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RESEARCH ARTICLE

Impact of mindfulness-based and health self-management interventions on mindfulness, self-compassion, and physical activity in older adults with subjective cognitive decline: A secondary analysis of the SCD-Well randomized controlled trial

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Abstract

INTRODUCTION: Older adults experiencing subjective cognitive decline (SCD) have a higher risk of dementia. Reducing this risk through behavioral interventions, which can increase emotional well-being (mindfulness and compassion) and physical activity, is crucial in SCD.

METHODS: SCD-Well is a multicenter, observer-blind, randomized, controlled, superiority trial. Three hundred forty-seven participants (mean [standard deviation] age: 72.7 [6.9] years; 64.6% women) were recruited from memory clinics in four European sites to assess the impact of an 8-week caring mindfulness-based approach for seniors (CMBAS) and a health self-management program (HSMP) on mindfulness, self-compassion, and physical activity.

RESULTS: CMBAS showed a significant within-group increase in self-compassion from baseline to post-intervention and both a within- and between-group increase to follow-up visit (24 weeks). HSMP showed a significant within- and between-group increase in physical activity from baseline to post-intervention and to follow-up visit.

DISCUSSION: Non-pharmacological interventions can differentially promote modifiable factors linked to healthy aging in older adults with SCD.

KEYWORDS
aging, Alzheimer's disease, dementia, mindfulness, non-pharmacological interventions, physical activity, self-compassion

1 | BACKGROUND

The increase in life expectancy is associated with a higher prevalence of age-related health conditions,[1] and higher dementia cases, expected to reach 153 million by 2050.[2] Subjective cognitive decline (SCD) is defined as the subjective perception of decline in cognition, even though scores on cognitive tests remain in the normal range.[3] Patients with SCD are at higher risk of developing dementia,[4,5] and more likely to experience mental health difficulties, including anxiety[6] and depressive symptoms,[7] which are, in turn, associated with an increased risk of cognitive impairment.[8,9]

It has been suggested that about 40% of dementia cases could be prevented by acting on modifiable risk factors.[10] Past studies have related low education, smoking, diabetes, social isolation, and physical inactivity,[10–12] but also psychological factors, such as depression[13,14] and anxiety,[15] to poorer cognitive outcomes, lower brain integrity, and/or greater dementia risk. This suggests that a reduction of such lifestyle and psycho-affective modifiable risk factors, and an increase of protective factors, constitute a powerful target to promote health and well-being in aging, but also to delay dementia onset and/or reduce Alzheimer's disease cases.[16]

Recently, mindfulness and compassion meditation have been proposed to promote mental health, well-being, and cognition in the context of healthy aging, and to reduce psycho-affective risk factors for dementia.[16]

Mindfulness refers to paying attention to emotions, thoughts, or inner experiences in the present moment without judgment.[17] Training in mindfulness has been shown to help develop attention, emotion regulation, and psychological well-being, as well as to reduce stress, anxiety, and prevent recurrence of mood disorders.[16,18,19] Trait mindfulness is associated with greater acceptance and openness.[20] Researchers have hypothesized that sustained and regular practice of mindfulness meditation can positively affect aging by improving mental health and perceived well-being,[21] as well as cognition,[22,23] and neuroplastic changes in brain regions sensitive to aging.[24]

Self-compassion, defined as a feeling of kindness toward oneself, having a sense of common humanity, and having an awareness of negative thoughts and feelings without over-identification,[25] may represent a valuable psychological resource for positive aging by improving subjective and psychological well-being.[26,27] It has been further demonstrated that self-compassion can have a beneficial impact on age-related thoughts and that it is correlated with better mental health.[28] Moreover, self-compassion has been related to a lower incidence rate of mental health disorders and symptoms (e.g., worry, depression, anxiety),[27,29] and with a range of positive psychological outcomes, including health-promoting behaviors,[30] motivation, life satisfaction, optimism, and happiness[31] in older adults. Despite the growing interest in mindfulness[24] and self-compassion,[32] research on the impact of meditation training on these outcomes in older adults is largely lacking. On this basis, self-compassion may be of great importance for older adults and may help improve psychological interventions to promote healthy aging.

Exercise, as demonstrated by different reviews, is one of the most robust lifestyle changes associated with increased health and a decreased risk of cognitive impairment.[33–36] Physical activity has many benefits for physical and mental functions and reversing some effects of chronic disease.[37] It has a positive impact on general health and quality of life,[38] mental health,[39,40] as well as on healthy aging.[41] Additional evidence suggests that a physically active life is associated with better brain health[34,42] and better cognition,[43] independent functioning,[44] and psychological health for older adults experiencing cognitive decline.[45] Therefore, interventions that increase physical activity in older adults are seen as a promising way to promote healthy aging.

