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Subjective Memory Impairment and Well-Being in Community-Dwelling Older Adults

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Abstract

Background—The relationship between subjective memory impairment (SMI), future cognitive decline and negative health status provides an opportunity for interventions to reduce memory complaints in high risk groups. This study aimed to examine the relationship between subjective memory impairment (SMI) and indicators of well-being in older adults enrolled in an exercise trial. Additionally, the study examined whether two different modes of exercise training, aerobic walking or non-aerobic flexibility, toning, and balance, differentially influenced subjective memory across the trial.

Methods—Community-dwelling older adults (n=179, M_{age}=66.4) were randomly assigned to a walking or flexibility, toning, and balance group for 12 months. Subjective memory, happiness, perceived stress, and symptom reporting were measured at baseline, 6 months and 12 months.

Results—A main effect of subjective memory indicated that individuals with the fewest memory complaints had lower perceived stress ($P<0.001$) and physical symptom reporting ($P<0.001$), and higher happiness ($P<0.001$) across all measurement occasions. Both main and interaction effects of time and group on SMI were not significant, suggesting SMI remained stable across the intervention and was not significantly impacted by participation in exercise training.

Conclusions—SMI was not responsive to exercise interventions, and the relationship between subjective memory impairment (SMI) and negative well- being demonstrates a need for interventions to reduce memory complaints in high risk groups.

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Keywords

subjective memory; memory complaints; well-being; exercise

Introduction

Subjective memory impairment (SMI) involves an individual's awareness and evaluation of their memory capability (1). Studies of community-dwelling older adults report the prevalence of memory complaints to range from 27–43% (2). Although the relationship between subjective memory and objectively-tested memory performance has been inconsistent, memory complaints are a component of diagnostic criteria for varying degrees of dementia and associated with an increased risk of future cognitive decline and impairment (2). Individuals with memory complaints have been reported to have over 2.5 fold higher risk of developing all-cause dementia than individuals without such complaints (3).

The health implications of memory complaints go beyond an increased risk of cognitive decline. The evidence is fairly consistent that individuals with memory complaints may be at risk for poor mental health, as several studies have identified a relationship between memory complaints and depression and anxiety. In a sample of community-dwelling older adults, memory complaints were negatively associated with depression, trait anxiety, and health related quality of life measures (4). In older adults with depression or anxiety, prevalence of memory complaints was nearly double that of those without depression or anxiety (5). Cognitive complaints were strongly associated with depression (OR 2.08–6.35) in a longitudinal study of over 15,000 women in France (6). Additionally, depressive and anxiety symptoms were significantly associated with memory complaints in older adults even after correction for actual cognitive performance (7). All studies included in a review by Mol et. al (8) identified a negative association between memory complaints and quality of life, including satisfaction and feeling of well-being, and more recent studies have reported a similar relationship (5, 9). Subjective memory complaints that disrupt daily living can be a source of psychological distress, and this stress can further exacerbate memory problems (10). Memory complaints may also be a predictor of vulnerability to poor physical health, as evidenced by associations between memory complaints and a higher degree of dependency for basic and instrumental activities of daily life (5) and nursing home placement (11). Additionally, the percentage of persons with memory complaints in those who rated their health as average or poor was more than double compared to those with self-perceived health as excellent (12). Despite the functional and emotional difficulties that SMI may cause in one's life, individuals with memory complaints rarely seek help for their memory problems (13–15).

