution and variability of psychological outcomes in groups led by an experienced instructor compared to novice instructor | Not indicated       | Sample size, 74 (71% Black)<br>Mean age, 48.17<br>Gender, F<br>CMR, depressive symptoms, depression, and stress | Intervention<br>8 weeks<br>Follow-up<br>16 weeks | NA               | Novice instructor vs. experienced instructor led modified MBSR “M-Body”<br>MBT: meditation, toga, body scan | Psychosocial stress<br>PSS<br>IDS-SR<br>DSSS<br>Physical Activity<br>WHODAS 2.0<br>Well being<br>RPWB<br>Mindfulness<br>FFMQ | Experienced instructor group had a significant decrease in depressive symptoms from baseline to 16 weeks ( $p = 0.042$ , $d = 0.84$ )<br>Novice instructor group showed significant decrease in depressive symptoms from baseline to 8 weeks ( $p < 0.001$ , $d = 1.05$ ) and baseline to 16 weeks ( $p < 0.001$ , $d = 0.83$ )<br>Experienced instructor group had an increase in overall mindfulness from baseline to 8 weeks ( $p = 0.037$ , $d = -0.88$ ) and baseline to 16 weeks ( $p = 0.012$ , $d = -1.06$ )<br>Novice instructor group had significant increase in overall mindfulness from baseline to 8 weeks ( $p < 0.001$ , $d = -0.67$ ) and baseline to 16 weeks ( $p < 0.001$ , $d = 0.68$ )<br>Experienced instructor group had significant decrease in stress from baseline to 8 weeks ( $p = 0.014$ , $d = 1.06$ ) and baseline to 16 weeks ( $p = 0.015$ , $d = 1.02$ )<br>Novice instructor group had significant decrease in stress from baseline to 8 weeks ( $p < 0.001$ , $d = 0.79$ ) and baseline to 16 weeks ( $p < 0.001$ , $d = 0.95$ ) |

(Continued)

TABLE 1 (Continued)

| Author, year                          | Purpose  | Model/<br>framework    | Sample size,<br>mean age,<br>gender,<br>cardiometabolic<br>risk outcome<br>assessed (CMR)                                     | Study duration/<br>follow-up<br>period          | Treatment type                        |  | Instruments  | Main results  |
|---------------------------------------|--|------------------------|---|---|---------------------------------------|--|--|---|
|                                       |  |                        |   |   | Control<br>group                      | Experimental<br>group  |  |   |
| Cox et al. (26)                       | Evaluated a novel stress management group-based behavioral weight control program compared to traditional behavioral lifestyle program | Not indicated          | Sample size, 44 (100% Black)<br>Mean age, 44.5<br>Gender, F<br>CMR, stress  | Intervention<br>12 weeks                        | Lifestyle diabetes prevention program | Lifestyle intervention + stress<br>MBT: guided relaxation, breathing techniques        | Biometrics<br>weight, height, BMI<br>Psychosocial stress<br>PSS, salivary cortisol   | Retention rate of 86%<br>Weight significantly decreased for both groups ( $p < 0.001$ )<br>Weight loss significantly associated with the number of sessions attended ( $r = 0.31, p = 0.04$ ), total diaries reported ( $r = 0.39, p = 0.01$ )<br>From baseline to post-intervention women in both groups reported lower perceived stress ( $p = 0.01$ ) no difference between groups<br>A trend toward greater reduction in salivary cortisol was observed in the Lifestyle intervention + stress group ( $p = 0.20$ ) |
| Mama et al., 2018 <sup>a,b</sup> (22) | Evaluated the feasibility and acceptability of Harmony and Health  | Typology of adaptation | Sample size, 50 (100% Black)<br>Mean age, 49.7<br>Gender, M&F<br>CMR, depression, anxiety, stress, QoL, and physical activity | Intervention<br>8 weeks<br>Follow-up<br>6 weeks | Wait list                             | Culturally adapted “Health and Harmony”<br>MBT: yoga, meditation, breathing techniques | Biometrics<br>BMI<br>Psychosocial stress<br>PSS, CES-D, Beck Anxiety Inventory, Positive & Negative Affect Scale<br>Physical Activity<br>IPAQ<br>Wearable<br>ActiGraph GT3X<br>Quality of life<br>RAND SF-36 | Retention rate 80%; adherence rate 61.5%; satisfaction Rate 100% (assessed with 40% of participants)<br>Trends suggest that participants in the intervention group reported greater improvements in self-reported physical activity with maintained improvements over time and psychosocial outcomes  |

(Continued)

TABLE 1 (Continued)

| Author, year                                  | Purpose  | Model/<br>framework | Sample size,<br>mean age,<br>gender,<br>cardiometabolic<br>risk outcome<br>assessed (CMR)   | Study duration/<br>follow-up<br>period                                 | Treatment type      |  | Instruments   | Main results  |
|---|--|---------------------|---|--|---------------------|--|---|---|
|   |  |                     |   |  | Control<br>group    | Experimental<br>group  |   |   |
| Okhominia et al., 2018 <sup>a,b</sup><br>(32) | Compared retention and adherence rates between yoga, walking, and health education interventions | Not indicated       | Sample size, 375 (100% Black)<br>Mean age, 59.6<br>Gender, M&F<br>CMR, cardiovascular disease   | Intervention 24 weeks<br>Follow-up<br>24 weeks                         | Health<br>Education | 3 yoga frequency groups (high, moderate, low)<br>Guided walking group<br>MBT: yoga, meditation, breathing techniques | Biometrics<br>Waist circumference<br>Cardiovascular<br>BP<br>Diabetes<br>HDL, LDL, A1c  | Retention 75.4%, pooled yoga group had the most participants complete the study (70.4%)<br>Adherence (successful at 75%) was reached first by the pooled yoga program at week 12, followed by the education group at the 23. The moderate frequency yoga group achieved the highest adherence throughout the intervention, reaching 80.2% at week 24.   |
| Schneider et al., 2012<br>(24)                | Evaluated effects of transcendental meditation program in the secondary prevention of CVD        | Not indicated       | Sample size, 201 (100% Black)<br>Mean age, 59<br>Gender, M&F<br>CMR: cardiovascular mortality, BP, psychosocial stress factors, and lifestyle behaviors | Intervention<br>transcendental<br>meditation<br>Follow-up<br>5.4 years | Health<br>Education | Transcendental<br>meditation<br>MBT: meditation  | Biometrics<br>weight, height,<br>BMI<br>Cardiovascular<br>BP<br>Psychosocial stress<br>CES-D, CMHI, Anger<br>expression scale<br>Physical Activity<br>Modified leisure time<br>physical activity<br>questionnaire<br>Dietary Habits<br>Dietary food<br>consumption<br>questionnaire | A significant decrease in systolic BP was found in the transcendental meditation group compared to the control group 95% CI, -8.3 to -1.5 mm Hg; $p = 0.01$ .<br>A 5.4-year hazard risk was calculated and found transcendental meditation vs. control group had a significant reduction in myocardial infarction, stroke, and mortality risk (hazard ratio, 0.52; 95% confidence interval, 0.29–0.92; $p = 0.025$ ). |