1.1 | Objectives

The SCD-Well trial is part of the "Medit-Ageing" project (public name: Silver Santé Study) funded through the European Union as part of the Horizon 2020 program. The present study is a secondary analysis of the SCD-Well trial.[46] The trial's primary outcome was the mean change in trait anxiety symptoms after an 8-week caring mindfulness-based approach for seniors (CMBAS) intervention, compared to a health self-management program (HSMP). In the primary outcome, participants reported a reduction in trait anxiety after both interventions, maintained at 6-month follow-up, with no differences observed between the two groups.[47] Moreover, in a secondary analysis, we observed beneficial effects of both trainings on cognition, demonstrating a modest improvement in global cognition, which was maintained at 6-month follow-up with no difference between the two interventions.[48]

The present study aims to extend these findings by assessing the relative impact of CMBAS and HSMP interventions on psychological and lifestyle behaviors associated with healthy ageing, and whether any changes are maintained at 6-month follow-up. Based on the assumption that training in mindfulness is the crucial active component of the CMBAS intervention, HSMP was selected as the comparison condition, which is structurally equivalent to the mindfulness-based training. HSMP is designed to improve lifestyle behaviors without targeting compassion and self-compassion. We hypothesized that the two interventions would have differential effects on our outcomes,

RESEARCH IN CONTEXT

1. **Systematic review**: A systematic review of the literature about non-pharmacological interventions to target protective factors related to delayed onsets of dementia (e.g., physical activity, mindfulness, and compassion), showed that multicenter clinical randomized controlled trials (RCT) are missing in older adults with subjective cognitive decline (SCD).
2. **Interpretation**: The current multicenter RCT SCD-Well shows that 8 weeks of regular mindfulness and compassion training increase self-compassion and that 8 weeks of regular health self-management training increase physical activity, with both changes being maintained at 6-month follow-up.
3. **Future direction**: Future studies are needed to test the clinical significance of these findings and to compare such intervention effects to passive control groups.

with a greater improvement in mindfulness and self-compassion after CMBAS, and a greater improvement in physical activity after HSMP.

2 | MATERIALS AND METHODS

2.1 | Trial design, setting, and participants

SCD-Well is a European multicenter, observer-blind, controlled trial comparing the effects of an 8-week CMBAS to an 8-week HSMP. The trial was conducted in four European memory clinics (London, UK; Cologne, Germany; Lyon, France; Barcelona, Spain) and included physician-referred and self-referring patients. After pre-screening, participants underwent a diagnostic assessment at the screening visit (V0) to determine eligibility, criteria reported in Table 1 (see Marchant et al.[46]). Eligible participants proceeded to the baseline visit (V1) and were randomized into HSMP or CMBAS groups. Post-intervention assessment occurred at the end of the 8-week intervention (V2), with a follow-up at 24 weeks post-randomization (V3; 6 months after V1). Each visit included biological and behavioral assessments, encompassing mindfulness, self-compassion, and physical activity questionnaires.

2.2 | Interventions

The CMBAS followed the format of the mindfulness-based stress reduction program, including a pre-class interview, eight weekly 2 hour group sessions, and a half-day meditation practice in the sixth week. Each session involved group meditation (sitting and walking), sharing, and teaching. To incorporate mindfulness skills into daily life, participants were encouraged to engage daily in both formal and informal guided meditations. Based on previous work by Zellner Keller et al.,[53] CMBAS was specifically designed to address the needs of older adults, aiming to develop mindfulness, kindness, and compassion to cope with challenges related to aging.

HSMP was selected as the comparison condition. It followed the same format and structure as the CMBAS and was matched in administration, dosage, and duration. Specifically, it consisted of a pre-class meeting with the facilitator, eight weekly group-based sessions of 2 hour duration, a half-day of practice after the sixth session of the program, and home practices. The program was based on a published manual for guidance on living with chronic conditions[54] that has been previously adapted and validated in a population with SCD.[55] Every session of the program covered different topics (e.g., self-management, problem solving, sleep, stress, exercise, eating, and planning for the future). Participants were provided with information about these topics and engaged in group exercises and discussions about them. They were asked to create and implement "action plans" to promote engagement in activities to improve health and well-being on 6 days per each week.

