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Title: Effects of a dance program on psychophysiological variables in hospitalized patients with depression: A mixed model approach

Abstract

This study intended to examine the effects of two programs, pharmacological treatment vs. pharmacological treatment + Dance Program (DP), on the perception of self-efficacy, depression, and heart rate variability (HRV) in hospitalized patients with major depressive disorder (MDD); The primary caregiver's perception was also considered and recorded. The sample consisted of 27 patients (pharmacological = 14 and pharmacological + DP = 13) who were admitted to the IMSS Psychiatric Hospital, with a diagnosis of MDD. There was a significant increase in the perception of self-efficacy in the pharmacological + DP group after treatment ($Z = 3.19$, $p < .01$), but not in the pharmacological group ($Z = .126$, $p > .01$). Regarding depression, a greater decrease was found in the pharmacological + DP group. In HRV there were differences only in heart rate, showing a reduction due to the impact of the time factor and the time and group factor. As for the results of the interview with primary caregivers, their perceptions indicate that dance is

an activity that can fortify the recovery process of their family members. In conclusion, a dance program of moderate to vigorous intensity in conjunction with pharmacological treatment reduces depressive symptoms and increases the perception of self-efficacy, resulting in a greater benefit for the recovery of depressive patients. Similarly, the primary caregivers involved in this study highlighted the importance of the dance program as an option to support the standard treatment of depression.

Keywords: dance program, depression disorder, self-efficacy, heart rate variability, primary caregiver.

Introduction

Physical exercise is an effective tool for health promotion and preventing health conditions caused by sedentary lifestyles. It also balances mood swings, generates psychological and emotional well-being, reducing high rates of morbidity and increasing the well-being of those who suffer a mental disorder (Bustamante-Sánchez & Del Coso, 2020; Iglesias et al., 2015; Marques et al., 2020; Murri et al., 2019; Pascoe et al., 2020; Piercy et al., 2018; Rebar & Taylor, 2017).

Depression is a mood disorder that manifests itself as a state of emotional exhaustion and unhappiness that may be transient or permanent (National Institute of Mental Health [NIMH], 2021). According to the World Health Organization (World Health Organization [WHO], 2017) approximately 322 million people suffer from depression and 800,000 commit suicide each year, making

this the second cause of death in individuals between the ages of 15 and 29. Depression has a high socioeconomic cost of up to 1 trillion USD a year and according to WHO this could double by 2030.

The consequences of this disorder affect not only the people who suffer from it but also the primary caregivers (Arias-de la Torre et al., 2018). In Mexico, family members frequently play the role of the primary caregiver and data suggests that are more likely to live with the patient showing high levels of caregiver warmth and support (Guerrero-Nava et al., 2016). In the same vein, the primary caregiver is identified as the main family member who provides basic assistance to patients according to the chronic disease condition, in which he/she is continuously providing support and assumes the main decisions about care. In addition, the primary caregiver is not only responsible for the basic needs of the patient but also for the emotions of both the patient and the caregiver (Guerrero-Nava et al., 2016; Izquierdo, 2004).

Different types of depressive disorders constitute a serious public health issue and are highly relevant in Mexico when considering Disability-Adjusted Life Years (DALY). The National Institute of Statistics and Geography (INEGI, in Spanish) reports that 29.9% of citizens suffer occasional depression from the age of 12, while 12.4% experience recurrent depression. These figures identify depressive disorders as the main cause of deterioration of women's quality of life and it is the ninth cause in men (Medina et al., 2016). The economic impact of depression during 2005–2013 showed an 88% increase in total cost. In the first year of this period the cost was 11,093,860 USD and in the last year it increased to 20,961,357 USD (Arredondo et al., 2018).

On the other hand, depressed people generally have low levels of perception of self-efficacy (Janko & Smeds, 2019; Wang et al., 2019; White et al., 2009). Self-efficacy has been defined as people's beliefs about their abilities to face different situations, generating strategies and skills to overcome them (Bandura 1989).

The perception of self-efficacy plays an important role in developing functional skills in the daily life of individuals with Major Depressive Disorder (MDD) (Milanovic et al., 2018). However, there is a scarcity of studies focusing on the enhancement of self-efficacy or how it is linked to exercise or physical activity in individuals diagnosed with MDD (Craft & Perna, 2004). There is indeed a need for more research aimed at obtaining evidence regarding the link between improved perception of self-efficacy and exercise or physical activity (Craft, 2005). Pinniger et al. (2013) reported that a tango dance program lasting 40–50 min per session in people with depression increased levels of self-efficacy. Similarly, a systematic review offering an overview of the effects of dance interventions on aspects of the "self" in a population of youth and adults argued that moderate to vigorous dance and music interventions could strengthen self-expression, general self-efficacy, and self-esteem in different age groups (Schwender et al., 2018).

