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ABSTRACT

The effects of the Music-with-Movement intervention on the cognitive functions of people with moderate dementia: A randomized controlled trial

Aging & Mental Health

Objective: The aim of this study was to examine the effects of the six-week Music-with-Movement (MM) intervention, as compared with music listening (ML) and social activity (SA), on the cognitive functions of people with moderate dementia over time.

Methods: A multi-center randomized controlled trial was conducted on 165 nursing home residents with moderate dementia. The MM intervention protocol was developed based on a critical literature review, and tested in three rounds of pilot studies before undergoing testing in this study. The participants were randomly allocated into three groups. Intervention participants (n=58) received a 12-week MM program led by a trained health care professional, while the participants in the comparison music listening group (n=54) listened to their preferred music, and those in the social activity group (n=53) engaged in social chatting. Cognitive functions, depressive symptoms, and anxiety were measured at baseline, the sixth week, and six weeks post-intervention.

Results: Greater improvements in memory and depressive symptoms for the MM group were revealed in the univariate analysis and pairwise comparisons. The effects on memory could last for at least six weeks post-intervention. However, a mixed MANOVA analysis indicated that there were no significant interactions of group by time effect

Conclusion: The findings revealed that the Music-with-Movement Intervention may be useful for enhancing the cognitive functions of people with dementia. However, there is insufficient evidence to show that the effects of the MM intervention on outcome variables over time significantly different from those observed among the comparison groups.

Keywords:

Dementia and Cognitive Disorders, Music and Art, Cognitive functioning

Introduction

Dementia is a neurocognitive disorder that causes cognitive impairments and affects daily functioning, and requires assistance over the trajectory of the disease. It is estimated that around 35.6 million people globally are living with dementia – a figure that is expected to rise to 65.7 million in 2030 and 115.4 million in 2050 (Prince et al., 2013). Asia is the region with the fastest growth in its aging population; thus, the number of people with dementia is expected to surge (Alzheimer's Disease International, 2015). As elderly people living in residential facilities are generally frailer, and cognitive impairment is one of the key predictors of institutionalization (Hajek et al., 2015; Gnjidic et al., 2012; Peng & Wu, 2015), the prevalence of dementia in residential facilities is higher than in the community. Therefore, it is worth making an effort to identify interventions that can maximize the abilities of residents with dementia living in nursing homes.

Apart from permanent neuropathological changes in the brain, the cognitive functions of patients with dementia can be affected by transient states, such as negative affective states. Numerous studies have shown that the presence of anxiety and depressive symptoms is negatively associated with cognitive functions. Selective attention and working memory (Landrø, Stiles, & Sletvold 2001; Ballard et al., 2000); verbal fluency (Fossati, Amar, Raoux, Ergis, & Allilaire, 1999); immediate memory (Kizilbash, Vanderploeg, & Curtiss, 2002); and spatial processing and learning (Benedict, Dobraski, & Goldstein 1999), have been found to be negatively impacted by anxiety and depression. A possible explanation for this is that symptoms of anxiety and depression such as fatigue and an inability to concentrate would tend to compromise cognitive performance (Smith 2005). A recent meta-analysis also showed that the presence of anxiety and depressive symptoms can lead to more rapid deterioration from mild cognitive impairment to dementia (Cooper, Sommerlad, Lyketsos, & Livingston, 2015). A functional magnetic resonance imaging study showed that abnormal emotional interference processing in the fronto-limbic brain circuitry of people with depression, affected cognitive performance (Liao et al. 2012). As a result, the presence of anxiety and depressive symptoms leads to excess disability of the cognitive functions. If this excess disability could be eliminated, the cognitive functions could be maximized (Cheung, Chien, & Lai, 2011).