(Continued)



TABLE 1 (Continued)

| Author, year                    | Purpose   | Model/<br>framework | Sample size,<br>mean age,<br>gender,<br>cardiometabolic<br>risk outcome<br>assessed (CMR)  | Study duration/<br>follow-up<br>period              | Treatment type   |   | Instruments   | Main results  |
|---------------------------------|---|---------------------|--|---|--|---|---|---|
|                                 |   |                     |  |   | Control<br>group                                       | Experimental<br>group   |   |   |
| Schneider et al., 2019<br>(25)  | Evaluated the effects of stress reduction with transcendental meditation on preventing LVH  | Not indicated       | Sample size, 85<br>(100% Black)<br>Mean age, 52.8<br>Gender, M&F<br>CMR, left ventricular mass index, systolic and diastolic blood pressure, anger, and perceived stress | Intervention<br>12- weeks<br>Follow- up<br>6 months | Health<br>Education                                    | Transcendental<br>meditation<br>MBT: meditation   | Cardiovascular<br>BP, M-mode<br>echocardiogram<br>Psychosocial stress<br>PSS, Anger expression<br>scale,<br>California self-<br>evaluation<br>scale 5-item subset,<br>Personal<br>scale   | At follow-up LMVI and pulse rate decreased significantly for the transcendental meditation group compared to the control group ( $p = 0.040$ , $p = 0.002$ respectively). It was noted that systolic BP and diastolic BP decreased significantly within groups, not between. Perceived stress increased significantly in both groups, change not significant between groups |
| Woods-Gibson et al., 2019* (28) | Examined the feasibility of conducting an randomized controlled trials of a novel mindfulness-based stress management program combined with diabetes risk-reduction education versus a conventional diabetes risk-reduction education program | Not indicated       | Sample size, 68<br>(100% Black)<br>Mean age, 52.66<br>Gender, M&F<br>CMR: stress, QoL, diabetes, BMI, and physical activity  | Intervention<br>8 weeks<br>Follow-up<br>6 months    | Conventional<br>diabetes risk-<br>reduction<br>program | Adapted mindfulness-<br>based stress reduction<br>MBT: body scan,<br>breathing techniques | Biometrics<br>waist circumference,<br>weight, height,<br>BMI, hip<br>circumference<br>Diabetes<br>HOMA-IR, A1c<br>Psychosocial stress<br>PSS<br>Physical activity<br>7-day Physical Activity<br>Recall<br>Quality of life<br>FACIT-Sp-Ex<br>Dietary habits<br>FHCRC_FFQ | Retention rate 90%, enrollment rate 79%, attendance rate 76.5%<br>In the intervention group trends were observed in reduced BMI, calories, perceived stress, and dietary habits, and spiritual wellbeing  |

(Continued)

TABLE 1 (Continued)

| Author, year  | Purpose   | Model/<br>framework | Sample size,<br>mean age,<br>gender,<br>cardiometabolic<br>risk outcome<br>assessed (CMR)  | Study duration/<br>follow-up<br>period | Treatment type   |   | Instruments   | Main results   |
|---|---|---------------------|--|--|------------------|---|---|--|
|   |   |                     |  |  | Control<br>group | Experimental<br>group   |   |  |
| QUASI/single-arm                                    |   |                     |  |  |                  |   |   |  |
| Smith et al., 2015 (33)                             | Tested whether MBSR is effective in reducing stress and anxiety and in improving mindfulness and health-related quality of life | Not indicated       | Sample size, 23<br>(87% Black)<br>Mean age, 54.9<br>Gender, M&F<br>CMR, depression and anxiety   | Intervention<br>4 weeks                | NA               | Mindfulness-based stress reduction (MBSR) short form<br>MBT: MBSR | Psychosocial stress<br>PSS, GAD-7<br>Quality of life<br>RAND SF-36<br>Mindfulness<br>PMS      | Self-reported anxiety reduced significantly ( $p = 0.005$ )<br>Health-related quality of life subscales with statistical significance:<br>Mental component summary (+9.1; $p = 0.001$ ), Social Functioning (+16.9; $p = 0.003$ ), Role Physical (+16.8; $p = 0.016$ ), and Mental Health (+15.6; $P < 0.001$ ), physical functioning (+6.6; $p = 0.039$ ), Vitality (+16.1; $P = 0.001$ ) |
| Waldron and Burnett-Zeigler, 2022 <sup>b</sup> (29) | Assessed the association between participation in a mindfulness-based intervention and post-traumatic stress symptoms           | Not indicated       | Sample size, 36<br>(88.99% Black)<br>Mean age, 52.23<br>Gender, F<br>CMR: post-traumatic stress, perceived stress, and depressive symptoms | Intervention<br>8 weeks                | NA               | Modified MBSR “M-Body”<br>MBT: meditation, yoga, body scan        | Psychosocial stress<br>PSS, IDS-SR,<br>DSM-5 (PCL-5),<br>DSM-5 (LEC-5)<br>Mindfulness<br>FFMQ | From baseline to end of intervention: trauma symptoms significantly decreased $t = 3.28$ , $p = < 0.01$ , depressive symptoms decreased from a mean of 26.94 (SD = 12.32) to 20.11 (SD = 10.53), $t = 3.48$ , $p < 0.01$ , perceived stress reduced from a mean of 19.89 (SD = 7.85) to 16.00 (SD = 7.86), mindfulness scores increased 10 points $p < 0.01$ .                             |

