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EFFECTS OF LISTENING TO MUSIC BEFORE PHYSICAL EXERCISE ON NEUROPSYCHIATRIC SYMPTOMS IN INSTITUTIONALIZED OLDER PEOPLE WITH DEMENTIA: A RANDOMIZED CLINICAL PILOT TRIAL

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ABSTRACT

Introduction. A combined training using physical exercise and cognitive stimulus with music could assist professionals regarding communication and behavioural approaches with institutionalized people with dementia. Objective. To determine the effects of listening to music before physical exercise on neuropsychiatric symptoms in institutionalized older people with moderate to advanced dementia. Method. A randomized controlled pilot trial was conducted with 17 institutionalized older people with moderate to advanced dementia. The participants were randomized into Training

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with Music Group (TMG) and Training without Music Group (TG). The TMG listened to 20 minutes of researcher-selected music (popular songs from their youth) prior to completing a physical exercise protocol. They performed light exercises with progression of intensity, lasting 40 to 45 minutes per session and mainly focused on maintaining or improving mobility. The TG performed the same exercises, without music. Both individual programs lasted 12 weeks with 1 session per week. The assessments included cardiovascular measures, facial expressions, and the Neuropsychiatric Inventory. Results. A tendency of worsening in heart rate variability after 12 weeks in the TMG was found (p=.065). No significant differences between groups and assessments were found regarding heart rate, heart blood systolic and diastolic pressure values, facial expression, neuropsychiatric symptoms and caregiver burden level. Discussion and Conclusion. Listening to music before physical exercise does not increase positive effects on neuropsychiatric symptoms in institutionalized older people with dementia.
Key words: Aged, Dementia, Neuropsychiatric Symptoms, Physical Exercise, Music.

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INTRODUCTION

Increased longevity brings a higher prevalence of complex and chronic diseases and syndromes, such as dementia (Alzheimer's Association, 2019; Bliss *et al.*, 2021; Prince *et al.*, 2013; WHO, 2019). In the advanced stage of dementia, individuals present more severe cognitive disorders, which result in total dependence, inactivity, need for self-care and deterioration of neuropsychiatric control (WHO, 2019). Neuropsychiatric symptoms, also named Behavioural and Psychological Symptoms of Dementia (BPSD), are usual disturbances along the evolution of dementia, and 90% of the individuals with this syndrome (Bremenkamp *et al.*, 2014) present these symptoms (Alzheimer's Association, 2019; Davies *et al.*, 2016; Edwards *et al.*, 2008; Ekman, 2011; Martin; Velayudhan, 2020; Profyri *et al.*, 2022; Radue; Walaszek; Asthana, 2019; Tang *et al.*, 2017).

Neuropsychiatric symptoms can lead to suffering in people with dementia and in their caregivers, and they need to be controlled. Pharmacological interventions can present negative side effects, such as autonomic dysfunctions, cardiovascular and cerebrovascular events and risk of mortality (Onyike, 2016). In this sense, non-pharmacological interventions strategies are preferably recommended in people with dementia (Aleixo; Santos; Dourado, 2017; Radue; Walaszek; Asthana, 2019).

In a pilot study, institutionalized older people with moderate to severe dementia underwent a seated physical exercise protocol focused on mobility. Improvement in neuropsychiatric dysfunctions, such as anxiety and depression, and stabilization in irritability were found after 12 weeks (Edwards *et al.*, 2008). According to a review, physical exercise training is effective in reducing restlessness and agitation in individuals with Alzheimer disease. However, there is no consensus on the effects of physical exercise in decreasing depressive symptoms in this population (Hernandez, *et al.*, 2011).

Another non-pharmacological method is listening to music, which may provide a decrease in agitation levels in older people with dementia (Jacobsen *et al.*, 2015; Petrovsky; Cacchione; George, 2015). Music memory is partially independent of other memory systems (Hillebrand; Weise;

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Wilz, 2023; Jacobsen *et al.*, 2015; Meyer; O'Keefe, 2020). Thus, music can be a complementary tool in the treatment process and facilitate the relationship between older people and their caregivers.

