



The Emotional Dance with Depression: A Longitudinal Investigation of OULA for Depression in Women

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TITLE PAGE

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INTRODUCTION

Depression is a psychiatric disorder that has a significant impact on individuals, families and communities. According to the World Health Organization (2018), more than 300 million people suffer from depression, and depression is the leading cause of disability across the world. One of the most well documented aspects of depression is that females are more likely to be depressed than males (Girgus & Yang 2015; Parker et al 2014; Parker and Brotchie 2010; Nolen-Hoeksema 2001). The risk of a woman developing depression at some point in her lifetime is 1.5 to 3 times higher than in men (Salk et al 2017; Kessler 2003; Blazer et al 1994).

There are many available treatments for depression but given that treatment for depression often starts in a primary care office (Amick et al 2015), antidepressant medications are usually the first approach used (Mojtabai and Olfson 2014). Over the past 20 years, antidepressant medications have expanded significantly; however approximately one- to two-thirds of depressed patients do not respond to the initial antidepressant prescribed (Carek et al 2011; Gaynes et al 2009; Cain 2007). Moreover, rates of non-adherence to antidepressants have consistently been reported as greater than 40% (Alekhya et al 2015; Sawada et al 2009; Bull et al 2002; Demyttenaere et al 2001), and recent research has shown that antidepressants may not be effective in people who live at altitude (Kanekar et al 2018). Finally, some patients prefer not to take antidepressants for a variety of reasons (Hanson et al 2016; Moradveisi et al 2014; Horne et al 2004). As a result, complementary and alternative approaches to treating depression are gaining popularity, and there is increasing scientific interest in the potential effectiveness of these modalities.

Physical activity or exercise serves as a cornerstone for the prevention of many chronic illnesses (Pedersen and Saltin 2015; Booth et al 2012), and over the past two decades, exercise is being prescribed to treat a variety of illnesses (Pedersen and Saltin 2015; Pedersen and Saltin

2006). Exercise has been well studied as a treatment for depression, and consistent findings demonstrate that exercise has positive effects. For example, several systematic reviews (Daley 2008; Sjösten et al 2006; Stathopoulou et al 2006; Lawlor and Hopker 2001), a Cochrane meta-analysis (Mead et al 2008) and a Cochrane review (Cooney et al 2013) have reported reductions in depression with exercise. Further, some studies have documented that exercise is comparable to psychosocial approaches to treating depression, like cognitive behavioral therapy (Mead et al 2008; Daley 2008; Sjösten et al 2006; Stathopoulou et al 2006; Lawlor & Hopker 2001), while others have indicated that exercise is similar to antidepressants for managing depression (Hoffman et al 2011; Blumenthal et al 2007; Babyak et al 2000).

Considering that dance has been shown to have beneficial effects on depression (Boing et al 2018; Murrock and Graor 2016; Adam et al 2016; McNeely et al 2015; Vankova et al 2014; Murrock and Graor 2014; Pinniger et al 2012), it is gaining interest as an exercise format to help relieve mood symptoms and improve body composition. A dance fitness program called OULA[®] (named after MissOULA, MT) was developed in recent years as a form of exercise that focuses on mind-body connection. Over the past several decades, there has been a growing body of research evidence in support of the importance of acknowledging the mind-body connection when treating illness (Dusek and Benson 2009; Littrell 2008; Gilbert 2003; Chiamonte 1997). The concept of mind-body connection relates to recognizing the interconnection between mental states and physical processes (Littrell 2008), in addition to fostering opportunities to practice using tools to better cope with upsetting life events (Gilbert 2003). Mind-body exercise can be described as physical activity that is implemented with an inward mental focus with little attention on physical performance or physiological measures, e.g., target heart rate (La Forge 2016).

OULA[®] is choreographed dance that can be used as a vehicle to process emotions through movement to songs that focus on connection with the self and others, femininity, power, determination, letting go and love; increase physical activity; as well as serve as a communal fitness format that is fun. Using exercises from older disciplines like Yoga, in addition to modern systems like Nia and dance/movement therapy, objectives of OULA[®] focus on enhancing breath awareness, expanding breath ability, experiencing the relationship between the physical, emotional and mental components of well-being, and feeling powerful. Available online and in nearly half the states in America, as well as three countries, OULA[®] is a high-energy dance workout to Top-40 American popular culture. A commonly used slogan in OULA[®] is, “it’s not about how it looks, but about how it feels,” encouraging participants to concentrate on how they feel while dancing and ignore how they look. In an Internet-based survey of OULA[®] participants, the authors report that the majority of OULA[®] participants are women and that the top two reasons for attending OULA[®] are for exercise and stress relief/improve mood (Hellem and Ferguson 2018).

Given the expanding body of evidence that both exercise (Cooney et al 2013; Daley 2008; Mead et al 2008; Sjösten et al 2006; Stathopoulou et al 2006; Lawlor and Hopker 2001) and dance (Boing et al 2018; Murrock and Graor 2016; Adam et al 2016; McNeely et al 2015; Vankova et al 2014; Murrock and Graor 2014; Pinniger et al 2012) are beneficial for improving depressive symptoms in a variety of populations, the aim of the current pilot study was to evaluate the dance fitness program OULA[®] as an intervention for depression in women diagnosed with major depressive disorder or persistent depressive disorder. Our primary hypothesis was that 12-weeks of OULA[®] participation would be associated with a reduction in depression severity, measured by the Hamilton Depression Rating Scale. Our secondary

hypotheses included that 12-weeks of OULA[®] participation would be associated with a reduction in anxiety severity, measured by the Beck Anxiety Inventory and increase in happiness, measured by the Subjective Happiness Scale (SHS).