The high prevalence of SMI in older adults and the fairly consistent association with dementia and other adverse health issues demonstrates a need for interventions aimed at reducing memory complaints. Numerous trials and observational studies have identified robust positive effects of exercise training on objective measures of cognition (17), but limited research exists on the effect of exercise training on changes in subjective memory. Only one physical training and three physical and mental training interventions have been evaluated for their efficacy in reducing memory complaints. A 2-month randomized trial compared the effects of an aerobic training program, a mental rehabilitation program, combined aerobic and mental training or a passive, control group on cognitive function and quality of life in older adults with memory loss complaints (18). Although there was a trend toward improved perceptions of memory in all intervention groups, the change was not significant, and individuals did not report satisfaction with the perceived changes in memory. A 6-week education intervention incorporating memory techniques and promotion of healthy lifestyles (i.e. physical activity, healthy diet, and relaxation) improved subjective memory in older adults with cognitive complaints; however, it is not known which aspects of the intervention were responsible for these changes (19). In adults with mild self-reported memory complaints, a 2-week healthy lifestyle program incorporating a healthy diet, relaxation and mental exercises, and daily cardiovascular conditioning did not significantly change subjective cognitive measures compared to the control group (20). The few trials investigating exercise training have utilized short-term interventions (≤ 2 months) with small to moderate sample sizes; therefore, longer interventions with larger sample sizes are needed to determine the potential efficacy of exercise training interventions for improvement of subjective memory.

Due to the fairly consistent association of SMI with adverse health issues, we hypothesized that memory complaints in older adults would also be associated with poorer well-being. In the present study, we examined the extent to which subjective memory in older adults was associated with indicators of well-being, i.e., happiness, perceived stress, and physical symptom reporting across a 12-month randomized exercise trial. In this trial, we have previously reported objective memory improvements (21, 22), changes in hippocampal volume (22), and changes in white matter integrity in the frontal and temporal lobes (21) that were dependent on changes in aerobic fitness; therefore, we also examined whether two different modes of exercise training, aerobic and non-aerobic, differentially influenced subjective memory across the trial.

Methods

Recruitment and Participant Characteristics

One-hundred and seventy nine community-dwelling older adults (117 female; 62 male) from east-central Illinois were recruited for this study. Participants between 59 and 81 years of age (M age = 66.4 years; standard deviation = 5.7 years) were recruited for a 12-month randomized controlled trial examining the effect of aerobic training on brain health. Complete details regarding recruitment, inclusion-exclusion criteria, study details and participant characteristics for the full sample have been reported elsewhere (21, 23). In brief, inclusion criteria were physical inactivity (< 3 days a week of physical activity in the past 6 months), absence of clinical depression as classified by the 5-item Geriatric Depression Scale (24), and absence of cognitive impairment as assessed by the modified Mini Mental Status examination (3MS) (score ≥ 51) (25). All participants were cleared for participation by their personal physician and completed an informed consent approved by an Institutional Review Board. After participants were approved for participation by their physician and passed screening, they completed self-report questionnaires including demographic and psychosocial measures at baseline, six-, and twelve-months. Data were collected in 2007–2010, and analyses were conducted in 2013–2014.

Exercise Intervention

Following all baseline assessments, participants were randomized into one of two exercise conditions: a walking group or a flexibility, toning, and balance (FTB) group. Full details of the intervention have been described elsewhere (23). Sixty-minute exercise sessions were held three times weekly and led by trained exercise instructors. Both sessions included 40-minutes of exercise activity plus 5–10 minutes of warm-up and cool-down stretches.

Walking—In the first seven weeks of the program, the duration of each session gradually increased by 5 minutes each week from 10 minutes to 40 minutes. Participants maintained 40 minutes of brisk walking for the remainder of the program. All participants wore heart rate monitors, and exercise intensity progressed from 50–60% of their maximum heart rate reserve during the first six weeks to 60–75% of their maximum heart rate reserve for the remainder of the 12-month intervention.

Flexibility, toning, and balance—In each session, participants completed four muscle toning exercises using dumbbells or resistance bands, two balance exercises, one yoga sequence, and one exercise of their choice. A new set of exercises was introduced every three weeks to maintain interest. Participants were encouraged to increase intensity by using more weight or adding repetitions. The low level of resistance and intermittent nature of the activities were selected to minimize cardiovascular or muscular adaptations (e.g. hypertrophy).

Demographic Characteristics and Health Conditions

Participants completed a short questionnaire assessing basic demographic characteristics (i.e., sex, age, education, marital status, race) and self-reported health condition at baseline.