Use of Music for People with Dementia

The use of music interventions for people with dementia (PWD) has grown in popularity in the past two decades. It is thought to be suitable for people with dementia because, even as the cognitive functions decline, receptivity to music and musical memory remains better preserved (Adridge, 2000; Norberg, Melin, & Asplund, 1986; Fornazzari et al., 2006; Cowles et al., 2003). Many studies revealed that music is associated with emotion (Samson, Dellacherie, & Platel, 2009; Juslin, Harmat, & Eerola, 2013), while emotionally arousing stimuli were found consistently remembered better explained by neurological mechanisms (Janata, Tomic, & Rakowski, 2007; Proverbio et al., 2015). Hence, music is often used in reminiscence therapy for PWD (Ashida, 2000; Otera, Horike, & Saito, 2013). From a practical perspective, a music intervention can be delivered flexibly according to the preferences of the participants, and is considered safer than pharmaceutical therapy, with fewer side effects having been reported.

Its effects on the agitation (Lin et al., 2011; Sung, Lee, Li, & Watson, 2012; Ridder, Stige, Qvale, & Gold, 2013; Cooke, Moyle, Shum, Harrison, & Murfield, 2010a); neuropsychiatric symptoms (Raglio et al., 2015; Sakamoto, Ando, & Tsutou, 2013; Raglio et al., 2008); anxiety (Sung, Chang, & Lee, 2010; Sung et al., 2012; Cooke et al., 2010a) and depression (Chu et al., 2013; Sung et al., 2012; Cooke, Moyle, Shum, Harrison, & Murfield, 2010b); and cognitive functions (Chu et al., 2013; Särkämö et al., 2014; Van de Winckel, Feys, & Weerdt, 2004) of people with dementia have been reported. However, most studies have been criticized as being too poor in methodological rigor to make it possible to come a confident consensus on the efficacy of music interventions (Petrovsky, Cacchione, & George, 2015; Vasionytė & Madison, 2013). The flaws in study design include small sample size, threats to the intervention fidelity or assessor biases were not well controlled.

Second, different protocols have been used across studies, making it difficult to draw valid conclusions through systematic reviews or meta-analyses (Ing-Randolph, Phillips, & Williams 2015). These intervention protocols were designed with different dosage (in terms of frequency, duration, length of each session etc.) and modality (e.g. active or passive music intervention; individual based or group-based); delivered by different personnel (e.g. music therapist, nurses, family caregivers, or trained staff); and adopted different philosophies. Most studies did not report whether the intervention protocol was tested in pilots. Thirdly, a narrative synthesis systematic review on music intervention in dementia also concluded that most available studies were not supported relevant theoretical framework (McDermott et al. 2013). It is suggested to develop an intervention with theoretical underpinning and follow the recommendation of Medical Research Council (Craig et al. 2008) on developing complex interventions.

Fourth, unlike agitation in dementia, there are only a few studies have focused on enhancing cognitive functions through a music intervention. Those studies (Chu et al., 2013; Van de Winckel et al., 2004) mainly adopted mini-mental states of examination as an outcome measurement, which is a scale for measuring global cognition only. The effects of music interventions on various cognitive domains have yet to be well investigated. Lastly, inconsistent results for MM on cognitive functions have also been noted (Ueda, Suzukamo, Sato, & Izumi, 2013). There is a need to develop and rigorously test an evidence-based music intervention to promote the cognitive functions of people with moderate dementia.

Music-with-Movement Intervention

A wide variety of music interventions have been used on older adults with dementia, such as listening to music, singing, improvisation, playing musical instruments, discussing music, moving with music, and combining music with other art forms (Sung, Chang, & Lee, 2010; Gerdner, 2000; Gerdner, 2012; Osman, Tischler, & Schneider, 2014; Camic, Williams, & Meeten, 2011; Dassa & Amir, 2014; Eggert et al., 2015; Wigram, 2004; Chu et al., 2013) These music activities may be used alone or in combination; delivered individually or in a group; and conducted in an activity room or at a patient’s bedside. The music to be played during the intervention could be pre-recorded or live. Among various types of music interventions, an active and interactive type of music intervention, music-with-movement (MM) is the most highly recommended for persons with moderate-stage dementia (Gfeller & Hanson, 1995; Hanson, Gfeller, Woodworth, Swanson, Garand, 1996; Sakamoto et al., 2013). Raglio et al. (2015) explained that this approach is better in reactivating and developing the archaic expressive and relational abilities, that promote new learning strategies and improve well-being. Participants may move their gross body muscles with their preferred music, while no movement of the fine motor muscles or verbal ability is necessarily required during the intervention.