MATERIALS AND METHODS

Participants

A total of n=70 women were screened in person for participation and n=53 met eligibility criteria. Women were recruited using purposive sampling based on the following criteria for inclusion: between the ages of 18 – 70 years, female gender, OULA[®] naïve (defined as attended 6 or less classes in the past 12 months), 17-item Hamilton Depression Rating Scale score of greater than 16 (i.e., moderate depression at a minimum [Furukawa et al 2007]), and Structured Clinical Interview for DSM-5 Disorders diagnosis of major depressive or persistent depressive disorder. Women were excluded if they were unable to provide adequate informed consent, if they had a clinically significant medical condition or illness that prevented them from participating in physical exercise, Structured Clinical Interview for DSM-5 Disorders diagnosis of bipolar disorder or schizophrenia, or current pregnancy (see Figure 1). If there was a concern about a potential participant's physical health, study personnel requested that she seek input from her primary care provider regarding the safety of participating in the study. Women with PTSD were not excluded from the current study because exercise (Shivakumar et al 2017; Whitworth & Ciccolo 2016) and dance classes (Steinberg-Oren et al 2016) have been shown to relieve symptoms of PTSD (Shivakumar et al 2017; Whitworth & Ciccolo 2016), as well as reduce stress and improve well-being (Steinberg-Oren et al 2016). Further, in a synthesis of dance/movement therapy and PTSD studies, Levine and colleagues (2015) found that a body-oriented intervention is important for bringing awareness to the mind-body connection,

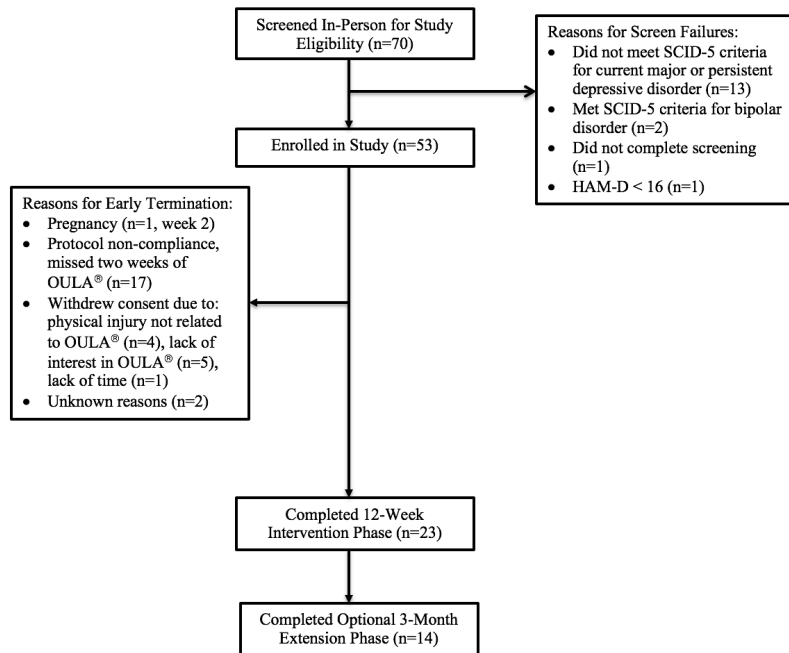


Figure 1. Flow Diagram of Participant Progress

improving range of motion, as well as for strengthening the relationship with the self and others through movement.

Recruitment occurred using a variety of advertising via social media, television, radio and flyers. After learning about the study, women contacted the research team and a preliminary phone screening

took place. For women who passed the phone screening, an in-person visit was scheduled where informed consent was obtained before any study procedures were initiated and the Structured Clinical Interview for DSM-5 Disorders and 17-item Hamilton Depression Rating Scale were administered to determine eligibility. The Structured Clinical Interview for DSM-5 Disorders was administered by project personnel who received extensive training on the use of the tool, and in situations when a diagnosis was unclear, a licensed clinical psychologist was consulted. Institutional Review Board (IRB) at a public university in the United States approved the study prior to data collection. All procedures performed in the study were in accordance with the ethical standards of the IRB and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Intervention

Each OULA[®] class consists of 16 choreographed songs, and instructors select songs for their playlist from a library of over 400 pre-choreographed songs. The choreography in OULA[®]

uses the movement of dance with the intensity of an aerobic workout, in addition to using philosophies from Yoga, Nia (Rosas and Rosas 2014; Rosas and Rosas 1987) and dance/movement therapy (Tantia 2015). A new song is choreographed 50 weeks out of the year, and usually the 10 most recent choreographed songs are played at each class, with the idea that a participant can attend OULA[®] anywhere and be familiar with the most recent songs. A typical OULA[®] class includes a warm-up song, two to four lower intensity songs (e.g., grounded and small movements), followed by eight high intensity songs (e.g., jumping, kicking, large movements), then a conditioning song (e.g., multiple squats or arm circles), a lower intensity song and ending with a cool down song.

After eligibility was determined, women were given the option to attend OULA[®] online for 4-weeks or initiate OULA[®] at a studio. Live OULA[®] classes are videotaped at a studio and uploaded to an online studio. The rationale for offering a 4-week online option was because many of the characteristics of depression, e.g., loss of interest, lack of motivation and energy, fatigue, low self-worth and confidence and psychomatic complaints, are barriers to exercising (Knapen et al 2015). Thus, introducing the women to OULA[®] in the comfort of their home had the potential to serve as a motivator and boost self-confidence before attending a studio.