Bennie et al. (2020) state that public health programs should support aerobic exercise as a key lifestyle modification strategy for depression. Likewise, Muller et al. (2017) concluded that physical exercise with music that has a dance pattern of repetitive steps induces greater neuroplasticity in the brain in the elderly population and it is an additional element to help counteract some mental disorder symptoms.

In line with this, Maiese (2018) suggests that expressive art interventions, such as music and dance movement, should be considered as auxiliary treatments in different mental problems such as depression and anxiety since they promote an environment of group belonging and cohesion. For this reason, mental health promotion policies should include physical activity and preferably exercise with music for early prevention or treatment of depressive symptoms (Marques et al., 2020; Teychenne et al., 2020).

A study conducted by Sivvas et al. (2015) stated that dance programs not only help to improve and preserve physical health but also can be of benefit when it comes to aspects related to mental health such as decreasing stress levels, depression and factors that impede the socialization of an individual.

Along the same lines, the results obtained by Carvalho De Melo et al. (2018) concluded that the regular practice of dance can be considered as a therapeutic tool that provides psychological and social benefits in elderly. Thus, various dance practices can be applied in a participatory process to strengthen the patient's sense of well-being and minimize suicidal thoughts generated by this disorder or by external triggers (Pylvänäinen & Lappalainen 2018).

Likewise, Akandere and Demir (2011), concluded that the effects of a 12 week dance program on depression levels had a positive impact by significantly reducing depressive symptoms.

A qualitative study that analyzed the relationship between depression, social isolation and dance program concluded that the participants developed a sense of belonging and group identity (Murrock & Graor, 2014). Their dance intervention, focusing on a sample of older adults, significantly reduced depressive symptoms and increased the integration of those who practiced it.

Also, Taylor (2010) asserted that depression is a risk for both the onset of cardiovascular disease (CVD) and increased morbidity in those who already have it because depressed patients present autonomic dysfunction, a high heart rate, and low heart rate variability (HRV). Although little is known about HRV in subgroups with depression a relationship between sympathetic dysfunction and depressive disorder has been found (Rottenberg et al., 2007).

Similarly, Liu et al. (2018), demonstrated that exercise exerts a protective effect against arrhythmias and allows a balance in HRV, achieving an adequate autonomic nervous system function in older adults with depression. Likewise, O'Regan et al. (2015) claim that antidepressant treatments can help to obtain a decrease in HRV in a population with depression.

Although previous studies have provided evidence of the benefits of exercise with music or a dance program on depression, few of them relate it to self-efficacy and HRV in hospitalized patients with depressive disorder. It has also not been possible to locate any study that has implemented a Dance Program (DP) in hospitalized patients with depression in Mexico.

For this reason, the main objective of this research was to examine the effects of pharmacological treatment vs. pharmacological + DP on the perception of self-efficacy, depression, and HRV in hospitalized patients with MDD; the primary caregiver's perceptions were also considered and recorded.

Method

Participants

The sample consisted of 27 patients ($M_{age} = 29.89$; $SD = 9.27$; 18-51 years) divided into two groups: 14 patients with pharmacological treatment; and 13 patients with pharmacological treatment + DP. Both groups were admitted to the Regional Psychiatric Hospital of the Mexican Institute of Social Security (IMSS, in Spanish) in Monterrey, Nuevo Leon. The patients had a clinical record and a diagnosis of MDD without psychotic symptoms. Among the activities provided by the hospital, the patients had psychological and occupational therapy once a week. Patient selection was made with the diagnosis of the psychiatrist in charge of the hospitalization process that occurs within the first three days of the patient's admission.

In addition, 21 primary caregivers were included (pharmacological = 11 and pharmacological + DP = 10). The pharmacological group was composed of individuals who were mothers (90%) and husbands of patients (10%); while the pharmacological + DP group was composed of individuals who were either mothers (78%), husbands (11%) or fathers of the patients (11%). Finally, 20% of the primary caregivers in the pharmacological group had a history of depressive episodes, a situation similar to pharmacological + DP group with a percentage of 22%.

The inclusion criteria for the pharmacological group were individuals of both sexes, who were not recurrent patients, aged between 18 and 65 years, and with a diagnosis of MDD without psychotic symptoms. In addition to the above, in the pharmacological + DP group, the psychiatrist's approval was taken into account to allow participation of the patients in the dance program. Participants should not present any motor limitation and during the sessions they had to be able to maintain a heart rate (HR) between 65-85% to comply with the desired intensity.