This study was a multicenter randomized controlled trial to evaluate the immediate and lasting effects of an evidence-based MM intervention, as compared with music listening (ML) and social activity (SA), on the cognitive functions of nursing home residents with moderate dementia.

Methods

Participants

Inclusion criteria were: those aged 65 or above who had been diagnosed with any type of dementia; at stage 5 or 6 on the Global Deterioration Scale, which indicates moderate dementia; in stable medical condition and able to participate in a music-with-movement intervention; able to understand Cantonese and follow simple directions; and suffering from symptoms of anxiety as screened using the Rating Anxiety in Dementia scale. Excluded from the study were those who disliked group music and social activities, and who had uncorrectable visual and auditory impairments. No music therapy or music interventions were provided in these study sites at least six months before the commencement of this intervention.

A sample size of 156 participants (52 per group) was needed to achieve a power of 0.80 and an alpha level of 0.05 (Cohen, 1988), based on a previous study that found that music-based exercises had a medium effect size on the total mini mental state examination (MMSE) score as compared with conversational activities (Van de Winckel et al., 2004). Through convenience sampling, 165 participants were recruited from 12 residential care facilities in Hong Kong. All of these facilities were publicly funded, and were similar in capacity and in the level of care provided.

Intervention and comparison condition

The MM intervention was developed with reference to the Medical Research Council's (Craig et al., 2008) complex intervention development guide. First, based on the abovementioned theoretical conceptual framework stating the relationship between cognitive functions and depressive and anxiety symptoms, the MM intervention was proposed. A systematic search of the literature (published up to January 2010) on MM interventions for people with dementia was then conducted. Based on a critical analysis of seven articles using the MM approach or an equivalent as part of the intervention (Broton & Pickett-Cooper, 1994; Brotons & Marti, 2003; Van de Winckel et al., 2004; Berger et al., 2004; Sung, Chang, Lee, & Lee, 2006; Tuet & Lam, 2006; Bruer, Spitznagel, & Cloninger, 2007), a preliminary evidence-based protocol was developed for piloting. The movement that was designed was slightly modified after the first pilot study, and the number of sessions was reduced after the second pilot study. The feasibility of the intervention was confirmed in the third pilot study before the protocol was finalized.

The participants in the MM group (4-6 participants in a closed group) listened to their preferred music and moved their limbs and trunk, twice a week for six weeks. Casual conversation among the participants was encouraged. The structure of each session was: 5 minutes for singing a greeting song, 20 minutes for MM activities, and 5 minutes for singing a closing song. The MM activities included: batting balloons, waving ribbons, foot tapping, playing musical instruments (such as hand bells, drums, triangles, etc.), and mimicking movements demonstrated by the interventionist. The participants could freely move their bodies and props without any restrictions. The preferred music was suggested by the family relatives, and carefully assessed throughout the sessions. The pieces of music used were songs that had been popular when participants were young, religious music, and nursery rhymes. The first author served as the interventionist, did not participate in group randomization, and was well trained in delivering the intervention.

The participants in the ML group listened to their preferred music, while the SA group chatted casually, twice a week for six weeks. Two independent, trained research assistants facilitated these two groups. Strategies were applied to ensure consistency of comparison conditions, and adherence to the protocols, including: (1) the use of an activity manual; (2) intensive training and supervision of the facilitators; and (3) regular monitoring of the delivery of the control conditions.

Outcome measurements

Three trained research assistants who were blinded to the group allocation collected the data at baseline (T0), immediately post-intervention (T1, i.e. the sixthth week), and six weeks after the completion of the intervention to determine the lasting effect of the intervention (T2, i.e. the 12th week). They were trained by giving an administration guideline, through discussion and practice with elderly with dementia under the supervision of the principal investigator, in order to reach 90% agreement before collecting data. Overall, it took 23 – 26 hours in training.

Apart from demographic data, six data collection tools were used to measure the outcomes.