A systematic review found 17 articles that studied the influence of music interventions on neuropsychiatric factors in institutionalized individuals with dementia at different stages (Van der Steen *et al.,* 2017). The review found little evidence for the effects music-based intervention on emotional well-being. Moderate quality evidence was found in reducing depressive symptoms, and poor-quality evidence was found in anxiety and social behaviour.

There is a need for studies with different protocols involving music to prove neuropsychiatric effects in older people with dementia (Van der Steen *et al.*, 2017), and if listening to music can enhance the effects of physical exercise on BPSD. Music can be important in the adherence to a treatment and it may favour the effects of physical exercise (Mathews; Clair; Kosloski, 2001; Sole *et al.*, 2014).

Most studies have worked concurrently with both interventions and in a group approach (Sole *et al.*, 2014). The improvement on neuropsychiatric factors in people with dementia is also beneficial for caregivers and professionals. There is a lack of studies about the effects of physical exercise with other non-pharmacological interventions on BPSD in institutionalized people with dementia.

There is a need for understanding the benefits of listening to music before a physical exercise protocol in an individualized approach in people with dementia. Still, listening to music prior to physical exercise rather than during can bring positive effects in people with dementia in advanced stages, since they present more difficulty to perform dual task activities and to divide attention (Prince *et al.*, 2013; WHO, 2019). Since musical memory can be preserved even in advanced stages of dementia, a combination of these tools may be effective to maintain or improve neuropsychiatric factors in institutionalized older people with dementia and it may be a mechanism for a better interaction and treatment of this population.

The purpose of this pilot randomized study was to determine the effects of listening to music before physical exercise on BPSD in

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institutionalized older people with moderate to advanced dementia, and to analyse neuropsychiatric disturbances in the sample.

MATERIAL AND METHODS

DESIGN OF THE STUDY

A randomized, two-arm, controlled pilot trial was carried out at the "SIRPHA – Lar do Idoso" nursing home (Campo Grande, Brazil). This study was registered (Brazilian Clinical Trials Registry ID: RBR-5m3s2s) and approved by the UFMS Ethics Research Committee (ID: 135731/2017). All the participants were informed about the assessments and interventions and they were provided a written informed consent.

SAMPLE AND RANDOMIZATION

Eligible participants were institutionalized older adults aged 60 years old and older, with diagnosis of dementia. The inclusion criteria were diagnosis of moderate or advanced-stage dementia, according to the Clinical Dementia Rating (CDR), and availability to participate in the proposed assessments and interventions. The exclusion criterion was mild-stage dementia (CDR).

The participants were randomized into two groups (named Training with Music Group [TMG] and Training without Music Group [TG]) using a computerized random-number generator, with blocks of fixed size (Ekman, 2011) According to the randomization sequence, each participant corresponded to an opaque and sealed envelope, numbered in order, which contained a card stating which group the participant would be allocated to. Randomization was carried out by a researcher not affiliated with the study. The envelopes were opened after the first evaluation.

ASSESSMENT

The participants were assessed at baseline and after 12 weeks of training, preferably at the same time of day in both assessments, by two

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trained researchers who were blind to the intervention. The tests were applied in an environment with minimal visual and auditory stimuli. All the instructions were explained to the participants in a simple, clear and objective way.

Clinical and sociodemographic data were collected at baseline from the participants' medical records and interviews with the nursing team responsible, including age, gender, literacy, marital status, use of medications, presence of diseases, time of institutionalization and type of dementia. The CDR was used to classify the stage of dementia (Macedo Montaño; Ramos, 2005).

Cardiovascular data were collected to indirectly monitor agitation levels and physiological changes related to behaviour. The assessment consisted of blood pressure (BP), heart rate (HR) and heart rate variability (HRV). Systolic BP (SBP) and diastolic BP (DBP) were measured using an aneroid sphygmomanometer and a stethoscope over the brachial artery. HR and HRV were measured by palpation of the radial artery during 60 seconds and the Cardioemotion cardiovascular biofeedback device. The HRV is described as oscillations of intervals between consecutive heart beats (RR intervals) and is an indicator of autonomic nervous system functions (Vanderlei *et al.*, 2009). The Cardioemotion device gives a grade for performance and percentages of training state, in which the red, blue and green colours are related from worst to best performance of HRV, respectively. For data collection, non-invasive sensors were placed on the fingers (over the 2nd or 5th distal phalanx) or ear lobe. Data were guided to a computer program that evaluated HRV during 5 minutes (Gomes; Fábio Coghi; Fernandes Coghi, 2014).