The intervention period was a total of 12 weeks: 4-weeks of OULA[®] online or at a studio and 8-weeks of OULA[®] at a studio. Women were instructed to attend OULA[®] at least once per week. If women missed two consecutive weeks of OULA[®], they were terminated from the study. Attendance to OULA[®] at a studio was collected via self-report and verified with the attendance roster for each class provided by studio staff. After the 12-week intervention period, the women abstained from OULA[®] for one week and attended a study visit 7-10 days after abstaining from OULA[®] (week 14). Finally, a 3-month OULA[®] extension was offered to all participants (weeks

14-26). This allowed women to continue OULA[®] for 3-months at a studio free of cost. See Table 1 for a visual representation of the study flow and procedures.

Outcome Measures

The primary outcome measure was depression severity and secondary outcome measures included anxiety severity and subjective happiness. Depression severity was evaluated using the previously well validated 17-item Hamilton Depression Rating Scale (HAM-D; Bagby et al 2004; Hamilton 1960). Each item of the 17-item HAM-D relates to a symptom of depression and is rated on a 3- or 5-point scale representing the severity for each item over the prior 7 days. Scores for the 17 items are summed to obtain a total HAM-D score where higher values indicate greater depressive symptoms. In this study, the 17-item HAM-D was administered by two raters (authors Dr. Tracy Hellem and Hayden Ferguson), and an inter-rater reliability analysis was performed to see the degree that the two raters consistently assigned a similar HAM-D score. This was assessed using a two-way mixed, consistency, average measures intra-class correlation (McGraw & Wong 1996). The resulting intra-class coefficient was in the excellent range, $ICC = .92$ (Hallgren 2012). For this study, treatment response for the HAM-D was defined a priori as a decrease of 50% or more from baseline (Furukawa et al 2007).

Since depression and anxiety are highly comorbid (Moscati et al 2016), anxiety severity was examined as a secondary outcome. Further, in general, mental illness is a significant cause of unhappiness (Layard et al 2013). Thus, subjective happiness was examined as a secondary measure. To measure these outcomes, instruments that have been extensively validated were used: the Beck Anxiety Inventory (De Ayala et al 2005; Beck et al 1988) and the Subjective Happiness Scale (Mattei & Schaefer 2004; Lyubomirsky & Lepper 1999), respectively. The Beck Anxiety Inventory (BAI) is a self-administered scale that consists of 21 items relating to symptoms of anxiety that are scored from 0 (not at all) to 3 (severely). The score on the BAI is

the sum of the scores on the 21 items with higher scores indicating higher levels of anxiety. Treatment response for the BAI was defined a priori as a decrease of 50% or more from baseline (Leyer et al 2006). Happiness, defined descriptively as a person’s psychological state (Phillips et al 2017), was measured using the Subjective Happiness Scale (SHS), a self-administered tool that consists of four items measured on a seven point scale from 1 to 7. The scores on the four items are averaged to obtain the SHS score with the fourth item being reverse-coded. The same rater averaged each SHS score. Considering that happiness is a subjective state of well-being (Mattei and Schaefer 2004), as opposed to a disorder, treatment response was not defined.

During the first four weeks of the study, the 17-item HAMD, BAI and SHS were collected at weeks 2 and 4, and then weekly during weeks 5-14. A final study visit was scheduled for week 26 for women who elected to enter the optional 3-month OULA[®] phase (see Table 1).

Table 1. Summary of Design and Procedures

	Screening	Weeks 2 & 4	Weeks 5-12	Week 13	Weeks 14 - 25	Week 26
Informed Consent, Demographics	X					
Structured Clinical Interview for DSM-5 Disorders	X					
Clinical Scales: HAM-D, BAI, SHS	X	X	X	X		X
Weight	X	X	X	X		X
Current Medications	X	X	X	X		X
OULA [®] Online or Studio Attendance		X				
OULA [®] Studio Attendance		X	X		X	X
OULA [®] Attendance Frequency		X	X	X		X

HAM-D = Hamilton Depression Rating Scale; BAI = Beck Anxiety Inventory; SHS = Subjective Happiness Scale

Statistical Analyses

This single arm study was a pilot study, and a power analysis to determine number of participants needed for statistical significance was not performed (Leon et al 2011). Descriptive data are presented as mean \pm standard deviation for continuous variables and frequency percentages for categorical variables.

Analyses for change in HAM-D, BAI and SHS scores were performed using a linear mixed effects model repeated measures analysis, which is capable of handling missing data and time varying covariates (Mallinckrodt et al 2003). Time was included as a fixed factor and subject was treated as a random factor. Sidak correction, a method to compensate for multiple comparisons (West et al 2006), was used to control for Type I error for all linear mixed effects repeated model analyses. Finally, a paired t-test was performed for each outcome variable to evaluate mean change in outcome scores between weeks 13 and 14. Women abstained from OULA[®] during week 13, and we were interested in learning if outcome scores significantly changed after one week of no OULA[®]. Cohen's d was used as an effect size.

Splitting the intervention into two phases may have introduced a confounding factor given the companionship and attention from OULA[®] instructors and other OULA[®] attendees at a studio. To understand if a covariate was introduced, considering the unequal and small group sizes (week 2: n=15 online versus n=31 studio, week 4: n=5 online, n=31 studio) (Zimmerman 1987), Mann Whitney U was used to compare outcome (HAM-D, BAI and SHS) scores by group (online versus studio attendance) for weeks 2 and 4.