1. Rating Anxiety in Dementia Scale (RAID)

   The Chinese RAID (Cheung, 2012) is used to measure anxiety levels in people with dementia over the past two weeks. It consists of 18 items divided into four domains: worry, apprehension and vigilance, motor tension, and autonomic hypersensitivity. Each item is rated on 4-point scale with the total score ranged from 0 – 54, and the scale has good validity and internal reliability (r = 0.91).

2. Geriatric Depression Scale (GDS)

   The original GDS-15 was developed by Sheikh and Yesavage (1986), and was translated into Chinese and validated in Hong Kong. Internal reliability r = 0.92; test-retest reliability r = 0.84 (Lee et al., 1993; Boey & Chiu, 1998). It consists of 15 items of yes/no questions with the total score ranged from 0 – 15, and was used for assessing the depressive symptoms of the participants in this study.

3. Mini-Mental State Examination (MMSE)

   The MMSE (Folstein, Folstein, & McHugh, 1975) is an instrument for assessing global cognitive functions that is widely used in both clinical settings and research. It was translated into Cantonese by Chiu and colleagues (Chiu, Lee, Chung, & Kwong, 1994), and this was the version used in this study. Its internal consistency was r = 0.86; test-retest reliability was r = 0.78.

4. Fuld's Object Memory Evaluation (FOME)

   Fuld's Object Memory Evaluation (Fuld, 1981), which had been translated into Chinese and validated by Chung (2008), was used to assess the short-term memory (total storage and delayed memory) of the participants. It examines the memory storage (possible score: 0-50) and retrieval (possible score: 0-50), delayed recall (possible score: 0-10), and delayed memory (possible score: 0-10). The convergent validity of FOME with MMSE was r = 0.69 – 0.74, while the test-retest reliability was r = 0.92.

5. Modified Fuld Verbal Fluency Test (MVFT)

   Chiu et al. (1997) translated the original Fuld Verbal Fluency Test (Fuld, 1981). The MVFT was used to measure the verbal fluency of the participants. The convergent validity with MMSE was r = 0.76, and test-retest reliability was r = 0.74. Higher scores reflect better verbal fluency.

6. Digit Span Test (DST)

   The DST is a part of the Wechsler Adult Intelligence Scale (WAIS, Wechsler, 1997). It was adopted to assess the participants' attention and immediate recall. The digit span forward reflects the processing of short-term rote auditory memories and attention, and the digit span backward reflects attention and executive function processing. The higher score means better performs.

Ethical considerations

Ethical approval was obtained from the university involved in the study and from the corresponding study sites. Participation in this study was voluntary. An information sheet and a verbal explanation were given to the proxies and eligible participants. Verbal and written consent were sought. Withdrawal at any time was allowed without any penalty. The anonymity of the participants was assured by the aggregation of statistical data and the use of coding.

Statistical analyses

The collected data were entered into SPSS. Multiple imputations were used to replace missing values for analysis, and the intention-to-treat principle was employed in the data analysis. Mixed MANOVA was used to investigate the multivariate between-group effect (GROUP: MM, ML, SA); the within-group effect (TIME: T0, T1, T2); the interaction of group by time (GROUP X TIME) effect on the outcome variables of cognitive functions (global, memory, attention, verbal fluency), anxiety level, and depressive symptoms.

Repeated univariate analysis and pairwise comparisons on variables of the individual groups among three-time points were conducted as a post-hoc analysis after mixed MANOVA.

Results

One hundred and sixty-five participants were recruited in this study. They were residents of 12 residential facilities in Hong Kong. They were randomly allocated into three groups: the music-with-movement (MM, n = 58), music listening (ML, n = 54), and social activity (SA, n = 53) groups by block randomization by an independent research assistant. The CONSORT Statement is shown in Fig 1. The sample was comprised of 40 (24.2%) males and 125 (75.8%) females. The mean age of this sample was 82.27 (SD = 6.96). Over half of the sample (n = 90, 54.5%) had not received any kind of formal education at all. The mean RAID score was 5.75 (SD = 6.77), the mean GDS score was 5.29 (SD = 3.39), and the MMSE score was 12.19 (SD = 4.10). There were no significant differences in demographic and clinical characteristics among three groups at baseline, as shown in Table 1.