All the patients and primary caregivers who participated provided written informed consent and had the approval of the psychiatrist in charge. Sociodemographic data are presented in Table 1.

Table 1
Sociodemographic characteristics of patients in both groups

	Pharmacological <i>n</i> = 14 <i>n</i> (%)	Pharmacological + DP <i>n</i> = 13 <i>n</i> (%)
Sex		
Female	14(100)	11(85)
Male	0	2(15)
Marital Status		
Single	7(50)	10(77)
Married	7(50)	3(23)
Socioeconomic Level		
D + (Medium Low)	6(43)	8(62)
D (Low High)	8(57)	5(38)
Pharmacological Treatment		
Fluoxetine	3(21)	5(39)
Citalopram	6(44)	2(15)
Sertraline	1(7)	1(8)
Paroxetine	2(14)	3(23)
Venlafaxine	2(14)	2(15)
Family background		
Denied Depression	12(86)	11(85)
Mother/Depression	1(7)	2(15)
Both Parents/Depression	1(7)	0

Ethical aspects

The sample diagnosed by the psychiatric specialists of the IMSS provided informed consent for participation according to the IMSS appendix with code No. 2810-009-013, the aspects of confidentiality of the data, willingness, and possibility of dropping out of the program with no distinction between gender, race, or sexual orientation were clearly stated and explained to the participants.

Psychological assessment instruments

The perception of self-efficacy, was measured by means of a self-report through the General Self-Efficacy Scale (GSE) (Baessler & Schwarzer 1996) adapted to Spanish (Padilla et al., 2006), focused on behavior, task performance and emotion. The scale presents adequate reliability ($\alpha = .87$).

The Beck Depression Inventory (BDI) (Beck et al., 1961), standardized by Jurado et al. (1998), was administered in the context population to measure the level of depression. It consists of 21 items with adequate reliability ($\alpha = .87$).

Semi-structured interview for primary caregivers

Two questionnaires were used as a basis to develop the semi-structured interviews: Beck's Test and General Self-efficacy, adapting them to the perception that the primary caregiver had of the patient. For this, two introductory questions were generated focusing on the primary caregiver's perception about depressive symptoms and the patient's self-efficacy at two different times; when the patients were admitted to the hospital and before being discharged from the hospital.

Heart Rate Variability Assessment

HRV and exercise intensity monitoring was performed with the Polar Team 2 device, with a Wear Link wrist Polar band (Polar Electro OY, Kempele, Finland) located at chest level. The data analysis was carried out with Kubios computer software, version 2.2 University of Kuopio, Kuopio, Finland (Hernández-Cruz et al., 2017).

Procedure

Initially, authorization was obtained from the IMSS Regional Delegation of the Regional Psychiatric Hospital to get the permission to use the facilities of the hospital. Several meetings were held with the management team and medical staff of the hospital in order to establish the appropriate way to develop the intervention program ensuring that all guidelines and regulations of the hospital were respected.

Before collecting data on the pharmacological group, a pilot assessment was performed for approximately a week to become familiar with the hospital environment and adapt to the internal psychiatric hospital processes. Data from the pharmacological group were collected in the first three months; the study participants completed the depression and self-efficacy questionnaires on admission. An HRV test that lasted 10 min was carried out in a sitting position at the beginning and once again after discharge from the hospital. For the pharmacological + DP group, patients admitted after the fourth month were selected using the same recruitment process as the pharmacological group. The difference was that in addition to the questionnaire and HRV, they participated in a dance program offered during the week. The time it took the patients to complete the questionnaires and finish the DP session was between 50 to 60 min.

Qualitative data were collected by means of a semi-structured interview carried out at the psychiatric hospital in the waiting room. The primary caregivers (11 patients from the pharmacological group and 9 from the pharmacological + DP group) were approached in two moments, at admission and at discharge from hospitalization.

The pharmacological group was informed that once the intervention with the pharmacological + DP group had ended, they could access the same dance protocol.

Dance Program

The intervention lasted approximately 6-8 days, according to the maximum average hospitalization of a depressed person in the psychiatric hospital. A certified dance instructor led the sessions, which has a duration of 50 min. The dance program was carried out from Monday to Friday (except for Saturdays, Sundays, and holidays); each session had a three-phase structure: initial, central, and final. The initial phase focused on joint mobility and warm-up, where a greeting and body activation process were presented with soft musical rhythms (ballads and pop). The intensity executed in this phase was mild (up to 65% of the expected heart rate). In the core phase, movements were developed according to the different Latin rhythms such as merengue, Cuban salsa, bachata, cumbias, and reggaeton at desired intensities from moderate to vigorous exercise (65-89% of the expected heart rate).