With respect to linear mixed effects repeated model assumptions, visual inspection did not reveal any obvious deviations from linearity of the residual plot, homoscedasticity or normality of residuals. The assumptions for paired t-test were also reasonably met. The impact of dropouts on the analyses were examined. Because results did not change substantially, the results presented include all observations as opposed to only complete observations. A significance

level of equal to or less than 0.05 was used for directional hypothesis testing, and statistical analyses were conducted through the Statistical Package for the Social Science 25.

RESULTS

Baseline Characteristics

The characteristics of the eligible subjects (n=53) at the time of screening are displayed in Table 2. The average age was 41.83 ± 13.85 years. The majority of subjects were married (n=19, 35.9%), divorced/separated (n=14, 26.4%) or living with their partner (n=10, 18.9%). Over half of the subjects had children (n=32, 60.4%), and the sample was relatively homogeneous in terms of race, as n=51 of the subjects (96.2%) were white/Caucasian. Two of the subjects (3.8%) reported being Hispanic or Latino.

Table 2. Baseline Characteristics (n=53)

Characteristic	
Mean age (SD)	41.83 (13.85)
Race, N (%)	
Caucasian	51 (96.2%)
American Indian	1 (1.9%)
Native Hawaiian or Pacific Islander	1 (1.9%)
Ethnicity, N (%)	
Hispanic or Latino	51 (96.2%)
Marital Status, N (%)	
Married	19 (35.8%)
Widowed	2 (3.8%)
Divorced	12 (22.6%)
Separated	2 (3.8%)
Never Married	8 (15.1%)
Living With Partner	10 (18.9%)
Children, N (%)	32 (60.4%)
Employment Status, N (%)	
Employed	30 (56.6%)
Unemployed	6 (11.4%)
Retired	5 (9.4%)
Disabled	2 (3.8%)
Homemaker	5 (9.4%)
Student	5 (9.4%)
Education Level, N (%)	
Graduated high school or GED	10 (18.9%)
Part College	8 (15.1%)
Graduated 2 year college	14 (26.4%)
Bachelor's Degree	15 (28.3%)
Master's Degree	3 (5.7%)
Professional Degree	1 (1.9%)
Doctoral Degree	2 (3.8%)
Annual Income, N (%)	
< \$15,000	7 (13.2%)
\$15,001 - \$25,000	11 (20.8%)
\$25,001 - \$35,000	10 (18.9%)
\$35,001 - \$45,000	8 (15.1%)
\$45,001 - \$55,000	3 (5.7%)

\$55,001 - \$65,000	3 (5.7%)
\$65,001 - \$75,000	2 (3.8%)
\$75,001 - \$85,000	1 (1.9%)
\$85,001 - \$95,000	1 (1.9%)
\$100,000+	5 (9.4%)
Current Participation in Exercise, N (%)	26 (49.1%)
Type of Current Exercise, N (%)	
Yoga	5 (9.4%)
Pilates	1 (1.9%)
Running	4 (7.5%)
Walking	15 (28.3%)
Hiking	10 (18.9%)
Swimming	1 (1.9%)
Lifting Weights	6 (11.3%)
Biking	2 (3.8%)
Dance Classes	1 (1.9%)
Frequency of Current Exercise, N (%)	
1 Day Per Week	1 (1.9%)
2-3 Days Per Week	10 (18.9%)
4-6 Days Per Week	13 (24.5%)
7 Days Per Week	4 (7.5%)
Family History of Depression, N (%)	46 (86.8%)
History of Taking Antidepressants, N (%)	44 (83.0%)
Currently Taking an Antidepressant, N (%)	29 (54.7%)
Currently Taking an Anxiolytic, N (%)	1 (1.9%)
How Many Different Antidepressants Tried, N (%)	
One	8 (15.1%)
Two to three	22 (41.5%)
Four to five	12 (22.6%)
Six or More	2 (3.8%)
Reasons for Terminating Antidepressants, N (%)	
Did Not Work	23 (43.4%)
Side Effects	25 (47.2%)
Loss of Insurance	3 (5.7%)
Stopped Feeling Depressed	6 (11.3%)
Not Sure Why Antidepressant Stopped	1 (1.9%)
Other	6 (11.3%)
SCID-V Diagnoses, N (%)	
Major Depressive Disorder (MDD), Lifetime	50 (94.3%)
MDD, Last Month	45 (84.9%)
MDD, Last Month Severity	
Mild	4 (7.5%)
Moderate	41 (77.4%)
Severe	5 (9.4%)
MDD, Recurrent	40 (75.5%)
MDD, Seasonal Pattern	3 (5.7%)
Persistent Depressive Disorder (PDD), Lifetime	29 (54.7%)
PDD Past 2 Years	26 (49.1%)
PDD Early Onset	21 (39.6%)
Premenstrual Disorder Past 12 Months	3 (5.7%)
Alcohol Use Disorder, Lifetime	9 (17.0%)
Alcohol Use Disorder, Last Month	1 (1.9%)
Sedative Use Disorder, Lifetime	1 (1.9%)
Stimulant Use Disorder, Lifetime	5 (9.4%)
Stimulant Use Disorder, Last Month	2 (3.8%)
Opioid Use Disorder, Lifetime	2 (3.8%)
Panic Disorder, Lifetime	32 (60.4%)
Panic Disorder, Last Month	16 (30.2%)
Agoraphobia, Lifetime	7 (13.2%)
Agoraphobia, Last Month	2 (3.8%)
Social Phobia, Lifetime	22 (41.5%)
Social Phobia, Last Month	20 (37.7%)
Generalized Anxiety Disorder, Lifetime	36 (67.9%)