It was hypothesized that the effect of the MM intervention would differ from that of the comparison conditions of ML and SA over time on cognitive functions, anxiety, and depressive symptoms. The overall mixed MANOVA analyses showed that no significant interaction of group by time effect (multivariate Pillai F [32,296] = 1.31, $p = .128$, power = .97), and between-group effect (multivariate Pillai F [16,312] = 1.01, $p = .448$, power = .68). However, there was a significant within-group (multivariate Pillai F [16, 147] = 7.61, $p<.001$) effect with a large effect size (partial $\eta^2 = 0.45$) and high power (power = 1.00).

In the repeated measures univariate analysis, there was significant interaction of group by time effects on both the memory storage (F [4,324] = 2.92, p=.021, partial η^2=0.04) and delayed memory variables (F [4, 324] = 3.22, p=.013, partial η^2=0.04) as measured with the Fuld Object Memory Evaluation, and depressive symptoms (F [4, 324] = 2.51,

p=.042, partial η^2=0.03) as measured with the Geriatric Depression Scale. Significant changes in these three outcomes from baseline to T1 were observed in the MM group; a significant change in delayed memory only was seen in the ML group; while no changes in any of these variables from baseline to T1 were evident in the SA group. The results (shown in Table 2) indicated that MM is more preferable than other two groups.

Pairwise comparisons on these variables of the individual groups among three time-points were conducted, and the results are shown in Table 2. The results showed that all cognitive outcomes, with the exception of short-term auditory memory and executive functioning process measured with the Digit Span Test, were significantly changed from baseline to T1 and were sustained for at least six more weeks in the MM group. In the ML group, there was a significant change in global cognitive function and delayed memory from baseline to T1, while there was no significant change in any of the outcome variables from baseline to T1 in the SA group.

Discussion

The results of this study provide some promising directions for future research and testing regarding the effects of MM on the cognitive functions of people with dementia, although the difference in outcomes between groups in this study did not attain the level of statistical significance. In this study, we used a randomized controlled trial to investigate the effects of MM on the cognitive functions of residents with moderate dementia, as compared with ML and SA. To our knowledge, this is the first study to have investigated the effects of MM on specific cognitive domains, while most previous studies adopted other types of music intervention (Choi, Lee, Cheong, & Lee, 2009;

Goka, 2005; Raglio et al., 2010) or measured global cognitive function with MMSE (Van de Winckel et al., 2004; Chu et al., 2013) as the only outcome variable.

Although there was insufficient evidence to conclude that MM was significantly different from ML and SA in enhancing cognitive functions and improving anxiety and depressive symptoms in the overall mixed MANOVA model, the univariate repeated measures analysis as well as the pairwise comparison of the outcomes in the MM group across three time-points revealed new knowledge.

Effects on memory

The results of the pairwise comparison of the MM group across three time-points showed MM may be useful for improving memory storage and delayed memory, and that it lasted for at least six weeks, which was not the case with the SA group. The ML group also demonstrated a significant improvement in delayed memory from baseline to T1. This finding echoed that of previous studies. Bruer et al. (2007) compared listening to music with watching films, and Irish et al. (2006) compared the condition of music with the condition of silence; both found a significant improvement in memory in the music group. However, this is the first study to investigate the effects of an active form of music intervention on memory, and it revealed that MM has a greater effect than ML in improving memory storage (the effect size partial η^2 at T0-T1 of MM was 0.24, i.e. medium, while ML showed no significant effect) and delayed memory (the effect size partial η^2 at T0-T1 of MM was 0.19, while for ML it was 0.14, which indicates a medium effect size). Raglio, Filippi, Bellandi, and Stramba-Badiale (2014) supported the view that an active approach to music intervention is one that is oriented toward aspects related to cognitive rehabilitation, which assists cognitive domains such as memory and speech.