In the final phase, the certified dance instructor provided the patients with the opportunity to dance alone, in pairs or freely, to conclude with a body stretch. In this phase, the intensity level was less than 65% of the expected heart rate.

Statistical analysis

Information processing was implemented using SPSS version 25 and dynamic tables in Excel. To compare the psychophysiological variables performed before and after, these were analyzed using non-parametric tests. For related samples, the Mann-Whitney U test was used; for independent samples, the Wilcoxon test. In both tests, the significance level $p < .05$ was estimated, and the effect size was calculated with Cohen's d . When analyzing the impact of the intervention programs (pharmacological and pharmacological + DP), repeated-measures ANOVA was used in each psychophysiological variable.

For the analysis of qualitative data on the perspective of primary caregivers before and after an intervention program (pharmacological and pharmacological + DP), a content analysis technique was used (Díaz, 2018), using ATLAS.ti 5 qualitative data analysis software.

Results

Quantitative results

Psychophysiological variables were assessed by using the Mann-Whitney U test to determine the equivalence of the groups before the intervention programs; no significant difference was found ($p > .05$).

When groups were compared after the intervention programs, it was found that the group with pharmacological treatment presented a lower perception of self-efficacy and a greater score of depression than the group with pharmacological treatment + DP ($U = 148, p < .01$; $U = 7.50, p < .001$). These differences show a medium and large effect size, respectively. In general, the perception of

self-efficacy explained 50% of the total variance, while the intervention program explained 84% of the total variance of the difference in depression.

The Wilcoxon test was used to carry out intragroup comparisons, contrasting the before and after treatment in each group. Regarding the perception of self-efficacy, there was a significant increase after treatment in the pharmacological + DP group ($Z = 3.19$, $p < .01$), but not in the pharmacological group ($Z = .126$, $p > .05$). Regarding depression, the results showed that in the pharmacological + DP group, it decreased significantly after treatment ($Z = -3.18$, $p < .01$), having an effect size of .91. On the other hand, in the group with pharmacological treatment, there was also a significant decrease after treatment ($Z = -3.10$, $p < .01$), but its effect was less ($d = .73$) compared to the pharmacological + DP group. Regarding heart rate variability, in the pharmacological + DP group, the HR decreased significantly at the end of treatment ($Z = -2.55$, $p < .01$), but not in the pharmacological group, where there was a slight decrease of ($Z = .10$, $p > .05$).

Repeated measures ANOVA showed that the pharmacological + DP program increased the perception of self-efficacy; the differences in means were located in the intervention program factor ($F = 18.25$, $p < .001$, $\eta_p^2 = .42$). Regarding depression, a reduction was observed; the mean difference was between the measurement times before and after ($F = 174.05$, $p < .001$; $\eta_p^2 = .87$). In HRV, most of the parameters did not show significant effects in the different experimental conditions, there were only differences in heart rate with a reduction due to the impact of the time factor ($F = 4.72$, $p < .05$; $\eta_p^2 = .164$), as well as the time and group factor ($F = 4.31$, $p < .05$; $\eta_p^2 = .152$).

Table 2*ANOVA of repeated measures of psychophysiological variables*

	Pharmacological	Pharmacological +DP		ANOVA		
	<i>M ± SD</i>	<i>M ± SD</i>	<i>Effect</i>	<i>F</i> ₍₁₎	<i>p</i>	<i>ηp</i> ²
self-efficacy						
Time 1	2.66±.482	2.34±.438	T	14.49	.001*	.37
Time 2	2.61±.592	3.21±.435	T x G	18.25	.000**	.42
Depression						
Time 1	31.92±9.6	35±8.77	T	174.05	.000**	.87
Time 2	16.28±8.77	2.76±4.83	T x G	20	.000**	.44
FC						
Time 1	75.79±7.53	79.98±10.5	T	4.72	.040*	.164
Time 2	75.63±10.1	73±8.17	T x G	4.31	.049*	.152
RR						
Time 1	778.1±111	768.9±118	T	2.98	.096	.107
Time 2	791.8±111	813.6±113	T x G	.838	.369	.032
LnRMSSD						
Time 1	3.02±.69	3.01±.27	T	.010	.939	.000
Time 2	3.05±.52	3.0±0.26	T x G	.050	.824	.002
PNN50						
Time 1	4.67±5.93	2.56±2.65	T	.504	.484	.020
Time 2	6.73±9.0	2.49±3.00	T x G	.575	.455	.022

Note: Time = before and after the intervention program. FC = Mean beats per minute. RR = Mean value of R-R wave interval. LnRMSSD = the natural logarithm of the square root of the mean sum of the squared differences between R–R intervals. PNN50 = Percentage of normal-to-normal interval more than 50 ms.