Furthermore, facial expressions and the Neuropsychiatric Inventory (NPI) were collected. Facial expressions were recorded using representative figures of emotions to verify perceived mood by person observation during the participants' routine activities, according to Ekman (2011). The assessments were conducted at baseline and after 12 weeks. Facial expressions were categorized by the researchers according to their emotion representations as positive (satisfied, funny, joyful, laughing, admired and surprised), neutral (serious, disdain, worried, down and

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alert) and negative (indignant, angry, aversive, disgust, disgusting, melancholic, restless, afraid, terror, sad, afflicted and shock) (Ekman, 2011). The modification of categorization groups was analysed according to maintenance and evolution along time (kept, improved, worsened and changed facial expression but remained in the same categorization group). The assessors and researchers were trained before data collection to standardize the categorization.

The NPI was answered by the nursing staff responsible for each participant. The NPI assesses frequency and severity of BPSD and level of caregiver burden using a 5-point scale (Camozzato *et al.*, 2008; Musa *et al.*, 2017). The results regarding neuropsychiatric disturbances and level of burden were summed to obtain final scores.

INTERVENTION

The individual programs lasted 12 weeks and included 1 session per week. Trained students of Physical Therapy implemented the interventions, with supervision of a physical therapist. The sessions were applied individually in an environment with minimal visual and auditory stimuli.

The participants of the TMG listened to 20 minutes of previous researcher-selected music (popular songs from their youth) delivered through a headset with the aim of stimulating memories. After this, they performed a set of light exercises with progression of intensity, lasting 40 to 45 minutes per session and mainly focused on maintaining or improving mobility. The sequence of physical exercises included rotational shoulder movements, wrist flexion/extension, elbow pronation/supination, elbow flexion/extension, shoulder horizontal adduction/abduction, shoulder flexion (elevation of and object), paddling, shoulder adduction/abduction, shoulder internal/external rotation, hip adduction/abduction, static gait, knee extension/flexion, dorsi/plantar flexion, circular ankle movements and neck stretching (Sole *et al.*, 2014).

The progress of intensity happened every three weeks by increasing active movements, adding motor/cognitive tasks linked to functional

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activities and increasing multiarticular and complex movements and stimulating orthostatism and gait.

The TG performed the same set of physical exercises, without the previous stimulus with music.

STATISTICAL ANALYSIS

For analysis, a significance level of $\alpha = 0.05$ and the SPSS software were used (version 18.0; SPSS, Chicago, IL, USA) to run the tests. Initially, a descriptive data analysis was done to identify neuropsychiatric disturbances. The analysis was carried out by intention to treat. Data normality was tested by the Kolmogorov-Smirnov test. To compare the groups regarding clinical and sociodemographic characteristics, the Student's t test for independent samples and the Chi-square test were used.

The MANOVA test was carried out to verify differences between groups and assessments, and the interaction between these two factors. If a significant interaction was identified, analyses of simple main effects were done. Furthermore, the Chi-square test was used to verify differences between groups and assessments regarding facial expressions of the participants.

The sample size of this pilot study was calculated using the G*Power 3.1 software. Assuming a statistical power of 80%, an effect size of 0.40 and an alpha of .05, a minimum of 16 subjects would be needed for the total sample.

ETHICAL CONSIDERATIONS

This study was registered (Brazilian Clinical Trials Registry ID: RBR-5m3s2s) and approved by the x Ethics Research Committee (ID: 135731/2017). All the participants were previously informed about the assessments and interventions and they were provided a written informed.

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RESULTS AND DISCUSSION

We included 17 institutionalized older people with dementia in moderate and advanced stages, with mean age of 79 years old. The sample loss was one person from the TMG, who died at the beginning of the intervention period (Figure 1).