Effects on verbal fluency

Verbal fluency in this study was found to have significantly improved only in the MM group from T0-T1 with a medium effect size (partial $\eta^2 = 0.11$), but not in either the ML or SA groups. Brotons and Koger (2000) and Van de Winckel et al. (2004) also found that an active form of music intervention significantly improved the speech content and fluency of the MM group, as compared with the conversation comparison group. One explanation for this may be that through an active form of music intervention, participants had more opportunities to interact with the other group members or with the facilitator when they were asked to do something together such as playing musical instruments and betting a balloon, which was observed in the MM sessions. Listening to music is a rather more individual activity, which was observed in the ML sessions. Referencing the principle of cognitive stimulation therapy (CST), which at present is the only non-pharmacological therapy recommended by NICE for enhancing cognitive functions (NICE-SCI, 2007), it is affirmed that social interaction is a key component for enhancing cognitive functions (Aguirre, Spector, Streater, Hoe, Woods, Orrell, 2011). Accordingly, MM is recommended over ML for enhancing verbal ability.

Surprisingly, no significant change in verbal fluency was observed in the SA group. Spector, Gardner, and Orrell (2011) suggested that the activities designed in CST furnished topics for communication, and provided a relatively supportive and non-threatening environment to “practice” verbal communication. Therefore, the findings of the current study may indicate that an MM intervention that consists of music, movement, and social elements is preferable to social interaction alone, as the former provides meaningful topics for discussion as well as a more relaxing environment than the latter.

Effects on attention and executive functioning

There was no significant change in attention and executive functioning in all three groups, as measured with the Digit Span Test. There are some possible reasons why MM would not exert an effect on attention and executive functioning; alternatively, the assessment tool Digit Span Test is not sensitive enough to capture the changes. However, to our knowledge, this is the first study to investigate the effects of an active form of music intervention on the attention and executive functioning of people with dementia. In another study using a music-based cognitive intervention (neurological music therapy), an insignificant effect on attention in brain-injured patients was found (Thaut et al., 2009). This study does not seem to support the arousal-and-mood hypothesis that music can enhance people’s level of arousal and, consequently, benefit their processes of attention (Thompson, Schellenberg, & Husain, 2001), further testing is required. In contrast, studies in neuropsychology have found that movement planning is functionally related to spatial attention and visuospatial working memory (Spiegel, Koester, & Schack, 2014); it is therefore suggested that assessment tools for measuring spatial attention and visuospatial working memory be used to capture the repeated stimulating effects of MM interventions.

Effects on global cognition

In the repeated measures univariate analysis, the interaction of group by time effect on the MMSE total score was almost significant (p = .055). In the pairwise comparison between time points of both the MM and ML groups, significant changes were seen from baseline to post-intervention. Without delineating the different music intervention approaches (i.e., singing, listening, moving to music, and improvising as interventions), a meta-analysis of 16 studies showed that the music interventions had no significant effects on cognitive functions measured with MMSE (Ueda et al., 2013). However, there were several limitations to that ever first meta-analysis of the effects on cognition. First, the studies that were included were of various levels of methodological quality. Second, the participants across the studies were too heterogeneous in their characteristics, such as in their stage of dementia. Third, the music intervention across the studies were also too different. Fourth, only the MMSE total score instead of the domain score (e.g., language, orientation, working memory, etc.) was used for analysis, which may have made it impossible to capture and sensitively reflect the changes. Thus, this rigorously designed randomized controlled trial may have an impact on the field.

Effects on anxiety and depressive symptoms

Music interventions are thought to be useful in reducing anxiety, based on the Progressively Lowered Stress Threshold model (Hall & Buckwalter, 1987), the Person-Environment Fit Theory (Lawton, 1982), or just because music provides an interpretable stimuli and can distract the people from stimuli that cause anxiety.