Qualitative results

From the information obtained in the interviews with the primary caregivers, two tables were generated, one for each research group with four categories in each: symptoms, behavior, reaction to the pharmacological, and opinion of the DP. These were contrasted at both times, before and after each intervention. These categories allowed analysis of the interviewees' discourse. The heading of each column is the corresponding category. Within each cell, the most representative fragments are detailed by the caregivers with a letter code and a pseudonym followed by their relationship with the patient.

The responses given by some primary caregivers of the pharmacological group, the different symptoms and behaviors that they recognized as fear, anguish, sadness, despair, and the lack of autonomy and independence on admission of the patient are shown in Table 3. These symptoms improved after the treatment given during hospitalization; however, in some patients, the response to pharmacological management was not adequate, as they showed some side effects, such as drowsiness, lethargy, and stomach pain or numbness in parts of their body. On those patients who presented side effects another pharmacological treatment was administered. On the other hand, when the patients were discharged, the caregiver's opinion towards the patient's need for exercise or participation in a physical activity program was consistent with the recommendations made by the treating psychiatrist.

Regarding the responses of the primary caregivers of the pharmacological + DP group, the most relevant are shown in Table 4. These responses show that, like the pharmacological group, they improved after hospitalization. However, the caregivers identified that by participating in the DP sessions, patients felt that they belonged to a group, interacted equally with other patients, were kept busy

during hospital activities, and had fun. Nevertheless, the side effects of the drug treatment were similar to those of the patients in the pharmacological group. The pharmacological treatment had to be changed to other antidepressants. At the end of hospitalization, the caregivers expressed that DP was an important contribution to the recovery process of people with depression, as it focused on the patient's well-being. Future research or suggestions should also consider how these activities positively affect socialization and share similar experiences with depression.

Table 3

The perspective of the primary caregivers of the pharmacological group.

	Symptoms	Behavior	Pharmacological reaction	DP opinion
B e f o r e	"I perceive her very overwhelmed, restless as if something was worrying her more" (MA-Mother).	"Well, she is difficult to deal with, she does not speak to anybody, other days she just sleeps or spends her time doing nothing ... she is very upset" (IL- Mother).	"The only thing was that the antidepressants sometimes made her feel very still and other times it irritated her a lot." (RO- daughter).	"I have insisted because all the doctors who have seen her have recommended sports or physical exercise, but she was not in the mood" (LE- Mother).
	"I feel she has a lot of fear with things ... as if I no longer feel sure of what she wants" (BRE-Mother).	"She does not like to do things by herself, she always says help me, come with me...she spends her time lying down, and she hardly spends time with her friends" (CA- Mother).	"Antidepressants took away her appetite" (LI- Mother).	"She was with a psychologist before who helped her manage these mood states and told her to exercise or join a gym, but it was difficult for her to do it" (SO- daughter).
	"She says that she was not concentrating on what she was doing, she was desperate, she was doing too much, her father felt that she		"They changed the antidepressant that always made her sleep and made her jaw numb and with pain" (DU- daughter).	

was absent in everything"
(**SU-Father**).

"Well, already calmer, more secure...as she says she really realizes her problem"
(**SU-Father**).

A "I see her much better, calm, I feel that she will be able to get out of those feelings of sadness; hopefully, the medicine that they sent her home with will help her"
(**LE- Mother**).

"The truth is that I have seen her calmer, serene, more willing to collaborate" (**IL- Mother**).

"Well, she seems calm I see that it has helped her; she talks more to me, compared to how she was before, I see her more awake" (**LI- Mother**).

"I have felt her calmer; she has told me that she is talking with other patients that although she has done nothing for a long time, she is talking with other people" (**DU- Mother**).

"The truth, she has told me that she has had sleep problems, she does not sleep very well" (**BRE- Mother**).

"Well, the truth is that I don't know what to say, because they have already changed her medication twice because they made her have cramps, and the other put her to sleep, but the latter I think is helping her a lot" (**RO- daughter**).

"I still see her as very sleepy, although I do not know if she is calmer" (**MA- Mother**).

"She wanted to join a gym to keep busy because a psychologist told her that exercise would help her focus on other things" (**SO- daughter**).