(Continued)

TABLE 1 (Continued)

| Author, year                         | Purpose   | Model/<br>framework | Sample size,<br>mean age,<br>gender,<br>cardiometabolic<br>risk outcome<br>assessed (CMR)                        | Study duration/<br>follow-up<br>period           | Treatment type   |  | Instruments   | Main results  |
|--------------------------------------|---|---------------------|--|--|------------------|--|---|---|
|                                      |   |                     |  |  | Control<br>group | Experimental<br>group  |   |   |
| Chang et al., 2021 <sup>a</sup> (20) | Evaluated the feasibility and potential benefits of an 8-week qigong exercise on physical ability and function, balance, frailty, depression and anxiety, and spiritual wellbeing | Not indicated       | Sample size, 17<br>(100% Black)<br>Mean age, 64<br>Gender, M&F<br>CMR, depression and anxiety                    | Intervention<br>8 weeks                          | NA               | Qigong   | Biometrics<br>DXA scan<br>Psychosocial stress<br>HADS<br>Physical Activity<br>6MWT, SPPB, Physical function domain of SF-36,<br>PROMIS-CAT, FIFE<br>Wellbeing<br>RPWB<br>Mindfulness<br>Qigong intervention questionnaire | Retention rate, 88.2%, attendance rate ranged from 25 to 93.8% for participants.<br>A trend toward improved anxiety (35% of participants) and depression scores (65% of participants) were observed                             |
| Mixed methods                        |   |                     |  |  |                  |  |   |   |
| Hong et al., 2022 <sup>b</sup> (31)  | Examined the association of mindfulness with depression stigma  | Not indicated       | Sample size, 31<br>(100% Black)<br>Mean age, 51.9<br>Gender, F<br>CMR, depressive symptoms and depression stigma | Intervention<br>8 weeks<br>Follow-up<br>16 weeks | NA               | Mindfulness-based stress reduction (MBSR) modified “M-Body”<br>MBT: mindfulness, meditation, body scan, yoga | Psychosocial stress<br>IDS-SR, DSSS, self reported past depression diagnosis<br>Mindfulness<br>FFMQ   | A significant increase in mindfulness was observed from baseline to 8 weeks ( $p = 0.04$ ) and baseline to 16 weeks ( $p = 0.01$ )<br>Depressive symptoms decreased significantly from baseline to 16 weeks ( $p = 0.04$ ) only |

(Continued)

TABLE 1 (Continued)

| Author, year                            | Purpose   | Model/<br>framework                                    | Sample size,<br>mean age,<br>gender,<br>cardiometabolic<br>risk outcome<br>assessed (CMR)  | Study duration/<br>follow-up<br>period | Treatment type   |   | Instruments  | Main results   |
|---|---|--|--|--|------------------|---|--|--|
|   |   |  |  |  | Control<br>group | Experimental<br>group   |  |  |
| Zhou et al., 2017 <sup>ab</sup> (23)    | Tested the feasibility of a multiple-component lifestyle intervention & cardiometabolic risk-reduction program on diet, activity, & stress, using community-engagement principles | Social cognitive theory and theory of planned behavior | Sample size, 34 (100% Black)<br>Mean age, 56.1<br>Gender, M&F<br>CMR: obesity/weight change, stress, diet, and physical activity | Intervention<br>12 weeks               | NA               | Behavioral lifestyle program<br>MBT: yoga, breathing techniques | Biometrics<br>weight, height,<br>BMI, % body fat<br>Cardiovascular<br>BP<br>Diabetes<br>A1c, LDL, HDL,<br>total cholesterol<br>Psychosocial stress<br>PSS<br>Wearable<br>Body media fit<br>armband | Post-intervention male participants reduced body fat % (33.8 +/- 2.6 to 28 +/- 2.6, $p = 0.043$ ), 41% of participants lost at least 5lbs, 14.7% had a body weight reduction of 5% or more<br>HbA1c was significantly reduced ( $p < 0.001$ ) as well as cholesterol levels (total $p = 0.034$ ; HDL $p < 0.001$ ; LDL not significant)<br>Participants perceived stress was positively associated with adiposity levels (weight $p = 0.006$ ; BMI $p = 0.013$ ) |
| Johnson et al., 2014 <sup>ab</sup> (21) | Tested the feasibility and acceptability of a culturally tailored, internet-based intervention  | Social constructivist, Pender's health promotion model | Sample size, 24 (100% Black)<br>Mean age, 43.4<br>Gender, F<br>CMR: metabolic syndrome   | Intervention<br>4 weeks                | NA               | Yoga dance posture "yogic"<br>MBT: yoga, breathing techniques   | Biometrics<br>waist circumference,<br>weight, height,<br>BMI<br>Cardiovascular<br>BP<br>Physical activity<br>IPAQ  | Retention 71% of participants<br>Acceptability of intervention observed in 100% of participants  |

<sup>a</sup>Feasibility, acceptability, retention, and adherence assessed. <sup>b</sup>Culturally tailored intervention. HDL, high-density lipoprotein; LDL, low-density lipoprotein; BP, blood pressure; PSS, Perceived Stress Scale; RAND SF-36, RAND short-form health survey; ASA24, Automated self-administered 24-h recall; IDS-SR, Inventory of depressive symptoms- self-reported; DSSS, Depression self-stigma scale; WHODAS 2.0, WHO disability adjustment scale 2.0; RPWB, Ryff's scale of psychological wellbeing; FFMQ, Five facet mindfulness questionnaire; CES-D, Center for epidemiological studies depression scale; IPAQ, International physical activity questionnaire; CMHI, Cook-Medley hostility inventory; GAD-7, Generalized anxiety disorder scale; PMS, Philadelphia mindfulness scale; PCL-5, PTSD checklist for DSM-5; LEC-5, Life events checklist for DSM-5; DXA scan, dual x-ray absorptiometry scan; HADS, Hospital anxiety & depression scale; 6MWT, 6-min walk test; SPPB, Short physical performance battery; PROMIS-CAT, NIH patient-reported outcomes measurement information system; FIFE, Frailty index for elders; HOMA-IR, Homeostasis model assessment of insulin resistance; FACIT-Sp-Ex, Functional assessment of chronic illness therapy, spiritual wellbeing expanded version; FHCRC FFQ, Fred Hutchinson cancer research center food frequency questionnaire.