Generalized Anxiety Disorder, Last Month	29 (54.7%)
Substance-Induced Anxiety Disorder, Lifetime	1 (1.9%)
Obsessive Compulsive Disorder, Lifetime	3 (5.7%)
Obsessive Compulsive Disorder, Last Month	1 (1.9%)
PTSD, Lifetime	12 (22.6%)
PTSD, Last Month	7 (13.2%)
Currently Receiving Psychosocial Treatment, N (%)	17 (32.1%)
Mean HAMD score (SD)	20.08 (2.87)
Mean BAI score (SD)	19.87 (11.51)
Mean SHS score (SD)	3.39 (1.12)

SD=standard deviation

The majority of subjects were currently employed (n=30, 56.6%), and had obtained a bachelor's degree or less (n=47, 88.7%). At baseline, nearly half of the women (n=26) endorsed that they currently participated in regular exercise. With respect to DSM-5 diagnoses, 84.9% (n=45) met diagnostic criteria for current major depressive disorder, and n=26 (49.1%) endorsed criteria for persistent depressive disorder. A little over half, 54.7% (n=29), of the women were being treated with an antidepressant at baseline. Forty-five subjects (84.9%) met DSM-5 criteria for an anxiety disorder in the past six months, and n=7 (13.2%) had current Post Traumatic Stress Disorder.

Screening, Attendance, and Attrition

Over the course of 12 months, we screened a total of n=147 women by phone and invited n=94 women to attend an informed consent and formal screening visit. Of these n=94 women, n=70 attended the in-person screening visit. As previously mentioned, there was a total of n=53 women enrolled in the study. Of these women, n=23 completed the 12-week intervention phase (43.4% retention rate) and n=14 completed the optional 3-month extension phase. Figure 1 outlines reasons for early termination, with protocol non-compliance being the primary reason (n=17). The majority of the early terminations occurred during weeks 2 and 4.

As a reminder, women were offered optional online OULA[®] for the first four weeks of the intervention period. Twenty-eight percent (n=15) of the women elected to attend OULA[®] online during the first two weeks of the intervention period and 9.4 % (n=5) of the sample

attended OULA[®] online for weeks three and four of the intervention period. The rest of the women (n=31) attended OULA[®] at a studio from the beginning of the intervention period. During the intervention period, on average, participants reported attending 14.72 ± 13.03 OULA[®] classes (on average 1.22 classes per week). Attendance data from the studio indicate that, on average, women attended 11.48 ± 11.90 classes. Of interest, there was not a strategy for validating online classes. Further, 22.7% (n=10) of the sample attended at least one OULA[®] class at a location other than the studio, and these classes were also not validated.

HAM-D

Table 3 provides summary statistics of HAM-D at each time point while Figure 2 visually displays this information. At the time of screening, the average HAM-D score was 20.08 ± 2.87 , indicating a moderately depressed sample (Furukawa et al 2007). At the end of the intervention period, the average HAM-D score decreased to 6.48 ± 4.73 , indicating “borderline” depression (Furukawa et al., 2007). The average HAM-D score spiked during week 14 likely because the women abstained from OULA[®] the prior week.

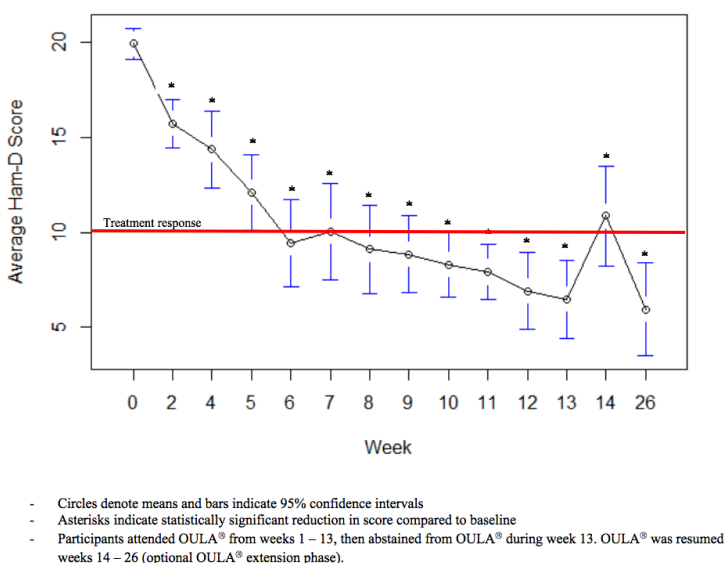
Table 3: Average Hamilton Depression Rating Scores at Each Data Collection Time Point

Week	0	2	4	5	6	7	8	9	10	11	12	13	14	26
Mean	20.08	15.74	14.36	12.09	9.43	10.04	9.11	8.85	8.29	7.91	6.91	6.48	10.87	5.93
SD	2.87	4.28	5.91	5.71	5.89	6.38	6.01	5.02	4.07	3.36	4.72	4.73	6.11	4.23
n	53	46	36	33	28	27	28	26	24	23	23	23	23	14