Happiness

Happiness was assessed with the Memorial University of Newfoundland Scale of Happiness (MUNSH)(26). The MUNSH is a 24-item measure comprised of four subscales, Positive Affect (PA), Negative Affect (NA), Positive Experiences (PE), and Negative Experiences (NE). A total happiness score is attained by the formula PA – NA + PE – NE. A constant of (+20) was added to the score as recommended by McNeil (27), giving a total score range of 0–44. Internal consistency ranged from 0.85 to 0.88 across the 12-month period.

Perceived Stress

Subjective stress was measured with the 10-item perceived stress scale (28, 29) and items were rated on a 5 point Likert scale. The scale is designed to measure the degree to which situations in one's life are considered stressful. The total possible score ranged from 10 to 50 with higher scores reflecting higher perceived stress. Internal consistency ranged from 0.82 to 0.86 across the 12-month period.

Symptom Reporting

The Cohen-Hoberman Inventory of Physical Symptoms (CHIPS) (30) was used to assess symptom reporting. The CHIPS is a list of 33 common physical symptoms, and items were carefully selected so as to exclude symptoms of an obviously psychological nature (e.g., felt nervous or depressed). The scale does, however, include many physical symptoms that have been traditionally viewed as psychosomatic (e.g., headache, weight loss). Items are rated on a 5-point Likert scale for how much that problem bothered or distressed the individual during the past two weeks from not at all (0) to extremely (4). A total score is created by summing the scores across all items (possible score range = 0–132), with lower scores indicating that an individual was less bothered by physical symptoms. Internal consistency in this study was very good (α = 0.79 – 0.84).

Subjective Memory Impairment

A 10-item version of the 33-item Frequency of Forgetting (F of F) scale (31), developed from the Memory Functioning Questionnaire (32) was used to assess subjective memory. The 10-item F of F scale assesses the frequency with which participants have forgotten things such as names, faces, events, and where they placed things. Items were rated on a 7-point Likert scale with a total possible score of 10 to 70, with lower ratings indicating more negative self-report, or a greater occurrence of memory problems in one's life. Internal consistency in this study ranged from 0.88 – 0.89.

Statistical analysis

Demographics and medical history were described using frequency and descriptive statistics to characterize study participants. Intent to treat analyses using multilevel modeling were conducted on the entire sample from baseline (N = 179, 537 observations).

A series of iterative multilevel growth curve models were conducted to assess associations over time between treatment assignment and subjective memory impairment as predictors of change in perceived stress, happiness, and physical symptoms in older adults. To investigate our secondary outcome of whether subjective memory improved over time by participation in the intervention, treatment assignment was assessed as a predictor of change in SMI. In each multilevel growth curve model, time was measured continuously. The time variable was centered at initial status; therefore, the intercept of the model was interpreted as participant reports of the outcome variable at baseline. To enhance interpretability of model intercept parameters, all predictor variables were grand-mean centered to allow for inference of average predictor effects (33). Significant 2-way interactions were further decomposed via simple intercepts and slopes analyses (34). Relationships between predictor and outcome variables were assumed to be constant throughout the study if interaction terms were not significant. Models were developed in a stepwise fashion (35, 36) as follows: An initial unconditional model was developed for each outcome variable, followed by unconditional growth models. Based on these growth models, predictor variables were tested individually for main effects and for interaction effects with each time and group term. Significant predictors and their time interactions, if significant, were then tested together as part of their respective overall scale. Final trimmed conditional growth models were developed by entering all significant predictors and their interactions to test overall prediction of outcome variables across time (exclusion $p > .10$). Cohen's d, a distribution-based effect size measure, was calculated from the t statistics and degrees of freedom provided in the multilevel modeling output ($d=2t/\sqrt{df}$). Effect sizes were interpreted using Cohen's interpretation of .20 as a small effect, .50 as a moderate effect and .80 as a large effect (37). All data analyses were conducted using IBM SPSS version 22 (IBM, 2013).