TABLE 2 Study characteristics (*n* = 14).

|  | <i>N</i> | %     |
|--|----------|-------|
| Age  |          |       |
| Range  | 43.34–64 |       |
| Mean   | 53.2     |       |
| Race   |          |       |
| 100% AA  | 11       | 78.0% |
| Above 60% AA   | 3        | 21.4% |
| Gender   |          |       |
| Female   | 6        | 40.0% |
| Male and female                                      | 8        | 57.1% |
| Design   |          |       |
| RCT  | 8        | 57.1% |
| Mixed methods  | 3        | 21.4% |
| Single-arm/quasi                                     | 3        | 28.6% |
| Cultural tailoring                                   |          |       |
| Yes  | 7        | 50.0% |
| Study location                                       |          |       |
| Health Center  | 5        | 35.7% |
| Church   | 2        | 28.6% |
| University   | 4        | 28.6% |
| Local Public School                                  | 1        | 7.1%  |
| Online   | 1        | 7.1%  |
| Not indicated  | 1        | 7.1%  |
| Theoretical framework                                |          |       |
| used   | 4        | 28.6% |
| Outcomes assessed                                    |          |       |
| Obesity/weight change                                | 5        | 35.7% |
| Depression and depressive symptoms                   | 6        | 42.8% |
| Feasibility, acceptability, retention, and Adherence | 7        | 50.0% |
| Anxiety  | 4        | 28.6% |
| Stress   | 7        | 50.0% |
| Metabolic syndrome                                   | 1        | 7.1%  |
| Quality of life                                      | 2        | 28.6% |
| Left ventricular mass index                          | 1        | 7.1%  |
| Blood pressure                                       | 2        | 14.3% |
| Diabetes A1c   | 2        | 14.3% |
| Diet   | 5        | 35.7% |
| Physical activity                                    | 8        | 57.1% |
| Mind–body therapies                                  |          |       |
| Mind–body stress reduction (MBSR)                    | 5        | 35.7% |
| Meditation   | 10       | 71.4% |
| Yoga   | 7        | 50.0% |
| Body scan  | 6        | 42.8% |
| Qigong   | 1        | 7.1%  |
| Breathing techniques                                 | 7        | 50.0% |
| Guided therapy                                       | 2        | 14.3% |

studies utilized faith-based wording (scriptures), music, and imagery (22, 23), while one study employed Western African dance as a part of its intervention design (21). Strategies aimed at participant retention included financial incentives for transportation, flexible session attendance, and fellowship between staff and participants (32). None of the studies did a side-by-side comparison of culturally adapted interventions to generic non-tailored intervention.

### 3.5 Quality of included studies: GRADE assessment

Reviewers DAM and JH reviewed and assessed the risk of bias using predefined criteria based on the Grade Assessment, Development, and Evaluation (GRADE) tool. GRADE assessment describes five appropriate categories of questions for randomized and non-randomized studies addressing: risk of bias or limitations in the study design and/or implementation, unexplained heterogeneity or inconsistency of results, indirectness of evidence, imprecision of results, high probability of publication bias (19). Quality was assessed at the outcome level. Outcomes deemed critical were CMR factor physiologic outcomes, psychological CMR factors, and feasibility/acceptability of the interventions.

Of the 14 studies, two of the eight RCTs were rated high certainty of evidence. There were four RCTs rated as low certainty and the remaining, and two RCTs were rated as moderate level of certainty. Reasons for downgrading the RCTs were lack of explanation of randomization procedures, under-powering of the study, lack of significance findings, or not testing CMR critical clinical outcomes. Ratings of 5 of the 6 non-randomized controlled trials (quasi, single-arm, or mixed methods) studies all remained low certainty rankings due to lack of justification for upgrade. One mixed methods study was upgraded to moderate due to its large effects on the clinically important outcome of adherence. Details regarding quality judgments for the 14 studies are presented in Table 3. The quality assessment for the included studies ranged from high- to very low-quality of evidence.

## 4 Study results

### 4.1 Feasibility, acceptability, retention, and adherence

Fifty percent of studies ( $n = 7$ ) tested feasibility, acceptability, and/or adherence. Feasibility was assessed in four studies (21–23, 28), and acceptability, defined as participant satisfaction, was assessed in one study using an *a priori* benchmark of 50% of participants rating the study intervention positively (21). Johnson, Taylor (21) conducted a trial of dance-modified yoga in middle-aged Blacks with CMR factors or diagnosed with metabolic syndrome and had as their primary aims testing feasibility, recruitment success, and adherence of the yoga technique. Using an *a priori* benchmark of 50% of respondents recruited, enrolled, and completing the study, Johnson, Taylor (21) reported 71% of participants completed all study components confirming their primary aims. In the study exit interviews, 59% of participants affirmed that the yoga intervention was acceptable. In the study of a

mindfulness-based diabetes prevention intervention, Woods-Giscombe, Gaylord (28) had 79% of eligible participants complete 76.5% of intervention sessions and retained 90% of participants. There was a predetermined feasibility and adherence goal of 50% completion in a study of movement and faith-based mindfulness by Mama et al. (22). This goal was exceeded as 80% of participants completed an 8-week intervention targeting physical activity for CMR modification. Of the four studies that measured feasibility, three met their benchmarks (21, 22, 28).

Zhou et al. (23), combined multicomponent counseling (nutrition, mindfulness, and exercise) for their test of CMR factor reduction. This mixed methods study did not report retention or adherence statistics but did conduct focus groups during the study to enhance study acceptability to participants in real time.

Three studies considered attendance as a proxy for adherence and retention outcomes (20, 27, 32). Adherence was considered a key target by Bernstein et al. (27) in their multidimensional approach to diabetes which included mindfulness, meditation, and relaxation components; 100% of randomized participants in the intervention arm completed the study. Chang et al. (20) study of qigong in middle and older aged Blacks determined that qigong was acceptable as an intervention to their study participants based on self-reported response on the Qigong Intervention questionnaire. Okhomina et al. (32), in a longitudinal study of yoga versus guided walking and a health education control, also confirmed adherence and retention using yoga for CMR modification. This longitudinal study demonstrated that more than 70% of those in the yoga study arm completed a 6-month intervention and a 6-month follow-up.