SD = Standard deviation

The linear mixed effects repeated measures model analysis revealed a statistically significant reduction in mean HAM-D scores from baseline as early as week 2 and maintained through week 26 ($p = .009$ for week 2 compared to baseline and $p = .000$ for all other weeks compared to baseline). Further, the results of a paired t-test examining change in mean HAM-D scores between weeks 13 and 14 indicated a statistically significant increase in HAM-D scores at week 14 compared to week 13, $t(22) = 3.413, p = .002, d = 0.71$. Finally, the results of Mann

Figure 2: Average Hamilton Depression Rating Scale (HAM-D) Scores Over Time



Whitney U evaluating group (online versus studio attendance) and HAM-D scores for week 2 were insignificant ($p = .371$), but were significant for week 4, indicating that the median HAM-D score was significantly higher for the women ($n=5$) who attended online (Mdn = 27.90) versus the women ($n=31$) who attended at a studio (Mdn = 16.98), U

= 30.50, $p = .031$.

BAI

Table 4 provides summary statistics of BAI scores at each time point while Figure 3 displays this information visually. At the time of screening, average BAI was 19.87 ± 11.51 indicating a low to moderately anxious sample (Leyer et al 2006). At the end of the intervention period, average BAI score was 7.33 ± 6.20 . Table 4 and Figure 2 display that average BAI scores decrease throughout the study with the greatest decreases occurring during the first five weeks. One notable exception is during week 14 when average BAI score spikes. During this week of the study data were collected but OULA[®] was not offered, which may account for this spike.

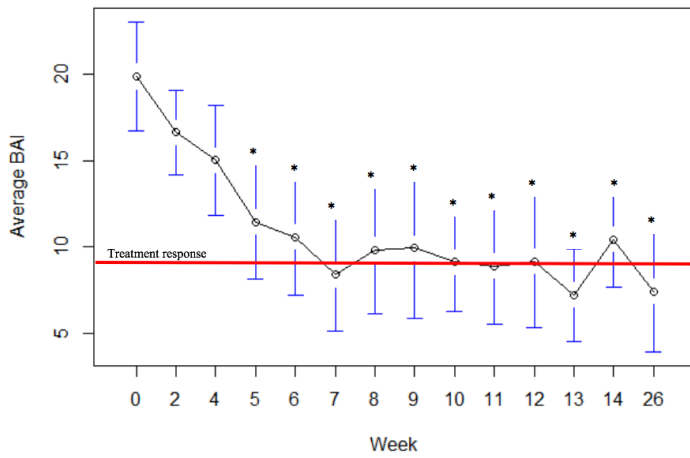
Table 4: Average Beck Anxiety Score at Each Data Collection Time Point

Week	0	2	4	5	6	7	8	9	10	11	12	13	14	26
Mean	19.87	16.63	15.03	11.45	10.57	8.41	9.82	9.92	9.13	8.91	9.17	7.33	10.43	7.43
SD	11.51	8.21	9.45	9.37	8.70	8.34	9.58	10.04	6.83	7.79	8.89	6.20	6.33	6.09
n	53	46	36	33	28	27	28	26	24	23	23	23	23	14

SD = Standard deviation

The linear mixed effects repeated measures model analysis revealed a statistically significant reduction in mean BAI scores from baseline starting at week 5 and maintained through week 26 ($p < .05$ for weeks 5-26 compared to baseline). Additionally, the results of a

Figure 3: Average Change in Beck Anxiety Inventory (BAI) Scores Over Time



- Circles denote means and bars indicate 95% confidence intervals
- Asterisks indicate statistically significant reduction in score compared to baseline
- Participants attended OULA® from weeks 1 – 13, then abstained from OULA® during week 13. OULA® was resumed weeks 14 – 26 (optional OULA® extension phase).

paired t-test evaluating change in mean BAI scores between weeks 13 and 14 demonstrated a statistically significant increase in scores at week 14 compared to week 13: $t(22) = 3.217, p = .036, d = 0.47$. Finally, the results of Mann Whitney U tests to compare BAI scores by group (online versus studio) for weeks 2 ($p = .227$) and 4 ($p = .963$) were insignificant.

SHS

Table 5 provides the summary statistics of SHS for each week of the study which is visually displayed in Figure 4. These summary statistics indicate that average SHS increased throughout the course of the study. The greatest increases in SHS occurred during the first seven weeks of the study with slight changes occurring after week seven. At baseline, the average SHS score was 3.39 ± 1.12 , and the mean SHS score was 4.50 ± 1.13 at the end of the intervention phase.

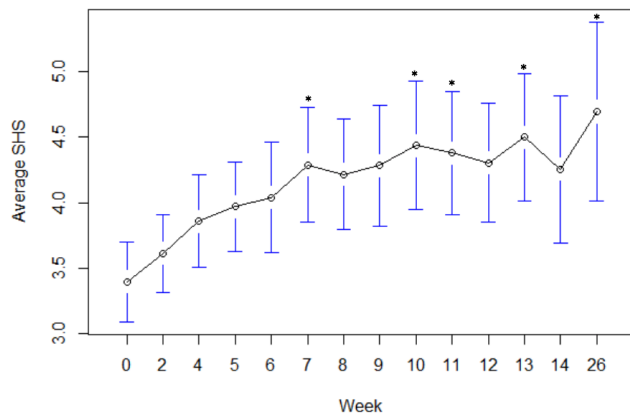
Table 5: Average Subjective Happiness Scale Scores at Each Data Collection Time Point