Each site had two clinically trained facilitators, one for each intervention group. They were provided with a specific intervention protocol, instructions, and a day-long training about their respective intervention before starting the study. Facilitators completed checklists to monitor the fidelity of treatment delivery.[56]

TABLE 1 Eligibility criteria.

Inclusion criteria	Exclusion criteria
• Aged ≥ 60 years. • Meets research criteria proposed by the SCD-I working group.[49] • Performance within the normal range on standardized cognitive tests already administered at each site as part of standard clinical assessments according to research criteria based on those defined by Jak and Bondi[50,51] for exclusion of mild cognitive impairment as recommended by Molinuevo et al.[52] • Being referred to the memory clinic because of memory concern. • Ability to provide informed consent in accordance with International Conference on Harmonization of Good Clinical Practice (GCP/ICH) guidelines and local regulations. • Stating that they are available for the trial duration (39 weeks).	• Presence of a major neurological or psychiatric disorder. • Under legal guardianship or incapacitation. • History of cerebral disease. • Visual or auditory impairment sufficient to interfere with the aims of the study protocol. • Presence of a chronic disease or acute unstable illness, which interferes with the aims of the study protocol. • Current or recent medication that may interfere with cognitive action. • Regular or intensive practice of meditation or comparable practices.

2.3 | Outcomes

All outcomes were collected at pre- (V1), post-intervention (V2; 8 weeks after V1), and at follow-up (V3; 6 months after V1) visits. In the present study, we assessed the relative impact of CMBAS and HSMP on mindfulness, self-compassion, and physical activity.

2.3.1 | Mindfulness

Mindfulness was measured with the 39-item self-report Five Facet Mindfulness Questionnaire (FFMQ).[57] Items are rated on a 5-point Likert scale, ranging from 1 (never or very rarely true) to 5 (very often or always true).[58] A higher score indicates a higher mindfulness level.

2.3.2 | Self-compassion

Self-compassion was measured with the Self-Compassion Scale–Short Form (SCS-SF). This self-report questionnaire has 12 items rated on a 5-point Likert scale (0 = "Almost never" to 5 = "Almost always") to record how often one behaves kindly and caringly toward oneself in difficult life situations.[59] A higher score corresponds to higher levels of self-compassion.

2.3.3 | Physical activity

Physical activity was evaluated with the Physical Activity Scale for the Elderly (PASE), a brief self-report survey, designed to assess physical activity in older adults over the last week.[60] It uses frequency, duration, and intensity levels of activity over the previous week to assign a total score, ranging from 0 to 793, with higher scores indicating greater engagement in physical activities.[61]

2.4 | Statistical considerations

2.4.1 | Sample size

The sample size measurement was conducted based on the primary outcome.[47] Specifically, as the trait State-Trait Anxiety Inventory has no absolute cut-off levels, the sample size was based on the effect size (i.e., the ratio between the expected interarm differences from the common standard deviation). With a minimum effect size of 0.50,[62] 64 participants per group (128 total) were needed to demonstrate a significant difference in the primary endpoint in a *t* test with 80% power and a two-sided type I error of 5%. A greater number of participants were recruited in anticipation that a small proportion of volunteers would drop out of the trial and to provide sufficient power for secondary analyses.

2.4.2 | Statistical methods

Descriptive statistics were calculated for the sample's demographics and baseline measures. Linear mixed models (LMMs) were used to assess the effect of intervention assignment on outcomes over time. All models included age at baseline (years), education level (years), sex, trial site, trial group, and Mini-Mental State Examination (MMSE), as well as random participant intercepts. Time was modeled by the inclusion of a factor variable for visit (coded as V1, V2, or V3). Intervention effects were compared through the inclusion of an interaction term between visit and trial group. Within-group changes were also examined. The LMM used all available data for analysis, including participants for whom outcome values were missing for one or two visits (e.g., due to dropout). The LMM achieves this by interpolating missing values through the subject-pooled covariance matrix, based on a missing at random (MAR) assumption, which assumes that missing values can be recovered from observed values.