Therefore, retention or adherence was confirmed in all four of those studies measuring those constructs. The one study that had a predetermined definition of acceptability met those specified standards (21).

TABLE 3 Quality of studies using GRADE assessment.

| Studies                          | Rating   |
|----------------------------------|----------|
| <b>RCT</b>                       |          |
| Bernstein et al. (27)            | Low      |
| Burnett-Ziegler et al. (30)      | Low      |
| Cox et al. (26)                  | Moderate |
| Mama et al. (22)                 | Low      |
| Okhomina et al. (32)             | Low      |
| Schneider et al. (24)            | High     |
| Schneider et al. (25)            | High     |
| Woods-Giscombe et al. (28)       | Moderate |
| <b>Quasi/single-arm</b>          |          |
| Smith et al. (33)                | Low      |
| Waldron and Burnett-Ziegler (29) | Low      |
| Chang et al. (20)                | Low      |
| <b>Mixed methods</b>             |          |
| Hong et al. (31)                 | Low      |
| Johnson et al. (21)              | Moderate |
| Zhou et al. (23)                 | Low      |

## 4.2 Effects of mind–body interventions

The outcomes associated with CMR assessed in these studies included diabetes/A1c (2, 14.3%), obesity/weight control (3, 21.4%), metabolic syndrome (1, 7.1%), left ventricular mass index (blood pressure effect) (1, 7.1%), blood pressure (2, 14.3%), diet (5, 35.7%), physical activity (8, 57.1%), anxiety (4, 28.6%), stress (7, 50%), depression (6, 42.8%), and quality of life (2, 14.3%).

### 4.2.1 Mind–body intervention affecting physiologic CMR reduction

In the seven studies addressing cardiometabolic physiologic outcomes, varied effects of MBT were observed. Three studies assessed obesity and weight change (22, 25, 26), two examined the effects of MBT on diabetes and hemoglobin A1c (26, 27), and three assessed blood pressure (23, 24, 31).

Notably, body weight and composition significantly improved in two studies that implemented a church-based lifestyle behavior program incorporating breathing, stretching, and yoga practices (22), as well as a lifestyle program combined with stress management techniques, including guided relaxation and mindfulness with diaphragmatic breathing (25). Zhou et al. (34) reported reductions in weight and hemoglobin A1c after the 12-week intervention. However, low-density lipoprotein (LDL) was not significantly changed (22). Cox et al. (25) found significant trends toward greater weight loss in their intervention group, despite their pilot study not being designed to detect significant differences. An adapted MBSR program also demonstrated a significant reduction in BMI in both groups at 3-month and 6-month follow-up (27).

In terms of blood pressure, significant reductions were noted in two interventions utilizing transcendental meditation (23, 24). Schneider et al. (23) reported significant decreases in systolic blood pressure in the transcendental meditation group compared to a health education control group, with a notable 5.4-year hazard risk reduction in myocardial infarction, stroke, and mortality.

Schneider et al. (24) found significant within-group reductions in both systolic and diastolic blood pressure among participants practicing transcendental meditation, although no significant difference emerged between the meditation and control groups (24).

While these studies suggest that mindfulness practices and meditation may benefit weight management, stress reduction, and cardiovascular health, they varied in design and scope. Some were small pilot studies that were not necessarily designed to detect significant changes, suggesting the need for further comprehensive research to determine the impacts of mindfulness-based interventions on cardiometabolic health.

### 4.2.2 Mind–body intervention affecting psychological function

In studies that addressed psychological outcomes ( $n = 11$ ), seven assessed stress (22, 23, 25, 26, 28–30), five assessed effects of MBT on depression or depression symptoms (20, 22, 24, 30, 31), three assessed anxiety (20, 22, 33), five assessed mindfulness (20, 29–31, 33), and two studies observed quality of life (22, 28).

#### 4.2.2.1 Stress

Several studies examining stress measurement utilized multiple methodological approaches, incorporating both validated self-report

measures and physiologic markers to assess stress outcomes. The Perceived Stress Scale was identified as a primary tool utilized across studies. Culturally adapted mindfulness-based stress reduction interventions have shown significant reductions in perceived stress, while lifestyle change interventions varied in effectiveness among different participant groups.

Seven studies utilized the Perceived Stress Scale to measure stress (22, 23, 25–30, 33), one study utilized Perceived Stress Scale and salivary cortisol (26), and another used Perceived Stress Scale and Post-Traumatic Stress Disorder Checklist for the Diagnostic and Statistical Manual of Mental Disorders (DSM-5) (29).

Stress affect outcomes were variable across the seven studies. Two studies that tested modified MBSR interventions demonstrated a significant decrease in their perceived stress score (29, 30). Lifestyle change interventions showed to have a positive effect on stress. A study evaluating the effects of a lifestyle plus stress reduction intervention on Black women demonstrated improvements in perceived stress across all participants, and there was no difference between groups (26). In a church-based lifestyle intervention, baseline perceived stress was associated with baseline adiposity levels, weight, and BMI; however, this association did not remain throughout the intervention (23). In the adapted MBSR, perceived stress was significantly reduced at 3-month follow-up for the intervention group (28). Schneider et al. (35) observed a significant increase in perceived stress. These researchers posed that an increase in measured psychological variables for stress might be because of individual variation in stress perceptions and emotional responses. Authors found that this corroborated other transcendental meditation studies that demonstrated improved physiologic improvements without concurrent improvements in psychological variables.

Trends toward effects on stress were, however, found in three studies. A lifestyle plus stress group showed a trend toward greater reductions in salivary cortisol than in the control group (26). A short-form MBSR reduced stress by approximately 20% (33). Culturally adapted lifestyle intervention observed trends toward reduction of stress (22). These findings illustrate the complexity of stress measurement and interventions, highlighting the critical need for population-specific approaches that account for diverse individual and contextual factors affecting stress experiences and responses.