There was a mean participation in interventions of 87.9% in the TMG and of 89.5% in the TG in the proposed interventions. Abstention occurred when the participant refused to participate in at least two attempts on the same day. No adverse effects from the interventions were reported.

There were no significant differences between groups relating to clinical or sociodemographic characteristics (Table 1).

Figure 1 - Recruitment and randomization flowchart of participant

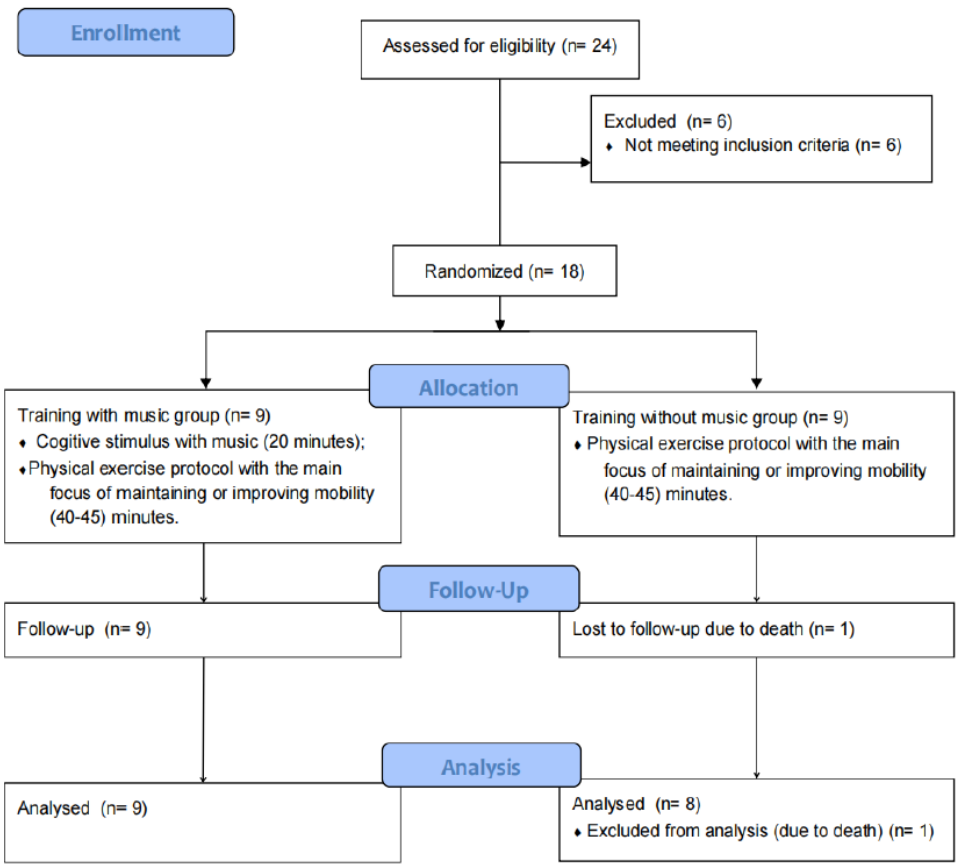

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Table 1 - Descriptive data of the sample

Characteristics	TMG (n=09)	TG (n=08)	P value
Age, years, M±SD	79.6±9.3	79.0±12.6	0.918
Female gender, n (%)	5 (55.6)	3 (37.5)	0.457
Literate, n (%)	6 (66.7)	3 (37.5)	0.229
Marital status, n (%) Single Married/stable union Divorced Widower	 4 (44.4) 2 (22.2) 0 (00.0) 3 (33.3)	 4 (50.0) 0 (00.0) 1 (12.5) 3 (37.5)	0.399
Total of medications in use, M±SD	3.7±2.7	5.0±2.7	0.290
Total of diseases, M±SD	2.3±1.5	3.2±1.5	0.226
Hypertension, n (%)	3 (33.3)	4 (50.0)	0.486
Diabetes, n (%)	1 (11.1)	2 (25.0)	0.453
Time of institutionalization, years, M±SD	2.1±1.9	3.0±1.6	0.317
Type of dementia, n (%) Senile Non-specified Alzheimer disease	 4 (44.4) 5 (55.6) 0 (00.0)	 2 (44.4) 5 (55.6) 1 (00.0)	0.446
CDR, n (%) 2 3	 6 (66.7) 3 (33.3)	 6 (75.0) 2 (25.0)	0.707