Analyses were conducted in R v.4.2.1 (www.R-project.org). LMMs were fit using the package lme4 v.1.1-30; *P* values for LMMs were obtained via lmerTest v.3.1-3. Post hoc analyses to obtain LMM-adjusted means and 95% confidence intervals (CIs) for each group/outcome/time point, as well as change (Δ) in scores within and across groups, were run using the emmeans package v.1.8.2. The evaluation of the visit-by-group interaction effect included both an omnibus test (analysis of variance [ANOVA]; to test for between-group differences in the trajectory of the outcomes across all visits), as well as post hoc contrasts evaluating the between-group effects from V1 to V2, and V1 to V3. We opted to conduct post hoc contrasts even when the ANOVA was not significant, as we hypothesized that different mechanisms might affect the outcomes from V1 to V2, versus V1 to V3. That is, for V1 to V2, the recency of interventions might be most relevant, whereas from V1 to V3, change in the outcome may reflect the cumulative effects of engagement with the interventions over time. For all analyses, uncorrected *P* values are reported and were deemed statistically significant at < 0.05.

2.5 | Safety and study monitoring

SCD-Well is registered on ClinicalTrials.gov (NCT03005652) and adheres to Consolidated Standards of Reporting Trials (CONSORT) of non-pharmacologic treatment guidelines.[63] The sponsor established a trial steering committee according to Good Clinical Practice guidelines with the responsibility to provide oversight on the conduct of the trial, advise on scientific credibility on behalf of the sponsor and the funder, and assess the progress of the trial.

For more details on data management, monitoring, dissemination and access, and study governance (blinding, safety, auditing) see Marchant et al. (their supporting material 1).[46] Briefly, the local study coordinator dedicated to this observer-blinded study oversaw data management at the first level under the responsibility of the principal investigator.