#### 4.2.2.2 Depression, anxiety, mindfulness, and quality of life

Researchers utilized multiple validated measures and self-reported surveys to assess psychological and wellbeing indicators, including depression, anxiety, mindfulness, and quality of life through various standardized questionnaires and assessment tools. Several validated measures and self-reported surveys were used to assess depression, anxiety, quality of life, and mindfulness. Depression was assessed across studies utilizing five different tools: Center for Epidemiological Studies of Depression Scale, Inventory of Depressive Symptoms Self-Reported, Depression Self Stigma Scale, Hospital Anxiety and Depression Scale, and self-reported past depression diagnosis. Across the four studies assessing anxiety, Generalized Anxiety Disorder, Beck Anxiety Inventory, and Hospital Anxiety and Depression Scale were utilized. Mindfulness was assessed using either the Five Facet Mindfulness Questionnaire or the Philadelphia Mindfulness Scale. Quality of life was assessed using either the Health-Related Quality of

Life 36-item short form or Functional Assessment of Chronic Illness Therapy, Spiritual Well-Being Expanded Version.

Three studies employing modifications of the MBSR reported significant decreases in depression scores and improvements in mindfulness indices at a level of statistical significance following the intervention (29–31). Short-form MBRS was positively associated with a reduction in anxiety ( $p = 0.005$ ) and an increase in quality of life, along with participants improving their mindfulness scores by 2 points from baseline to follow-up showing a trend toward statistical significance (33).

A study utilizing qigong exercise found that participants showed improved depression and anxiety change scores from baseline to follow-up, illustrating a trend toward significance (20). Mama et al. (22) identified positive trends in depressive symptoms from baseline to 6-week post-intervention follow-up. Schneider et al. (36) observed a decrease in depression in the transcendental meditation group. Researchers posit the lack of reduction in depression was due to an already low depression score at baseline for participants.

Two studies observed quality of life (22, 28). Mama et al. (22) was unable to demonstrate significant increases in quality of life. Woods-Giscombe et al. (28) observed the intervention group experiencing significant increases in total spiritual wellbeing at 6 months, contrasting with the control group who experienced significant decreases in spiritual wellbeing at 6 months.

Overall, multiple studies, particularly those employing modified mindfulness-based stress reduction interventions, reported significant decreases in depression scores, improvements in mindfulness indices, and positive trends in anxiety and depressive symptoms. Some studies demonstrated notable improvements in psychological wellbeing and spiritual health; others found more modest or mixed results, with researchers attributing variations to factors such as baseline participant characteristics and intervention design.

### 4.2.3 Mind–body intervention affecting lifestyle change

The research examined lifestyle changes related to cardiovascular metabolic risk (CMR) factors, focusing on physical activity and dietary outcomes across multiple studies. Physical activity was measured in 57.1% ( $n = 8$ ) of the mind–body intervention studies, whereas dietary outcomes were a target outcome in just over a third of studies (See Table 2). One study included alcohol consumption in their dietary data collection.

Physical activity was measured across studies using direct activity measurement and/or self-report surveys. Two studies used accelerometry as objective indices of physical activity: ActiGraph™ (22) and Body Media Fit Armband™ (23). Mama et al. (22) calculated moderate-to-vigorous physical activity from the accelerometer data, whereas Zhou et al. used the BodyFit wearable to capture daily step counts. Chang et al. (20) used physical functioning as their target activity outcome. Defined as mobility capability, they used the National Institutes of Health Patient-Reported Outcomes Measurement Information System Computerized Adaptive Short Form 36 which contains a 10-item mobility limitation subscale. The Chang et al. (20) study was the sole study conducting pre-post intervention 6-min walk tests to determine increased aerobic exercise capacity to quantify impact of improved physical functioning.

Six studies relied upon validated self-report tools to measure levels of physical activity. The International Physical Activity Questionnaire

was used by two studies (21, 22). Additional self-report measures were the Recent Physical Activity Questionnaire (27), a Modified Minnesota Leisure Time Physical Activity Questionnaire, and the 7-day Physical Activity Recall (28). Schneider et al. (25) developed a custom physical activity diary to record duration of activity in minutes.

None of the studies demonstrated statistically significant improvements in physical activity levels. A trend toward a positive physical activity outcome was evident, however, in two studies with multicomponent interventions: qigong with musical accompaniment and pre-post relaxation sessions (20) and another with the combination of yoga, guided relaxation, music, breath focus, and spirituality sessions (22).

Five of the studies targeted dietary lifestyle change outcomes. Two of these studies modified existing diabetes programs (26, 27) which had physical activity and nutrition guidance to also include some aspects of cognitive behavioral training with mindfulness, and mediation and stress management (breath work and guided imagery), respectively. Bernstein et al. (27) combined physical activity recommendations and mindfulness training and used an investigator-designed food preparation intervention.

Schneider et al. (24) matched a MBT intervention (transcendental meditation) arm against a lifestyle change health education control arm which included diet instruction as did Woods-Giscombe et al. (28) who compared a traditional prediabetes lifestyle program to a mindfulness prediabetes intervention. Finally, Zhou et al. (23) single-arm study tested a multicomponent intervention that paired MBSR with diabetes risk reduction in a church setting.

The tools used to collect data to confirm dietary lifestyle changes were as follows: The National Institutes of Health/National Cancer Institute Automated Self-administered 24-h dietary recall (27), the Dietary Food Consumption Questionnaire (24), Fred Hutchinson Cancer Research Center Food Frequency Questionnaire (28), and an investigator-designed questionnaire on food preparation (23). Food preparation specifics were methods of food preparation, ingredients, meals consumed in the home, mealtimes, and time spent in a meal. The Woods-Giscombe et al. (28) intervention demonstrated non-statistically significant decreases in both carbohydrates and lipids and therefore calorie intake in both the control (customary diabetes prevention group) and intervention arms (mindfulness + diabetes prevention) at 3- and 6-month follow-ups.

In summary, one of the dietary lifestyle studies had statistically significant changes in body fat with a trend toward lower sodium intake (23). Three of the other four studies also demonstrated a trend toward a decrease in BMI, body weight, or weight loss through their dietary lifestyle intervention. The research suggests that mind–body interventions may have potential for influencing lifestyle behaviors, although more comprehensive studies are needed to establish clear, consistent outcomes.

## 5 Discussion

This study used a scoping review strategy to summarize the state of the research, including types of studies, feasibility/acceptability evaluations, effectiveness of mind–body therapy interventions for reducing cardiometabolic risk factors in middle-aged Black adults, and evaluation of the attention to theory and/or culture in designing interventions. Identifying what has been covered in the research, and



what one might learn from these studies' types, intervention choices, feasibility evaluations, and outcomes are discussed with recommendations for what still needs to be addressed.