"The doctor told her to try to exercise, to run and do some physical activity... I hope she will do it because exercise is very important" (**CA- Mother**).

Table 4

The perspective of the primary caregivers of the pharmacological + DP group

	Symptoms	Behavior	Pharmacological reaction	DP opinion
B e f o r e	"She was sad; she cried every night; I felt that she was really bad." (ED-Husband).	"She used to be very active. Now she stays in bed all afternoon; she stopped doing her job, she can't do things by herself" (NI-Mother).	"I see her very high, I asked a nurse and she told me it was normal because of the antidepressants" (MO-Mother).	"She exercised in high school. Then she started working and with her children she no longer had time" (AR-Mother).
	"I saw her downcast and separate; she didn't care about anything ... she suddenly turned serious" (LI-Mother).	"She usually doesn't clean, doesn't bathe, I have to beg her, she doesn't want to look good...it's like she's not here." (YE-Mother).	"Well, I see her well... she is calm; she hardly speaks, she stays lying down and very sleepy" (AN-Mother).	"He always told me that he wanted to dance again; he went to some salsa classes for two years, then a year and a half ago he stopped going due to his work" (DA-Mother).
	"He cried a lot; he felt lonely; he felt guilty of his condition" (VI-Father).			
A f t e r	"I've seen her smile, she didn't before. It's good to see her like this; she told me that no longer feels distressed and that she will try to talk to me more" (LI-Mother).	"I feel that now she can do things well, she tells me that she dances and talks with a friend about how that could distract her when she leaves the hospital, and I feel that she will do well" (AN-Mother).	"I came once, and I saw her very sleepy, and this weekend they changed her antidepressants, and she was already more awake." (TA-Mother).	"She told me that dancing was helping her feel better because there are not many activities to do in the hospital, that dancing helped her feel better and to be occupied. I see that it is a very good therapy to help them improve" (AR-Mother).
	"I perceive her more tranquil, more optimism to get ahead, I think she will make it" (NI-Mother).	"I see her much better. She already cares about her physical appearance again; she told me everything she had done, she has	"Well, much better, she had stomach aches, but for the last three days, she is much better" (MO-Mother).	"...that he is entertained, he does not dance much, but he

"I think she feels very encouraged to finish her studies, she is more cheerful, I perceive her with more autonomy" (YE- Mother).

been eating much more" (ED- Husband).

"He told me that he wanted to draw again, that he misses his sketchbook, that he has been talking to other patients in dance program and after class, so he is with company" (DA- Mother).

"She told me that she had cramps in her face at night; according to the nurse, it is a reaction to the medicine" (ES- Mother).

has learned something. That the dance has helped him not to be thinking about the same thing too much and that the doctor told him that when he leaves the hospital, he should try to exercise. I think there should be more activities like these in the hospital." (VI- Father).

The results shown below are derived from the quantitative and qualitative sections, indicating the relationship between them.

Comparison of quantitative and qualitative data

After the treatments, both the perception of self-efficacy ($M_{\text{pharmacological}} = 2.61$ vs. $M_{\text{pharmaceuticals+DP}} = 3.21$) and depression ($M_{\text{pharmacological}} = 16.28$ vs. $M_{\text{pharmaceuticals+DP}} = 2.76$) presented better indicators in the pharmacological + DP group. This is also was confirmed by data derived from the primary caregivers, since, for example, in the perception of self-efficacy, greater socialization and independence are observed in the actions of the patients in the pharmacological + DP group. With respect to the depressive symptoms caregivers perceived them as more cheerful, calm, optimistic and with motivation to move forward.

In the pharmacological group, when comparing before and after the perception of self-efficacy ($M_{\text{before}} = 2.66$ vs. $M_{\text{after}} = 2.61$) and depressive symptoms ($M_{\text{before}} = 31.92$ vs. $M_{\text{after}}=16.28$), it is shown that with regard to the perception of self-efficacy there was a slight decrease and with regard to depression there was a significant decrease. This is in line with the perceptions of the primary caregivers, as it shows that although their relatives after the intervention had more communication with them, they did not express any perception of their ability to carry out daily activities on their own, and regarding depressive symptoms, they perceived their relatives as more calm, secure and reassured. In the pharmacological + DP group, when comparing before and after the perception of self-efficacy ($M_{\text{before}} = 2.34$ vs. $M_{\text{after}} = 3.21$) and depressive symptoms ($M_{\text{before}} = 35$ vs. $M_{\text{after}} = 2.76$), both variables showed an improvement in the results after the intervention. This is corroborated by the perception of the primary caregivers who indicated that

they perceived their relatives as more autonomous and sociable, and also identified in them joy, motivation, tranquillity and optimistic thoughts to move forward.