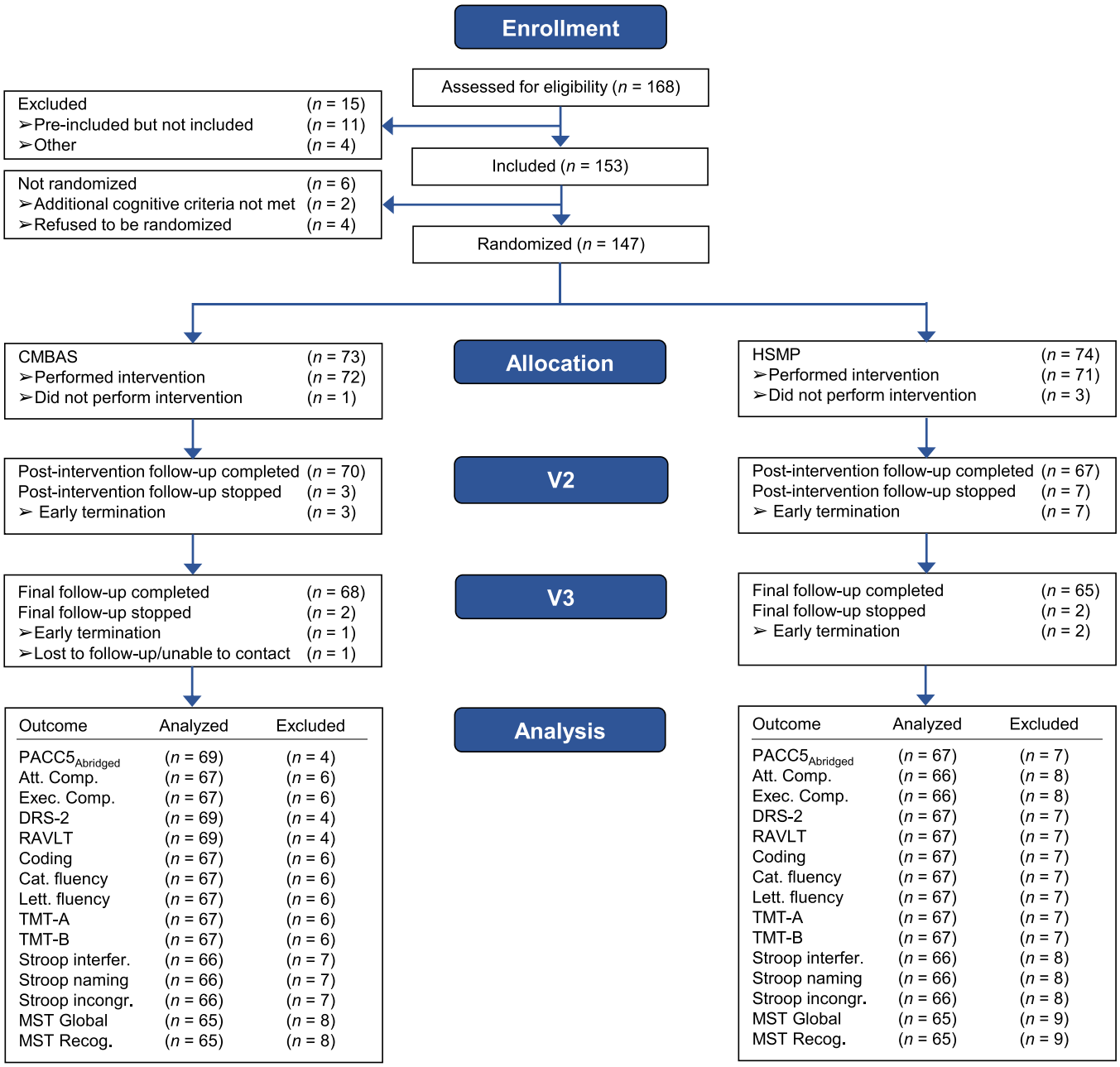

FIGURE 1 Consort flow diagram of enrolment and randomization to CMBAS and HSMP interventions. CMBAS, caring mindfulness-based approach for seniors; HSMP, health self-management program.

3 | RESULTS

3.1 | Participant flow and baseline characteristics

Recruitment took place from March 23, 2017, to January 25, 2018. Data collection was completed on September 18, 2018. Figure 1 shows the flow of participants through the study. Among the 147 participants who took part in the study and completed the questionnaires, 95 (65%) were female and 52 (35%) were male, with a mean age of 72.2 years. The participants were randomized after the inclusion visit (V1) with a 1:1 allocation (stratified by site), resulting in a sample of 73 participants in CMBAS and 74 in HSMP. The CMBAS and HSMP intervention groups did not differ on demographic characteristics or in their engagement in the interventions (Table 2). Table 3 shows the average observed values for each outcome by group and visit.

3.2 | Mindfulness

The ANOVA for the visit by group interaction was not significant, indicating that the change in mindfulness scores across visits did not

TABLE 2 Participant characteristics.

Characteristics		Total sample ($n = 147$)	CMBAS ($n = 73$)	HSMP ($n = 74$)
Age, years		72.7 ± 6.9	72.1 ± 7.6	73.3 ± 6.2
Sex	Female/male ratio	95/52 (65/35)	47/26 (64/36)	48/26 (65/35)
Education, years		13.6 ± 3.6	13.9 ± 3.8	13.4 ± 3.4
Ethnicity	White	142 (97)	69 (94)	73 (99)
	Other	5 (3)	4 (6)	1 (1)
Recruitment center	London, UK	28 (19)	14 (19)	14 (19)
	Lyon, France	40 (27)	20 (27)	20 (27)
	Cologne, Germany	39 (26)	19 (26)	20 (27)
	Barcelona, Spain	40 (27)	20 (27)	20 (27)
Employment status	Retired	123 (85)	58 (82)	65 (88)
	Not retired	19 (15)	12 (18)	7 (12)
MMSE		28.8 ± 1.1	28.7 ± 1.2	28.9 ± 1.0
McNair scale		52.50 ± 20.77	53.92 ± 21.34	51.07 ± 20.07

Note: Data are presented as mean ± standard deviation or numbers (%).
Abbreviations: CMBAS, caring mindfulness-based approach for seniors; HSMP, health self-management program; MMSE, Mini-Mental State Examination.

TABLE 3 Scores for mindfulness, self-compassion, and physical activity by intervention condition.

	Baseline visit (V1)		Post-intervention visit (V2)		Follow-up visit (V3)		
	CMBAS Mean (SD)	HSMP Mean (SD)	CMBAS Mean (SD)	HSMP Mean (SD)	CMBAS Mean (SD)	HSMP Mean (SD)	Potential range
Mindfulness	51.41 (7.26)	51.91 (7.38)	51.14 (8.57)	51.81 (7.85)	51.05 (8.53)	52.15 (8.19)	0–195
Self- compassion	37.65 (6.92)	38.74 (7.48)	39.53 (7.19)	39.90 (7.15)	40.51 (6.60)	39.13 (6.82)	0–60
Physical activity	129.74 (74.86)	117.99 (64.23)	127.21 (71.70)	137.02 (64.29)	127.61 (63.88)	140.62 (65.44)	0–793

Abbreviations: CMBAS, caring mindfulness-based approach for seniors; HSMP, health self-management program; SD, standard deviation.

differ between interventions (F[2, 238] = 0.17, $P = 0.84$). Furthermore, within-group comparisons (Table 4) showed that mindfulness scores did not change in the CMBAS and HSMP group neither from V1 to V2 nor from V1 to V3.