A repeated measures univariate analysis found that there was an insignificant interaction group by time effect on the anxiety symptom variable, which means that MM did not differ from ML and SA in changing symptoms of anxiety. However, a pairwise comparison of anxiety at baseline and at post-intervention showed a significant reduction of anxiety in both the MM group (partial $\eta^2 = 0.39$, large effect size) and the ML group (partial $\eta^2 = 0.01$, small effect size) but not in the SA group. This finding adds to the existing knowledge that music interventions (including both active and receptive types) may be useful in reducing anxiety. Sakamoto et al. (2013) found that interactive interventions led to greater improvements in emotional state than listening to music and receiving the usual care. However, that study was based on individual interventions, while this present study was based on a group intervention. Group MM interventions are preferable because they are more economical. In addition, dementia patients are hindered from interacting with their environment because of their diminished cognitive ability (Kolanowski, Buettner, & Litaker, 2006). Interactive music interventions may make them more able to relate past pleasant memories and communicate with others than receptive music interventions, and lead to a reduction in stress and anxiety symptoms. There have been few studies (Raglio et al., 2015; Vasionytė & Madison, 2013; Sakamoto, Andop, Tsutou, 2013) comparing the effects of different approaches to music interventions, but the subject is worthy of further investigation.

Surprisingly, in this study, only the MM group, and not the ML group, showed a significant reduction in depressive symptoms. It is a rather promising indication that by listening to their preferred music, people with dementia may also experience a reduction in their symptoms of anxiety and depression, although limitations in research methodologies were noted (Chan, Wong, & Thayala, 2011; Petrovsky et al., 2015). Listening to one's preferred music stimulates the auditory cortex and also engages the limbic and paralimbic regions related to the processing of emotions (Brown, Martinez, & Parson, 2004; Blood & Zatorre, 2001). It also affects the mesolimbic structure, which regulates autonomic and physiological responses to rewarding and emotional stimuli (Menon & Levitin, 2005). In addition, music can evoke autobiographic memories and is associated with positive affections (Janata, Tomic, & Rakowski, 2007). In this present study, the change in depressive symptoms from baseline to T1 in the ML group was insignificant, which may indicate that the assessment instrument GDS may not be sensitive enough to measure the depressive symptoms of people with moderate dementia in the Chinese population, although O'Riordan et al. (1990) found it to be suitable. Over half of the sample had no formal schooling, while some of the questions in the GDS are rather abstract. In addition to their cognitive impairment, the answer may not reflect their true feelings. Therefore, in future research, it is suggested that other instruments be used to capture depressive symptoms, such as the Cornell Scale for Depression in Dementia (Alexopoulos, Abrams, Young, & Shamoian, 1988).

Implications and limitations

The results of this research supported the argument that MM and ML may be helpful in enhancing some domain of cognitive functions in residents with moderate dementia. This study involved 165 participants, making it the largest sample size among studies investigating the effects of music interventions over time. The observed power of the overall mixed MANOVA analysis and pairwise comparison tests of individual groups across time-points were all above 0.90, which indicated that the sample was sufficiently large to answer the research question and detect within-group differences in each group, respectively.

The attrition rate of the MM intervention was just 12.3% (48 out of 55 completed the whole program), which is comparable to another group music intervention study that had a 10% attrition rate (Sung et al., 2006). With the attrition rate of other common psychosocial interventions for those with moderate to severe dementia ranging from 6.7% to 20.8% (Boote, Lewin, Beverley, & Bates, 2006), the MM intervention is both a feasible and welcomed intervention. As dementia becomes increasing prevalent in long-term care facilities, this study has provided evidence that the MM and ML interventions are safe and acceptable for enhancing cognitive functions as well as affective states. There is growing evidence that social isolation and loneliness are associated with cognitive impairment and mortality (Shankar, Hamer, McMunn, & Steptoe, 2013; Holwerda et al., 2012; Cacioppo & Cacioppo, 2014).

There are several limitations in this study. Because of the inability to recruit enough participants to make up an additional group – the usual care group, the true efficacy of the MM intervention in enhancing cognitive functions has yet to be determined. Second, the postulation that reducing anxiety and depressive symptoms will enhance cognitive functions could not be confirmed from the analysis. A path analysis could be conducted, but this is outside the scope of this paper.

Despite its limitations, this study offered some insights for long-term care facilities. Physical care is always the major concern in long-term care facilities. However, caring means more than just giving physical assistance to the residents. Instead, care for the elderly should embrace compassion. Any interventions, including MM, ML, and SA, that are free, creative, and joyful may help to improve their overall well-being.

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