TMG=Training with Music Group, TG=Training without Music Group, M±SD=Mean±Standard Deviation, n (%)=number of participants (percentage), CDR=Clinical Dementia Rating

Regarding HRV measures, a significant interaction between factors was found in percentages of blue and red states. After analysis of simple effects, we verified a non-significant tendency of worsening in HRV performance between assessments in the TMG. No significant interactions between groups and assessments were found regarding heart rate, blood pressure, other variables from HRV (green state and grade), neuropsychiatric disturbances and level of burden, as assessed by the NPI. There was no significant main effect of groups and assessments on these variables (Table 2).

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Table 2 - Cardiovascular and behavioral outcomes

Variables, M±SD	TMG (n=09)		TG (n=08)		P value Group* Assessment	P value Group		P value Assessment	
	Baseline	12 weeks	Baseline	12 weeks		Baseline	12 weeks	TMG	TG
Heart rate	77.8±14.2	77.2±10.4	79.5±12.3	82.7±6.4	0.572	0.424		0.708	
Blood pressure									
Systolic	117.2±12.0	118.3±17.3	125.0±10.6	118.7±17.2	0.458	0.446		0.602	
Diastolic	70.5±6.3	71.1±9.2	71.8±7.5	75.0±13.0	0.633	0.490		0.496	
CardioEmotion									
Grade	1.8±0.6	1.2±0.7	1.4±0.7	1.8±0.8	0.065	0.555		0.744	
% Red	67.5±10.4	77.7±12.6	73.3±10.1	66.3±14.7	**0.045**	0.263	0 .107	0.077	0.240
% Blue	28.8±7.7	20.1±11.4	23.8±7.2	28.8±13.1	**0.046**	0.190	0 .162	0.061	0.294
% Green	3.5±3.5	2.1±2.3	2.7±5.0	4.6±3.0	0.176	0.521		0.856	
NPI D (FxS) Level of burden	 17.5±9.0 4.2±4.8	 19.2±10.8 3.6±3.8	 22.6±14.0 2.5±5.2	 20.2±14.6 5.5±8.3	 0.645 0.389	 0.470 0.978		 0.935 0.551	

TMG = Training with Music Group, TG = Training without Music Group, M ± SD = Mean ± Standard Deviation, n = number of participants, NPI = Neuropsychiatric Inventory, D (FxS) = Disturbances (frequency x severity)

Regarding facial expression outcomes, both groups had a predominance of neutral expressions at baseline. The TMG had a predominance of changing facial expression but remaining in the same categorization group along time. The TG had a predominance of worsening according to categorization groups along time. Nevertheless, there were no significant differences between groups and assessments in facial expression variables (Table 3).

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Table 3 - Facial expression outcomes

Variables, n (%)	TMG (n=09)		P value	TG (n=08)		P value	P value Group	
	Baseline	12 weeks	Assessment	Baseline	12 weeks	Assessment	Baseline	12 weeks
Register								
Serious	2 (22.2)	2 (22.2)		1 (12.5)	2 (25.0)			
Indignant	0 (0)	0 (0)		1 (12.5)	0 (0)			
Angry	1 (11.1)	0 (0)		0 (0)	0 (0)			
Disdain	1 (11.1)	0 (0)		1 (12.5)	0 (0)			
Satisfied	1 (11.1)	0 (0)		0 (0)	0 (0)			
Down	0 (0)	2 (22.2)	0.131	3 (37.5)	2 (25.0)	0.191	0.379	0.391
Alert	3 (33.3)	2 (22.2)		2 (25.0)	0 (0)			
Surprised	1 (11.1)	0 (0)		0 (0)	0 (0)			
Admired	0 (0)	1 (11.1)		0 (0)	0 (0)			
Worried	0 (0)	1 (11.1)		0 (0)	0 (0)			
Melancholic	0 (0)	1 (11.1)		0 (0)	2 (25.0)			
Categorization								
Negative	1 (11.1)	1 (11.1)		1 (12.5)	4 (50.0)			
Neutral	6 (66.7)	7 (77.8)	0.369	7 (87.5)	4 (50.0)	0.285	0.363	0.168
Positive	2 (22.2)	1 (11.1		0 (0)	0 (0)			
Modification of categorization[a]								
Kept	1 (11.1)			2 (25.0)				
Improved	2 (22.2)		-	1 (12.5)		-	0.379	
Worsened	2 (22.2)			4 (50.0)				
Changed[b]	4 (44.4)			1 (12.5)				