3.3 | Self-compassion

The ANOVA for the visit by group interaction was not significant, indicating that the change in self-compassion scores across visits did not differ between interventions (F[2, 240] = 2.12, $P = 0.12$). However, post hoc tests comparing the change in scores from V1 to V3 between groups favored the CMBAS over HSMP (estimated change [95% CI]: −2.37 [−4.65; −0.10], $P = 0.04$), and not from V1 to V2 (−1.31 [95% CI: −3.60; 0.99], $P = 0.26$; Table 4 and Figure 2). Within-group analyses showed an increase in self-compassion scores from V1 to V2 (estimated change [95% CI]: 2.00 [0.38; 3.61], $P = 0.02$), and also from V1 to V3 (2.57 [95% CI: 0.96; 4.19], $P < 0.01$) in the CMBAS group. In contrast, within-group scores did not change in the HSMP group from V1 to V2 (0.69 [95% CI: −0.94; 2.33], $P = 0.40$) or from V1 to V3 (0.20 [95% CI: −1.40; 1.81], $P = 0.80$).

3.4 | Physical activity

The ANOVA for the visit by group interaction was significant, indicating that the change in physical activity scores across visits differed between interventions (F(2, 240) = 5.06, $P < 0.01$). Post hoc tests comparing the change in scores from V1 to V2 between groups favored the HSMP over CMBAS (estimated difference in change: 26.17 [95% CI: 6.43; 45.91], $P < 0.01$), and also from V1 to V3 (28.54 [95% CI: 8.66; 48.41, $P < 0.01$; Table 4 and Figure 3). Within-group analyses showed that physical activity increased from V1 to V2 (estimated change: 18.74 [95% CI: 4.44; 33.04], $P = 0.01$) and from V1 to V3 (25.74 [95% CI: 11.82; 39.66], $P < 0.01$) in the HSMP group, while no significant changes were observed in the CMBAS group from V1 to V2 (−7.43 [95% CI: −21.03; 6.17], $P = 0.28$) or V1 to V3 (−2.79 [95% CI: −16.98; 11.39], $P = 0.70$).

4 | DISCUSSION

To the best of our knowledge, this is the first longitudinal randomized controlled trial testing the impact of a mindfulness and

TABLE 4 Estimated within-group and between-group differences in changes in mindfulness, self-compassion, and physical activity.

	CMBAS ($n = 73$)	HSMP ($n = 74$)		
	Within-group estimated change		Between-group difference in change	
	Estimate (95% CI)	Estimate (95% CI)	Estimate (95% CI)	*P* value
Mindfulness				
V1 to V2	−0.19 (−1.81; 1.43)	−0.17 (−1.78; 1.45)	0.02 (−2.27; 2.31)	0.98
V1 to V3	−0.34 (−1.97; 1.29)	0.27 (−1.31; 1.84)	0.60 (−1.67; 2.87)	0.60
Self-compassion				
V1 to V2	**2.00 (0.38; 3.61)***	0.69 (−0.94; 2.33)	−1.31 (−3.60; 0.99)	0.26
V1 to V3	**2.57 (0.96; 4.19)****	0.20 (−1.40; 1.81)	**−2.37 (−4.65; −0.10)***	**0.04**
Physical activity				
V1 to V2	−7.43 (−21.03; 6.17)	**18.74 (4.44; 33.04)***	**26.17 (6.43; 45.91)***	**<0.01**
V1 to V3	−2.79 (−16.98; 11.39)	**25.74(11.82; 39.66)*****	**28.54 (8.66; 48.41)***	**<0.01**

Note: For between-group differences, positive differences favor HSMP, whereas negative differences favor CMBAS. All analyses included covariates for sex, age, education years, baseline MMSE, site, visit, group, the visit by group interaction, as well as random participant intercepts. Significant effects appear in bold.

Abbreviations: CI, confidence interval; CMBAS, caring mindfulness-based approach for seniors; HSMP, health self-management program; MMSE, Mini-Mental State Examination; V1, baseline visit; V2, post-intervention visit; V3, follow-up visit.

*$P < 0.05$.