Week	0	2	4	5	6	7	8	9	10	11	12	13	14	26
Mean	3.39	3.61	3.86	3.97	4.04	4.29	4.21	4.28	4.44	4.38	4.30	4.50	4.26	4.70
SD	1.12	1.00	1.05	0.96	1.08	1.10	1.09	1.15	1.16	1.08	1.05	1.13	1.30	1.19
n	53	46	36	33	28	27	28	26	24	23	23	23	23	14

SD = Standard deviation

The linear mixed effects repeated measures model analysis revealed a statistically significant increase in mean SHS scores from baseline at week 7 ($p = .05$), week 10 ($p = .01$), week 11 ($p = .03$), week 13 ($p = .01$) and week 26 ($p = .01$). Moreover, the results of a paired t-

Figure 4: Average Change in Subjective Happiness Scale (SHS) Scores Over Time



- Circles denote means and bars indicate 95% confidence intervals
- Asterisks indicate statistically significant increase in score compared to baseline
- Participants attended OULA[®] from weeks 1 – 13, then abstained from OULA[®] during week 13. OULA[®] was resumed weeks 14 – 26 (optional OULA[®] extension phase).

test examining change in mean SHS scores between weeks 13 and 14 revealed no change: $t(22) = -.245, p=.217$. Finally, the results of Mann Whitney U tests to compare SHS scores by group (online versus studio) for weeks 2 ($p = .972$) and 4 ($p = .597$) were insignificant.

Missing Data and Tolerability

With respect to missing data, $n=6$ subjects missed one week of data collection due to traveling or an illness. None of the participants withdrew consent from the study due to injuries from OULA[®]. Five participants withdrew consent because of a lack of interest in participating in OULA[®].

DISCUSSION

In this paper, results of what is, to the best of our knowledge, the first study evaluating OULA[®] as an intervention for depression in women are reported. In this pilot study, women participated in at least once per week OULA[®] for 12-weeks and then abstained from OULA[®] for one week. Depression and anxiety severity, as well as subjective happiness were measured every other week for the first month, weekly through the intervention period and after one week of abstaining from OULA[®]. A consistent reduction in depression from baseline through the end of the 12-week intervention period was noted, while an increase in depressive symptoms was found after the week of abstinence. A reduction in anxiety severity was noted at week 5 through the end of the 12-week intervention period, with an increase in anxiety symptoms after a week of abstaining from OULA[®]. There was not a consistent change in subjective happiness over the

course of the intervention period. Finally, an optional 3-months of additional OULA[®] was offered to all participants after completing the week of abstinence from OULA[®]. Attendance to this optional phase of the study was low, but a decrease in depression and anxiety and increase in subjective happiness was noted from the end of the optional phase compared to baseline.

The results of this study add to a growing body of literature that dance and dance/movement therapy are associated with improvements in psychiatric clinical symptoms. This is likely due to several factors: first, from the synchronizing pleasurable experience of music and movement – when the brain’s reward centers are stimulated by music (Vuilleumier and Trost 2015) while brain sensory and motor circuits are also activated (Leisman et al 2016). Second, from the general well-known benefits of exercise (Pederson and Saltin 2015; Vina et al 2012). Third, from the sense of being part of a community (Fisher et al 2015). Finally, there are mind-body aspects of OULA[®] that focus on learning to move through emotions and practice self-acceptance that likely contribute to improvements in psychiatric symptoms.

The observation made in our study with respect to change in depression is in accordance with several longitudinal studies on the effect of some form of dance or dance/movement therapy on depression (López-Rodríguez et al 2017; Gao et al 2016; Pylvänäinen et al 2015; Murrock and Graor 2014; Punkanen et al 2014; Vankova et al 2014; Pinniger et al 2013; Baptista et al 2012; Pinniger et al 2012; Akandere and Demir 2011; Eyigor et al 2009; Hui et al 2009; Quiroga Murcia et al 2009; Haboush et al 2006; Jeong et al 2005; Noreau et al 1995). Fewer studies have evaluated anxiety as an outcome. However, similar to the present study, anxiety has been shown to improve with a dance-related intervention (Erwin-Grabner et al 1999; Noreau et al 1995), although Erwin-Grabner et al. (1999) and Noreau et al. (1995) compared baseline anxiety to end of intervention anxiety; thus, the exact onset of when relief from anxious symptoms occurred is unknown.

One potential explanation for the discrepancy in improvement in anxiety severity relative to depression severity is that nearly half the participants were currently taking an antidepressant at study entry and only one participant was taking an anxiolytic. Perhaps OULA[®] has an adjunctive effect to pharmacotherapy, although this thought warrants further investigation with a randomized controlled study. Another consideration is that, similar to some psychotropics, the anxiolytic effect of OULA[®] might take up to four weeks until improvement in symptoms is noted. Finally, the current sample attended, on average, OULA[®] 1.22 times per week during the intervention period. It is possible that the attendance frequency was not high enough to alleviate anxious symptoms, albeit, Viana and colleagues (2017) found a significant decrease in state anxiety in healthy women after a single session of the exergame Zumba. One difference between the current study and Viana et al.'s (2017) study is that the latter recruited healthy women, whereas we included women with a DSM-5 diagnosis of major depressive or persistent depressive disorder, and depression is known to complicate treating anxiety (Ballenger 2000). Moreover, Viana and colleagues (2017) investigated the dance exergame Zumba, a type of gaming exercise that involves Latin dancing, while OULA[®] in the current study was attended via online or in person. Also, state anxiety was measured pre- and post-single session of the exergame Zumba, and we collected anxiety severity over time.