## 5.1 Types

Types of research and interventions reviewed in the current study are not unlike what previous reviews have noted, whether these were evidence or scoping reviews. For example, the seven types of mind-body therapies and their representation in the current review parallel the approximate proportions of studies going on within the Black population (12, 15) as well other populations (34, 37, 38).

## 5.2 Feasibility/acceptability

The large number of studies reporting primarily adherence and feasibility showed similar rates of adherence, feasibility, and attrition results as the prior reviews. As described in Results, rates of adherence ranged from 50 to 100% across the studies with an average adherence retention rate of 72.7%, regardless of length of study which varied from 4 weeks to 6 months and irrespective of the MBT intervention implemented. Similar rates of adherence ( $\geq 75\%$ ) were noted by Gravesande et al. (36) and Watt et al. (35) for online MBT interventions, completed in different adult populations and outcomes. Of the four studies in our review that assess feasibility, three met their benchmark goal. These findings parallel feasibility studies previously conducted in other adult populations (39). While half of the included studies focused on measuring feasibility or adherence, none demonstrated high attrition illustrating both feasibility and acceptability. Combined, the studies demonstrated strong feasibility, adherence, and or retention in the MBT participants indicating the possibility of scalability of adoption by Black adults. This overall finding corroborates the acknowledgment of the American Heart Association that MBTs are feasible and acceptable adjuncts to CMR factor reduction strategies (11).

## 5.3 CMR reduction outcomes

As described in the Results section examining physiologic changes in CMR reduction outcomes, analysis of the 14 selected articles revealed that mind-body therapies were shown to have an overall significant positive effect on blood pressure, pulse rate, BMI or weight reduction, hemoglobin A1c, and left ventricular mass index. Most illuminating among the physiologic findings was the overall reduction in mortality and reduction of cardiovascular events at 5-year follow-up using transcendental meditation. It should be noted that all studies showed trends toward positive improvements in the assessed outcomes. In general, the data are promising for continuing to build research in this area of study for middle-age Black adults with physiologic CMR conditions.

As described in the Results section, MBTs were shown to have an overall significant positive effect on psychological experiences such as perceived stress, depression, mindfulness, quality of life, and anxiety. We noted that one outcome measure was nearly consistently used across studies. Nine studies included the Perceived Stress Scale; as

such, stress reduction has emerged as a salient target for CVD risk reduction (40).

While physical activity may be thought of by some as the MBT activity itself (for those MBTs that include movement), some have measured this as a target outcome because of the known effects of this lifestyle behavior on reducing CVD risk. Physical activity was measured as an "outcome" in 57.1% studies, interestingly half of which were studies in which the MBT was a practice that included movement. Although physical activity lifestyle changes did not significantly increase in any of the studies targeting this outcome, there were trends toward increases (and none showed decreases). It is interesting to note that X (number) studies did not measure physical activity as an outcome despite using a MBT that included a movement-based intervention. It could be concluded that participants in such interventions (e.g., yoga and qigong) will have increased their activity level to some degree unless they were already active prior to the study enrollment. Very few studies with movement-based MBTs exclude participants who are physically active. Since yoga and qigong have been shown to have a METS of 1.5–3.0, or 1.5 to 3 times the amount of resting energy expenditure, and their use is likely to result in some improvement in physical activity levels, unless they entered the intervention with already-high levels. If participating in these MM practices for 30 min, 5 times/week, this approaches the physical recommendations for adults (450 of the 500 METS min/week) (41).

Given the heterogeneity of interventions used across studies, it would be difficult to identify indicators of a MBT "gold standard" to reduce CMR in Black adults. Most studies used MBT paired as a part of a multicomponent intervention. Intervention dose and duration also varied across studies. Follow-up time frames ranged from 4 weeks to 5 years. Schneider et al. (24) was the only study with long-term follow-up (5 years). The lack of long-term follow-up across studies failed to capture sustained intervention effects. Twelve of the 14 studies employed a health professional: behavioral health specialist (3), certified MBT instructor (7), and health educators (2) creating a barrier to wide scale adaptability. While these professionals were instrumental in delivering the interventions, their involvement could present a potential barrier to the widespread adoption of mind-body therapies as it may not be easily scalable in settings with limited access to such specialists. Finally, it is important to note that the proportion of male participants in the studies ranged from 4.3 to 35.35%, indicating lower participation levels for males than females. Thus, many of the studies present results that may not fully represent Black men for feasibility and/or outcomes, leaving gaps in our knowledge of MBT appropriateness or effectiveness in Black men.

## 5.4 Use of theory or cultural adaptation in design of interventions

Studies varied in their approach to adapting interventions for the population tested. Common strategies included community-based participatory research, cultural adaptation, and culturally informed settings. A notable example of a comprehensive culturally relevant approach involved a church community, where a research team of predominantly Black researchers worked alongside senior church members, and the pastor, guided by Davidson et al.'s Theory of Adaptation. This framework utilized an adaptation toolkit to develop the intervention (22). Davidson et al. (42) created a Toolkit of

Adaptation Approaches designed to address cultural needs of the minority populations. The toolkit consists of three different items: 46-item Typology of Adaptation Approaches, Pathway to Adaptation, and a decision-making tool titled RESET (Relevance, Evidence base, Stages of intervention, Ethnicity, and Trends). Mama et al. (22) utilized the Pathway to Adaptation, which included six categories: collaborated working, team, endorsement, materials, message, and delivery to create their culturally adapted intervention.

Another successful example of a culturally adapted intervention was conducted at a Federally Qualified Health Center, which provided transportation vouchers and reduced session times to accommodate participants' needs along with modifying both wording and images to reflect the community (30).

No study specifically looked at a comparative difference between traditional (generic) MBT interventions and culturally adapted MBT interventions. Of the seven studies identified as culturally adapted, four demonstrated significant results in either physiologic health outcomes (23) or psychosocial health outcomes (29–31), with others showing trends toward significance (22).