**$P < 0.005$.

***$P < 0.001$.

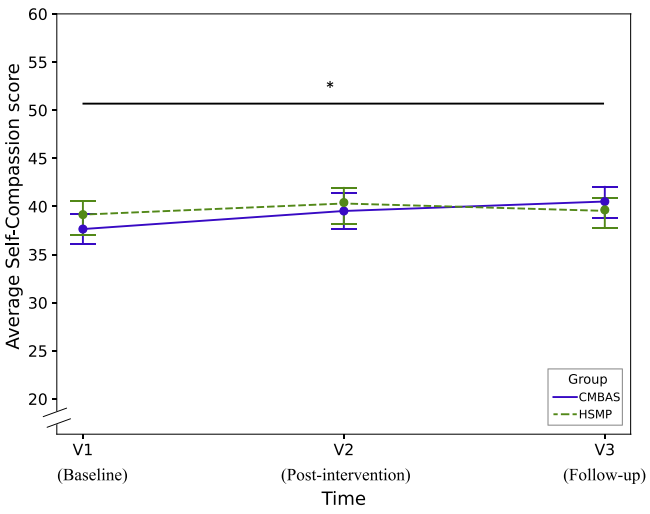

FIGURE 2 This data-based plot shows the evolution of average self-compassion scores from baseline (V1) to post-intervention (V2) and follow-up (V3) for each intervention condition. The *y* axis represents the mean score on the SCS-SF questionnaire from 20 to 60 (observed range in SCD-Well: 37 to 41). V1, baseline visit; V2, post-intervention visit after 8 weeks; V3, follow-up visit 24 weeks post-intervention. Asterisk corresponds to between-group significance. *$P < 0.05$. CMBAS, caring mindfulness-based approach for seniors; HSMP, health self-management program; SCS-SF, Self-Compassion Scale–Short Form.

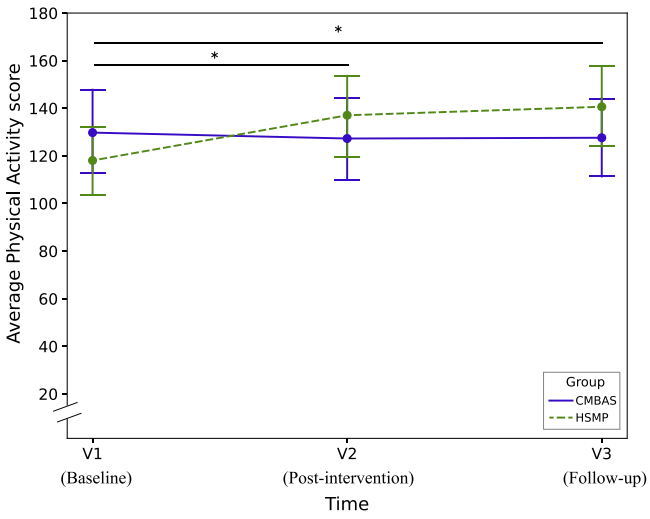

FIGURE 3 This data-based plot shows the evolution of average physical activity scores from baseline (V1) to post-intervention (V2) and follow-up (V3) for each intervention condition. The *y* axis represents the mean score on the PASE questionnaire from 20 to 200 to allow for a better visualization (maximum range: from 0 to 793, observed range in SCD-Well: 117 to 141. V1, baseline visit; V2, post-intervention visit after 8 weeks; V3, follow-up visit 24 weeks post-intervention. Asterisks correspond to between-group significance. *$P < 0.05$. CMBAS, caring mindfulness-based approach for seniors; HSMP, health self-management program; PASE, Physical Activity Scale for the Elderly.

compassion-based intervention and a HSMP, both specifically adapted for older adults with SCD, on psychological and lifestyle factors, namely mindfulness, self-compassion, and physical activity. While no changes in mindfulness were observed, intervention-specific benefits were found in self-compassion and physical activity. More specifically, the CMBAS intervention improved self-compassion post-intervention and at 6-month follow-up. On the other hand, the HSMP increased

engagement in physical activities post-intervention and this increase was maintained at 6-month follow-up.

4.1 | Mindfulness

Contrary to our hypothesis we did not observe a change in mindfulness after the CMBAS program. This result contrasts with previous research showing greater increase in mindfulness after a mindfulness-based intervention both in the general population[22,64–66] and in older adults.[22,67] Several factors could explain this result. First, the CMBAS intervention explicitly focused on cultivating compassion and self-compassion and less time was spent on mindfulness practice. Second, the 8 weeks of intervention may not have provided sufficient time for participants to develop mindfulness skills,[68] particularly given their age and the potential decline in cognitive abilities. A longer intervention period would allow them more time to embed the skills they learned and practice independently. Moreover, self-report–based measures of mindfulness are prone to introspection limitations, which can be challenging.[69] Future studies are needed to test the dosage of mindfulness training. Furthermore, future studies could use behavioral tasks[19] to evaluate whether mindfulness skills are objectively increased over the course of a mindfulness-based intervention.