It was surprising to learn that subjective happiness was not consistently increased in this study given that there is some evidence of a link between happiness and depression (Silva and Figueiredo-Braga 2018; Layard et al 2013). In contrast to this evidence, some research shows that happiness and depression are two separate variables rather than being on a continuum (Keyes et al 2010; Keyes 2005), meaning that the absence of symptoms of depression does not equal the presence of happiness (Keyes et al 2010). Indeed, one study shows that increasing well-being (happiness) predicts a decline in depression (Keyes et al 2010). Further, it has been

argued that happiness is challenging to define, in addition to measure (Kringelbach and Berridge 2011).

While there is a paucity of studies that used dance for happiness, there are a few controlled studies that measured quality of life or well-being associated with dance/movement therapy (Bräuninger 2012; Meekums et al 2012) or dance fitness (Delextrat et al 2016; Domene et al 2016). One of these studies recruited healthy women (Delextrat et al 2016), and another recruited adults with stress but no psychiatric illness (Bräuninger 2012). The third study included obese women (Meekums et al 2012), but psychiatric status was not reported, and, finally, the last study examined overweight, physically inactive women (Domene et al 2016), but psychiatric status was not known. These studies consistently demonstrated an increase in quality of life (Bräuninger 2012) and well-being (Delextrat et al 2016; Domene et al 2016; Meekums et al 2012) with dance/movement therapy or dance fitness in the treatment groups compared to controls. Considering that individuals diagnosed with depression, anxiety and comorbid mood disorders generally feel less happy than controls (Spinhoven et al 2015), the absence of or lack of knowledge regarding psychiatric illness in these studies might explain the increase in quality of life or well-being, yet, consistent changes in happiness were not documented in the present study.

The findings from this study could be useful for mental health professionals or primary care providers who treat depression and anxiety in women. While this study has several limitations to consider, which are discussed below, referring women to engage in dance fitness is not likely going result in harm. Indeed, given that many people do not respond to the conventional approach of treating depression, i.e., pharmacotherapy, or they are unable to tolerate side effects, suggesting a complementary and alternative approach that increases physical activity, as well as helps with processing emotions, is a very attractive option.

LIMITATIONS

This study suggests OULA[®] is associated with a reduction in depression and anxiety severity. However, there are several limitations that merit discussion. First, the attrition rate in this study was much higher than expected. Namely, in an Internet survey of OULA[®], the authors report that the majority of the sample attended OULA[®] for 4-5 years (Hellem and Ferguson 2018). In the current study, n=30 (56.6% attrition rate) women dropped out of the study, mostly due to protocol non-compliance. Most studies that investigate a form of exercise as an intervention note an attrition rate between 25-50% (Linke et al 2011). Specific to dance and dance/movement therapy studies, attrition rates appear to range between 0-32% (López-Rodríguez et al 2017; Delextrat et al 2016; Domene et al 2016; Gao et al 2016; Pylvänäinen et al 2015; Murrock and Graor 2014; Punkanen et al 2014; Vankova et al 2014; Pinniger et al 2013; Baptista et al 2012; Bräuninger 2012; Meekums et al 2012; Pinniger et al 2012; Akandere and Demir 2011; Eyigor et al 2009; Hui et al 2009; Quiroga Murcia et al 2009; Haboush et al 2006; Jeong et al 2005; Noreau et al 1995). The majority of early terminations occurred by week 4, and these women were lost to follow up. As a result, the reasons for non-compliance were not identified. Future studies should consider a mechanism for interviewing early terminators to understand reasons for not continuing with the study.

Second, the use of a single arm design presents concerns with internal and external validity. Along those same lines, the small homogenous sample poses threats to external validity and limits generalizability. It is also important to acknowledge that offering OULA[®] at a single studio presents limitations with respect to instructor selection bias. As a pilot study, though, it seemed reasonable to first learn if an OULA[®] study was feasible, and a larger scale study of OULA[®] should include more sites, in addition to a control arm.

Third, splitting the intervention into two phases; i.e., online and studio, appears to have introduced a confounding factor. The inability to verify online attendance poses a reliability concern, and while there was not a difference in HAM-D, BAI and SHS scores between online and studio attendance for week 2, there was a significant difference at week 4 for HAM-D scores (but not for BAI and SHS scores). Even though online attendance was low at week 4 (n=5), women may have experienced a greater improvement in symptoms with attending OULA[®] at a studio. A comparison between the benefits of online and studio attendance would be an interesting future study to learn if the environment at a studio plays a significant role in symptom management. Finally, we did not utilize blinding in this study with respect to data collection or extraction, which may have introduced biased determination of outcomes (Karanicolas et al 2010).

CONCLUSIONS

OULA[®], a form of therapeutic dance fitness, allows individuals to engage in physical activity and use dance to externalize tension that is generated by emotions. The aim of this study was to learn if 12-weeks of OULA[®] was associated with a reduction in depression and anxiety severity, as well as to an increase in subjective happiness in women with depression. The findings suggest that OULA[®] may help alleviate depressive and anxious symptoms but does not have a consistent influence on subjective happiness. While these findings should be interpreted with caution based on the limitations of the study, mental health professionals, as well as primary care providers, could consider suggesting OULA[®] to depressed women as a way to manage mood symptoms. OULA[®] is available in several states in the United States, as well as online, and therefore accessible to most women.

AUTHOR DISCLOSURE STATEMENT

None of the authors have conflicts of interest to declare, although, we would like to note that one of the authors attends OULA[®] classes.

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