Results

Subjective Memory Impairment Effects on Well-Being Measures

There was a significant main effect of subjective memory on physical symptom reporting [B = −.207 (.048), t = −4.279, p < 0.001, d= −0.43], indicating lower symptom reporting in those with fewer memory complaints across all measurement occasions. The main effect of exercise group, time, and interaction effects were non-significant. There was a significant effect of subjective memory on perceived stress [B = −.118 (.031), t = −3.780, p < 0.001, d= −0.38], indicating better subjective memory was associated with lower perceived stress across all measurement occasions. The main effect of time, exercise group, and interaction effects were non-significant. There was a significant main effect of subjective memory on happiness [B = .178 (.042), t = 4.215, p < 0.001, d= 0.40], indicating those with fewer memory complaints were happier across all measurement occasions. A significant main effect of time on happiness [B = .74 (.256), t = 2.885, p = 0.005, d= 0.46], suggests that happiness increased across time.

Subjective Memory Impairment Across the Intervention

Main effects of time [B = .36 (.25), t = 1.47, p = 0.142, d= 0.17] and exercise group [B = .08 (1.25), t = .062, p = 0.95, d= 0.01] on memory complaints across the intervention were not significant, suggesting that SMI remained stable across the intervention and was not significantly impacted by participation in either of the physical activity interventions.

Discussion

The purpose of this study was to determine the extent to which SMI in older adults was associated with indicators of well-being in two exercise training conditions over a 12-month intervention period. Additionally, we were interested in whether the different modes of exercise (aerobic vs. non-aerobic) differentially influenced SMI across the trial. A significant main effect of subjective memory on measures of well-being indicated that individuals with the fewest memory complaints were significantly happier, and had significantly lower perceived stress and lower physical symptom reporting across all measurement occasions. The relationship between SMI and overall well-being supports current literature that suggests cognitive impairment may have a negative impact on quality of life indicators in older adults (5, 8, 9) including higher perceived stress and worse physical health (38)(7, 14). Overall, our findings suggest that memory complaints are associated with physical and emotional difficulties that may be a source of psychological distress. The cause of poorer well-being in individuals with SMI warrants further examination, as it is currently unknown whether SMI results in poor well-being or if poor well-being is contributing to increased memory complaints. Negative affectivity resulting from stress, depression, poor physical health, or poor self-esteem may also contribute to negative perception of memory difficulty (39). Causes and/or consequences of SMI among older adults may indeed be multifactorial, and our study highlights perceived stress and happiness as psychological factors that are related to an individual's self-evaluation of memory.

In our study population of older adults without cognitive impairment, SMI remained stable across the intervention.Contrary to our previous findings of objective changes in brain function and function from this trial (21, 22), there was no difference in SMI over the 12-month intervention between those who participated in the aerobic exercise or flexibility/toning/balance. Changes in objective, but not subjective memory by exercise training has previously been reported in smaller intervention trials. Despite improvements in VO_2 max and objective cognitive function after a 2-month aerobic intervention in healthy elderly subjects, the participants' satisfaction with their memory did not significantly improve (40). Similarly, a 14-day lifestyle intervention that included mental exercises and daily cardiovascular conditioning resulted in objective, but not subjective, cognitive improvements (20). SMI may be more dependent on psychological health than neurological health. Indeed, a meta-analysis of fourteen nonpharmacological interventions concluded that expectancy change interventions alone or in combination with memory training were effective at improving subjective memory, but physical training interventions were not effective (16). The type and frequency of physical activity that can elicit benefits on self-evaluation of memory are yet to be determined, and future research endeavors might consider measuring SMI at baseline to identify individuals who may benefit from subjective memory improvements by an intervention.

Our study had several strengths, including a longitudinal design, as there are few longitudinal studies exist that have examined the effect of self-reported memory function on well-being in older adults, with previous studies being primarily cross-sectional. This 12-month randomized controlled trial included multiple measurement points, allowing for identification of potential changes in SMI and measures of well-being over time. SMI was determined from scored responses on a 10-item frequency of forgetting questionnaire and the study population was stratified to compare well-being outcomes in individuals with different levels of memory complaints. Previous studies of SMI have utilized a variety of instruments to measure subjective memory function including subjective memory scales, memory functioning questionnaires, meta-memory scales and a single item question (1). Despite the heterogeneity of scope and item content in assessment of SMI, our findings are consistent with previous research investigating the relationship between memory complaints and measures of well-being.