Identifiable differences between traditional and culturally adapted MBT interventions in this review included sample size, primary outcome focus, study design, and duration. Traditional MBT interventions in this review tended to have larger sample sizes to adequately power to detect significance, while culturally tailored MBT interventions primarily assessed feasibility (e.g., acceptability, retention, and adherence). Majority of these culturally adapted MBT interventions were not powered to test significance in secondary health outcomes. Moreover, study design played a role in the strength of the studies reviewed. Traditional MBT interventions mostly employed RCTs and/or longitudinal designs, where effect is gained over a significant amount of time utilizing several other influences. In contrast, many culturally adapted MBT interventions utilized mixed methods, offering qualitative aspect into the access barriers faced by the Black middle-age population in participating in MBT interventions.

While half of the studies did not utilize any form of adaptation, the studies that did use these strategies presented strong cases for creating a more accessible mind–body therapy that relates to Black adults to entice engagement in new forms of exercise to reduce CMR factors.

Future studies can improve culturally adapted MBT interventions by cultivating a people-centered research approach. Embracing a comprehensive cultural adaptation framework to guide community-based participatory research strategy which addresses community involvement, research design, recruitment methods, data collection protocols, and intervention implementation is advisable. Comparative studies examining generic versus culturally adapted approaches could provide valuable insight into the specific needs of the Black community with regard to improving research feasibility and acceptability of CMR reduction techniques.

## 5.5 Prior research

Our review corroborated other reviews which showed that there were an inadequate number of studies of MBT in our desired population (12, 15, 43). Our review was also in agreement that many “co-interventions” were bundled with MBT making the distinct impact of MBT difficult to assess. In addition, this review has also

concluded that there are limited high-quality studies, and the risk of bias is substantial across retrieved studies. We also concluded that meta-analysis of MBT use in Black adults is limited currently given the heterogeneity of study characteristics (population, setting, intervention, and outcome measure(s)) and be powered RCTs who report statistical data such as effect sizes and confidence intervals for combining and comparison.

Where this review refutes other published reviews is that unlike, for example, a commentary on mindfulness research among Black Americans (43), we found a breadth of tailoring employed in our retrieved studies. We also found that the efforts to enact community-based population research strategies, in studies that employed them, were also exactly described paving the way for replication of the researcher's methods. Both the Mama et al. (22) and the Burnett-Zeigler et al. (30) studies were very prescriptive in their outlining cultural adaptation which facilitates the study of MBT in different settings and with different samples of individuals.

## 5.6 Limitations

In regard to limitations, we did not include studies targeting smoking which is a significant contributor to CVD. The choice to exclude studies with lower percentages of Black participants may have eliminated potential sources of information, but then, the information derived would have been less specifically relevant to our population of interest. Only four out of 14 studies indicated the use of a theoretical framework or model, suggesting study design weaknesses due to a lack of theoretical underpinning in the field of mind–body therapy interventions in the available studies. Another source of weakness in studies included was discussed in the GRADE analysis, indicating very few high-quality studies thus far. As such the available studies to review had some weaknesses making it more difficult to draw conclusions from the evidence base. An additional limitation to this study was the lack of studies specifically targeting males creating a knowledge gap regarding the acceptability or effectiveness of mind–body therapy interventions for modifying CMR in male Black populations. Of the 14 studies, 7 were early phase studies intended to power large-scale randomized controlled trial studies of the identified intervention in Black Adults. Finally, the choice of databases, and time frame, may have limited identification of pertinent studies. Despite these limitations, this study contributes substantially by not only synthesizing the evidence of mind–body therapy interventions and their impact on middle-aged Black CMR factors but that it also highlights potential research gaps, which can guide future meaningful research in the Black population.

## 5.7 Barriers and future direction

Biggers et al. (43) identified three broad areas of barriers to MBT participation in Black adults. These were identified as practical, representational, and alienation issues. A lack of awareness or limited knowledge of research participation presents a hurdle to considering joining a research study. Practical issues limit participation in research through making participation difficult or impossible. Representational issues contribute to the third category of alienation by creating a “foreign” feel for MBT rather than reinforcing a natural sense of being

present in the moment. For some, MBT could present as a conflict to religious or spiritual beliefs and create dissonance for participants. Adapted messaging for recruitment including explanation of clinical research and participation should guide recruitment efforts. Centering MBT interventions in a community setting with like instructors, while addressing barriers such as transportation, childcare, and flexibility or convenience in intervention times, could enhance study participation, retention, and adherence factors. Focusing on representative researchers, interventionists to reflect the population could reduce enduring trauma of unethical medical experimentation. Finally, centering the adaptation of the MBT interventions themselves to be relevant, recognizable, and achievable would make MBT more palatable to participation in this population.

The persistent health disparities facing Black adults demand a multifaceted, culturally nuanced approach to reducing cardiometabolic risk factors. By leveraging implementation science and targeted interventions that recognize the complex interplay of biological, social, and environmental determinants, public health policies can more effectively address these critical health challenges (44, 45). The Healthy People 2030 objectives provide a strategic framework for focusing on key areas such as blood pressure reduction, cardiovascular health improvement, diabetes prevention, and physical activity promotion (46–49). Critically, these interventions must be developed through a lens of cultural appropriateness, drawing on diverse scientific disciplines and acknowledging the unique lived experiences of Black communities (44). The NIH's strategic emphasis on inclusive research that understands the intersectionality of individual characteristics represents a promising path forward in addressing these deeply rooted health inequities (50). Ultimately, success will require a comprehensive, adaptive approach that respects the complexity of health disparities while remaining committed to meaningful, population-specific solutions.

## 6 Conclusion

The results from the scoping review suggest that there is a growing yet widely targeted body of literature addressing this type of intervention. This scoping review confirms that mind–body therapy interventions are deemed feasible and acceptable in this population. The current state of research further demonstrates that mind–body therapies show promise for decreasing CMRs risk factors in

middle-aged Black adults. Future research should focus on conducting larger randomized control trials of MBT interventions in the Black community, development, and testing of culturally adapted MBT interventions to engage Black adults in mind–body therapies and conducting studies of male-specific mind–body therapy interventions.

## Data availability statement

The original contributions presented in the study are included in the article/supplementary material, further inquiries can be directed to the corresponding author.

## Author contributions

DM: Writing – original draft, Writing – review & editing. JH: Writing – original draft, Writing – review & editing. SK: Supervision, Writing – review & editing. LL: Supervision, Writing – review & editing. RL: Supervision, Writing – review & editing.

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## Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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