TMG=Training with Music Group, TG=Training without Music Group, n (%)=number of participants (percentage), [a]Modification of categorization groups along time, bChanged facial expression, but remained in the same categorization group.

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The present study aimed to determine the effects of listening to music before physical exercise on BPSD in institutionalized older people with dementia. In general, the physical exercise trainings previously submitted or not with music did not present significant differences in BPSD variables in the sample after 12 weeks. Cardiovascular data, BPSD, level of burden and facial expression outcomes maintained their performance after the interventions in both groups.

Most of the sample was female and the mean age was 79 years old. Increased longevity brings a higher prevalence of complex and chronic diseases and syndromes, such as dementia (Alzheimer's Association, 2019; World Health Organization, 2019). In the sample, the types of dementia found were senile, non-specified and Alzheimer disease. Senile and non-specified dementia are inconclusive diagnoses linked by the presence of symptoms associated with aging and they are usual in nursing homes (Alzheimer's Association, 2019; Parmera; Nitrini, 2015).

At baseline, the sample presented a considerable frequency and severity of BPSD using the NPI (Camozzato *et al.*, 2008) and a higher predominance of neutral facial expressions (serious, disdain, worried, down and alert). Baillon *et al.* (2019) did not find significant differences in the NPI scores between people with Alzheimer disease in early- versus late-onset, who scored 12.75 and 6.88, respectively. However, a worse NPI performance was seen in the Early-onset Group. The present study assessed older people with moderate to advanced dementia, which can explain the high NPI in both groups.

At baseline, the sample presented a mean HR between 77 and 79 bpm, SBP between 117 and 120 mmHg and DBP between 70 and 71 mmHg. Dias *et al.*, (2013) traced the clinical profile of older people with dementia (mean age of 71 years old). The prevalence of hypertension arterial systemic was 63%, the mean HR was 70.4 bpm and the mean SBP and DPB values were 146.4 mmHg and 80 mmHg (Dias *et al.*, 2013) The increase of BP is a risk factor for dementia (Alzheimer's Association, 2019). Our sample was composed of institutionalized older people with moderate and advanced dementia, whose profile is characterized by a sedentary lifestyle (Dias *et al.*, 2013), which can justify the BP values.

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Cardiovascular data were verified to monitor the physiological effects of the intervention linked to neuropsychiatric factors. In the present work, maintenance of cardiovascular data was found in both groups after 12 weeks. Regular and frequent practice of physical exercise can alter hemodynamics, stabilize BP and HR and increase HRV, which is a signal of good physiological adaptation (Cornelissen; Smart, 2013; Monteiro; Sobral Filho, 2004; Gomes; Fábio Coghi; Fernandes Coghi, 2014). Ferreira; Rodrigues e Soares (2017) found an increase in HRV in middle-aged and older adults without dementia after an 8-week aerobic training with higher intensity. Therefore, the low intensity of physical exercises regarding percentage of HR was probably not able to generate major changes in cardiovascular data in this work. A decrease in HRV is associated with a high rate of associated diseases such as hypertension, diabetes, depression and dementia due to declining homeostasis and autonomic dysfunction (Ferreira; Rodrigues; Soares, 2017).