Discussion

The main objective of this research was to examine the effects of two treatment programs. These are pharmacological vs. pharmacological + DP on the perception of self-efficacy, depression, and HRV in hospitalized patients with MDD; the primary caregiver's perceptions were also considered and recorded. Although depression and exercise as a treatment have been studied thoroughly, few studies have explored the link between dance program and self-efficacy. And even less studies have been conducted in a hospitalized depressive population (e.g., Maise, 2018; Milanovic et al., 2018). There is also a scarcity of studies assessing the perception of primary caregivers of depressive patients (Ahlström et al., 2010; Coventry et al., 2011).

Regarding the perception of self-efficacy, only one study with a pharmacological intervention program was found that indicates its effectiveness (Milanovic et al., 2018). Our results reveal that pharmacological treatment does not generate a change in the perception of self-efficacy. The reason of it can be due to the fact that antidepressants focus almost exclusively on biomedical phenomena, modifying the brain's neurotransmitters, and do not address the intrapersonal structure of the patient (David & Gourion, 2016; Read & Williams, 2018).

The patients who participated in the pharmacological + DP group at the end of the intervention program obtained higher scores in the perception of self-efficacy, demonstrating greater confidence in effectively handling unexpected events, overcoming unforeseen situations, and finding alternatives to solve a problem compared to the group that only received pharmacological treatment.

Our findings are similar to those by Pinniger et al. (2013), where a tango dance program was applied, showing increased self-efficacy in participants with depression. Likewise, Tokinan and Bilen (2011) showed that dance and music activities have a positive effect on self-efficacy. These findings could be explained by the benefits that dance can have in enabling participants to have fun, express themselves, interact with others, create a space for self-regulation, and at the same time, freedom of expression (Koch, 2017).

Regarding depression, the antidepressants that were administered to most of the patients were citalopram (pharmacological group) and fluoxetine (pharmacological + DP group). These antidepressants are commonly used selective serotonin reuptake inhibitors (SSRIs). They are administered because they have a higher safety and tolerability profile than other antidepressants. The side effects of these antidepressants which range from nausea, drowsiness to sexual dysfunction, are still being investigated (Atmaca, 2020; Yroni et al., 2019). Some of these effects were reported by the primary caregivers of the study population.

Regarding the results of depression in both groups (pharmacological vs. pharmacological + DP), at the end of the intervention program, there was a decrease in depressive symptoms; however, the lowest scores were obtained in the group where DP was applied together with pharmacological treatment. The preceding is consistent with the results reported by Carvalho et al. (2018), who stated that dance is beneficial in reducing depression, as it provides a sense of security. In the view of these results it can be considered that dance practices can be applied in a participatory process to strengthen the patient's sense of well-being.

Nonetheless, the studies carried out by Hyvönen et al. (2020), suggest that antidepressant treatment accompanied by a dance movement therapy program produces a greater decrease in depressive symptoms compared to participants who only receive pharmacological treatment. This

finding is important because it has been found that aerobic exercise modifies certain neurotransmitters such as dopamine, serotonin, and noradrenaline, substances that are related to the feeling of well-being (Eyre et al., 2018).

Although physical exercise in conjunction with pharmacological treatment has been found to greatly reduce depressive symptoms, the dose-response relationship in hospitalized patients is still unclear due to methodological weaknesses in the studies (Belvederi et al., 2019). However, it has been shown that the efficacy of exercise appears to be greater if it is aerobic, performed in a group and led by an instructor (Schuch et al., 2016). In addition, recent studies have identified significant associations between the intensity and duration of exercise interventions and their antidepressant efficacy (Paolucci et al. 2018).

Regarding the data obtained by the primary caregivers (family members), they coincide with the quantitative data since the relatives' perception at the end of the dance program was that participants presented indicators of a higher self-efficacy. They perceived that the patients were more confident and independent to carry out activities; they also observed that the feeling of liking or wanting to do something for themselves had appeared again. This was in contrast with what the caregivers had observed before the intervention - patients being sad, sleepy, and with no intention of doing anything - (Calderón-Rivera et al., 2020; El-Bilsha, 2019).

The primary caregivers also expressed that the DP allowed patients to be busy in other activities. It helped them to not think frequently about negative aspects due to the lack of activity during hospitalization. Similarly, primary caregivers perceived in patients the desire to take care of their personal appearance, regain interest in the activities they used to do in their free time, such as drawing, encouragement to go back to school, and a positive attitude about the future. González

et al. (2010) point out that primary caregivers perceive that psycho-educational and health programs are necessary for the recovery of patients with depression.