4.2 | Self-compassion

Self-compassion increased from pre- to post-intervention and to 6-month follow-up in the CMBAS group, but not in the HSMP group. Moreover, while between-group differences in change in self-compassion need to be interpreted with caution (given the non-significant ANOVA), scores followed a significantly more salutary trajectory in the CMBAS versus HSMP group from V1 to V3 (but not from V1 to V2). Our results are in accordance with previous studies demonstrating an increased level in self-compassion directly after an 8-week mindfulness-based intervention. However, these studies were conducted in a younger adult sample.[70–72] Moreover, the increase in self-compassion was seen also at the 6-month follow-up visit, suggesting that the benefits of the mindfulness intervention were embedded by participants in their life.

Given self-compassion's association with life satisfaction and self-care,[31,73] sense of connectedness with others,[74] and psychological resilience,[75] the increase in self-compassion in older adults with SCD observed after the CMBAS training indicates that this intervention may be one promising avenue to promote healthy aging.

4.3 | Physical activity

A small number of studies have shown promising results regarding the potential of health education interventions to promote physical activity engagement.[76–78] However, longitudinal and randomized controlled studies in older adults have been lacking. Our study demonstrated a beneficial impact of a HSMP on physical activity engagement in people with SCD immediately after the intervention and at 6-month follow-up. This is of great importance given the association of physical activity with mental and physical health, including measures such as self-esteem, quality of life, life expectancy, and mortality.[79] Also, the increment in physical activity is of particular importance for older adults with SCD,[12] because it has also been linked to a lower risk of dementia.[10] Our study indicates that the HSMP holds promise as an intervention to promote healthy aging via improving physical activity. However, it was not designed to address other lifestyle changes and future studies are needed to test for other improvements.

The findings from this study extend those from the primary outcome paper, which observed an improvement in subclinical anxiety symptoms maintained at follow-up after both the CMBAS and HSMP.[47] The present study highlights that in addition to joint effects, the two interventions also have a differential effect on modifiable risk factors for dementia.

For both interventions, the effects were maintained at 6-month follow-up. This was also the case for changes in anxiety[47]; therefore, it may be that the increment in self-compassion[80,81] and in physical activity[82–84] was a possible mechanism through which anxiety improved in CMBAS and HSMP groups, respectively. While the follow-up period is relatively short, such maintained benefits suggest that even after only 8 weeks of intervention, lasting effects can be observed in older adults with SCD.

5 | STRENGTHS AND LIMITATIONS

This study has strengths and limitations. The strength is that we conducted a randomized controlled clinical trial with a longitudinal 6-month follow-up, a large sample of older adults with SCD meeting strict eligibility criteria, and a well-matched active comparator intervention. This allowed us to assess the causal, differential, and longer term impact of CMBAS and HSMP interventions on mindfulness, self-compassion, and physical activity in older adults with SCD.

This study has several limitations. First, all outcomes reported here are based on self-reports, which can be affected by recall bias and social desirability. Future studies might consider using more objective measures of self-compassion and physical activity. Second, the intervention and follow-up were relatively short. While there were statistically significant improvements in self-compassion and physical activity, changes were small, and the clinical significance of these changes is unknown. Future studies with longer interventions and longer follow-up tests are needed. Finally, it will be important for future research to incorporate passive control groups to clearly establish the causal role of mindfulness practices in promoting holistic health in older adults.

6 | CONCLUSION

This study provides evidence regarding the immediate and sustained effects of a CMBAS intervention on self-compassion and of a HSMP on physical activity. This work adds to the growing body of evidence that non-pharmacological interventions can impact modifiable risk factors relevant for well-being and dementia risk in an older adult population with SCD. Importantly, our study may suggest that healthcare practitioners in community, primary care, or clinical settings could make use of targeted interventions for participants at risk for dementia.

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CONFLICT OF INTEREST STATEMENT

T.B. has received honoraria for workshops on MBI and is the co-author of a book on mindfulness-based cognitive therapy published by Guilford Press. O.K. received honoraria for research, training, and consulting related to meditation. All the other authors, Y.D., T.W., M.S., A.L., G.C., N.L.M., and J.G., have no conflicts to declare. Author disclosures are available in the supporting information.

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CONSENT STATEMENT

Written informed consent was secured from all participants after the procedures had been fully explained to them and prior to trial participation. The authors assert that all procedures contributing to this work comply with the ethical standards of the relevant national and institutional committees on human experimentation and with the Helsinki Declaration of 1975, as revised in 2008.

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SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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