In the TMG, there was a non-significant worsening in HRV performance between assessments. The modulation of HRV is related to the autonomic nervous system, which can be affected by emotional processes, such as listening to music. Pleasant music is able to raise HR and decrease BP by autonomic modulation and consecutively influence on HRV values (Davies *et al.*, 2016; Monteiro; Sobral Filho, 2004). Further studies involving music interventions in longer periods are needed to understand their influence on HRV.

In the present study, the BPSD (frequency and severity of neuropsychiatric disturbances and level of caregiver burden related) were similar between groups and both maintained their performance after 12 weeks of intervention. According to a systematic review, there is little evidence for the effects of music-based interventions on agitation levels in institutionalized older people with dementia (Van der Steen *et al.*, 2017). On the other hand, previous studies that worked with music interventions applied by a qualified music therapist, differently from our study, demonstrated effectiveness in reducing BPSD (Abraha *et al.*, 2017; Dimitriou *et al.*, 2018). Thus, changing the music intervention associated

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with other non-pharmacological interventions such as physical exercise may obtain better results on BPSD.

In a non-randomized controlled trial, 12-week moderate-intensity physical exercise training with three sessions per week improved depression and anxiety in 36 institutionalized older people with moderate and severe dementia (Edwards *et al.*, 2008). Our findings did not indicate significant differences between groups, which were submitted to the same physical exercise protocol. A systematic review (Forbes *et al.*, 2015) did not find clear evidence about the effects of physical exercise on BPSD, but it suggests physical exercises with high intensity and volume to maintain functionality and BPSD. Functional and symptoms maintenance is essential for the quality of life of older people with dementia and their caregivers (Onyike, 2016). More randomized trials comparing different volumes of physical exercise and music interventions are needed in institutionalized older people with dementia.

There were no significant interactions and differences in facial expressions between groups and assessments. However, the TMG presented a tendency to remain in the same categorization group and the TG presented a tendency to worsen facial expressions after 12 weeks. Music was an important instrument to improve adherence to the intervention and to maintain facial expressions (Delfino *et al.*, 2017; Meyer; O'Keefe, 2018). Language and communication impaired by dementia hinder social interaction and care (Delfino *et al.*, 2017; Meyer; O'Keefe, 2020; Sole *et al.*, 2014). Facial expressions can be used to assess BPSD, communication and general state of health (Delfino *et al.*, 2017). Sole *et al.* (2014) also analysed facial expressions of older people with dementia during sessions of music intervention. They found decreased expressions of anger and joy in older people with moderate stage of dementia and increased expression of anger in older people with advanced stage of dementia (Sole *et al.*, 2014).

We acknowledge that our findings can have been influenced by the choice of standardized and popular songs from the participants' youth. For a better understanding of neuropsychiatric effects, we decided to standardize the songs, which were remarkable for their time and probably

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stimulated memories. Perhaps, an individualized selection of songs that bring positive memories can lead to more satisfactory results. The same selection of songs could promote positive memories for one person and negative memories for another Garrido *et al.*, (2018), which could have influenced our findings. There is a need for more studies involving different choices of songs and profiles of older people with dementia for a better understanding of the effects of music interventions on BPSD.

Despite its innovation, this pilot study has some limitations, including its low sample size and low frequency of interventions. Future research involving a third group without any proposed intervention, a larger sample size and interventions with more sessions is needed for a better understanding of the effects of physical exercise and music interventions on symptoms of dementia. The use of non-pharmacological interventions, such as physical exercise and listening to music, may be employed to maintain BPSD in people with moderate to advanced dementia. The low cost of these interventions may also provide a new approach for health and care professionals (Mathews *et al.*, 2001; Sole *et al.*, 2014; Van der Steen *et al.*, 2017). Dementia is a clinical condition whose neurodegenerative symptoms are progressive. there is a decline in neuropsychiatric disorders as dementia progresses. The result of this research indicates that physical exercise is able to maintain function.

CONCLUSION

In conclusion, listening to music before physical exercise does not increase positive effects on BPSD in institutionalized older people with moderate to advanced dementia. Physical exercise is able to stabilize BPSD in older people with moderate to advanced dementia. Given the exacerbation of BPSD along the evolution of dementia, this stabilization can be a positive finding in advanced stages of dementia.

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