In line with this research, qualitative research that analyzed the relationship between depression and social isolation with dance program concluded that the participants developed a sense of belonging and group identity. This phenomenological aspect positively influenced the reduction of depressive and symptomatic symptoms. It increased the integration of those who practiced it, recommending this alternative as the ideal option to fortify treatment with the elderly population (Murrock & Graor, 2014). It has been similarly suggested that dance program can be a mechanism to reduce a patient's sedentary lifestyle and strengthen self-efficacy and confidence in their abilities within a group setting, perceiving better psychological well-being (Gregor et al., 2020; Tobar et al., 2019).

Regarding HRV, our results show that when comparing the intragroup HRV, a significant difference was observed only in the group that received pharmacological + DP, specifically in the HR parameter; other parameters showed no change. These results are similar to those presented by Bonet et al. (2017), who found a decrease in HR in the group that did aerobic exercise and a difference post-exercise compared to those who did not exercise. In this sense, Hughes et al. (2008) stated that depressive symptoms negatively correlate with HR recovery after an aerobic exercise test. Likewise, Liu et al. (2018) suggested a Tai Chi program for 24 weeks, three times a week for 60 min, in an adult and elderly population with depression recruited from primary care. They observed a decrease in the mean HR after the intervention. This modulation possibly contributes to the balance between the sympathetic and parasympathetic systems, reducing heart rate. This reduced HR may be due to the decrease in HRV in a depressed population caused by pharmacological treatment; however, some antidepressants have been shown to have less impact

on HRV, such as SSRIs. Nevertheless, they are still associated with low HRV values (O'Regan et al., 2015).

Other studies have suggested that aerobic exercise can significantly increase respiratory sinus arrhythmia (RSA) and argue that the decrease in HRV, in particular, the lower RSA observed in depressed patients, is a consequence of the lack of physical fitness and inactivity (Kesek et al., 2009; Sbolli et al., 2020). From a clinical and public health point of view, it is important to incorporate an exercise regimen for this type of population, given the beneficial effect of exercise on HRV (Taylor, 2010), contributing to reduce the mortality gap directly related to cardiovascular risk and high suicide rates (Belvederi et al., 2020).

As strengths of the study, our results evidenced that before the intervention in the psychophysiological variables show an initial equivalence between groups in order to ensure homogeneity among them and reduce the percentage of bias in the results (Hernández et al., 2014). Furthermore, it describes an application of dance program in a psychiatric treatment. Also, our study adds on the literature related to the relationship between self-efficacy with HRV, self-efficacy and depression and self-efficacy, depression and HRV in clinical context specifically with depressive patients. Finally, information is also contributed on how primary caregivers try to cope with and perceive their family members in a state of clinical depression.

Our study has a number of limitations. The number of male patients is much lower than that of female patients and therefore an analysis of the variables by gender could not be performed. Furthermore, the relative limited number of the participants of our sample limits the generalization of the study results. Likewise, the results obtained could have been influenced by the other activities taking place in the hospital. In addition, not all primary caregiver quotes were presented in the qualitative data. Moreover, the collection of patient data was seasonal; first, all the data from

the pharmacological group were collected, and then those from the pharmacological + DP group, a situation that could have generated environmental variables and influenced the results.

For future research, it would be appropriate to evaluate the hospital recurrence of depressive patients who participated in a dance program at a neurological level and evaluate general well-being. It would be interesting to have access to a larger hospitalized population and measure Brain-Derived Neurotrophic Factor (BDNF) serum levels, or if there is an increase in neurogenesis in the hippocampus after a program of pharmacological treatment + DP.

Conclusion

The findings in this study suggest that adding a moderate to vigorous intensity DP program to pharmacological treatment for depression is more beneficial for the recovery of hospitalized depressive patients, greatly reducing depressive symptoms and increasing self-efficacy compared with patients who only receive pharmacological treatment. Although DP did not increase heart rate variability, the heart rate parameter decreased, relating it to a modulation of the autonomic system. Likewise, supporting the quantitative data, the qualitative data derived from primary caregivers' perceptions also pointed out that DP could be a strategy to support pharmacological treatment to reduce depressive symptoms, increase the perception of self-efficacy, and improve the patients' lack of activity in psychiatric centers.

Besides information is contributed to the literature on the relationship between HRV with self-efficacy, self-efficacy and depression, and self-efficacy, depression and HRV in a clinical context specifically with depressive patients.

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