Several potential limitations need to be considered in the interpretation of the data. The majority of participants were white, female, and highly educated, reducing the generalizability of the findings. In addition, self-reported measures of well-being and memory complaints may be affected by current life situations rather than a reflection of usual feelings or frequency of memory problems. Although this should be taken into consideration, we demonstrated that all measures of well-being in this study were consistently lower in individuals with greater SMI, suggesting that these self-reported variables remained stable across the 12-month trial and were reliable measures in this population. Additionally, 3MS was used as a screening tool, but it is insensitive to mild cognitive impairment (MCI); thus, the prevalence of MCI in our sample is unknown. It has been suggested that the negative correlation between quality of life and memory complaints is stronger in MCI than in individuals with normal cognitive functioning (41). It is further acknowledged that a number of other factors are likely correlates of the relationship between SMI and well-being indicators including social support, stressful live events, and the personality facets of conscientiousness and neuroticisim (7, 42).

In conclusion, we found SMI to be associated with measures of well-being in community dwelling older adults. In addition, SMI remained stable over time regardless of participation in the walking or FTB group. Individuals with SMI are a population at risk for poor well-being; thus, the efficacy of intervention strategies to reduce memory complaints and improve psychological well-being and quality of life should be further investigated.

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Table 1

Subjective Memory Impairment and Well-Being Across the Intervention

Measure	Time Point	Total Sample	Walking	FTB
Subjective Memory Impairment (FOF)	Baseline	48.68 (.68)	48.80 (.97)	48.57 (.96)
	Month 6	49.12 (.74)	48.83 (1.05)	49.41 (1.05)
	Month 12	49.10 (.72)	48.61 (1.03)	49.59 (1.02)
Happiness (MUNSH)	Baseline	34.79 (.60)	35.24 (.85)	34.33 (.85)
	Month 6	36.67 (.63)	37.12 (.89)	36.23 (.89)
	Month 12	36.60 (.64)	37.54 (.91)	35.66 (.90)
Physical Symptoms (CHIPS)	Baseline	10.72 (.62)	10.34 (.88)	11.10 (.88)
	Month 6	11.03 (.75)	10.17 (1.07)	11.88 (1.06)
	Month 12	11.66 (.80)	9.89 (1.13)	13.43 (1.14)
Perceived Stress (PSS)	Baseline	10.68 (.40)	10.81 (.57)	10.56 (.57)
	Month 6	10.15 (.45)	10.49 (.64)	9.80 (.64)
	Month 12	9.89 (.48)	9.49 (.68)	10.23 (.68)

Values are presented as Mean (SE)

Table 2

Longitudinal multilevel regression models

	Physical Symptoms (CHIPS)			Perceived Stress (PSS)			Happiness (MUNSH)		
Predictor	**B (SE)**	**t**	**Sig**	**B (SE)**	**t**	**Sig**	**B (SE)**	**t**	**Sig**
Intercept	10.11 (.77)	13.11	<.001	10.74 (.51)	20.88	<.001	35.77 (.76)	47.31	<.001
Main Effects									
Time	.52 (.33)	1.59	.115	−.34 (.20)	−1.67	.096	.74 (.26)	2.882	.005
Exercise Group	1.05 (1.06)	.984	.327	−.26 (.70)	−.37	.712	−1.39 (1.02)	−1.363	.175
Subjective Memory	−.21 (.05)	−4.28	<.001	−.12 (.03)	−3.78	<.001	.18 (.04)	4.22	<.001
Pseudo R^2	.634			.622			.718		

B = estimate; SE= standard error; t = t-Test

Excluded (p > .1): age, education

Note: Dashes in cells indicate excluded variables not entered into the model.