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Psychological Benefits of Water Aerobics for Fibromyalgia Patients

Jamie E. Brass and Lynda Federoff

Individuals with fibromyalgia, a musculoskeletal syndrome, suffer from potentially debilitating symptoms that include pain, tenderness, and fatigue. Because symptoms of fibromyalgia are difficult for others to see, family members and practitioners might not believe that the individual is suffering. The combination of a diagnosis of a debilitating disease and the disbelief of people in one's life can lead to depression. Exercise has been shown to decrease physical and psychological symptoms in individuals with fibromyalgia. This study looks at the psychological benefit of water aerobics in individuals with fibromyalgia. Significant decreases in pain and depression scores were found at posttest and follow-up, suggesting that water aerobics can help improve physical and psychological well-being.

Key Words: aquatic exercise, aquatic therapy

Fibromyalgia is a syndrome that can occur at any age and in any ethnic or cultural group (Russell, 2001), but it is most frequently seen in older women. Approximately 90% of diagnosed patients are women, most in mid- to later life (Yunus & Inanici, 2002). One explanation for this might be a lower tolerance for pain in women. Typically, a patient with fibromyalgia will report to her doctor that she has widespread pain and that her symptoms are interfering with daily activities (Russell). Onset of fibromyalgia can occur at any age, but as many as 25% of sufferers first notice symptoms in childhood (Hulme, 1995).

Fibromyalgia is considered a syndrome of widespread pain. Pain is felt over much of the body and can be characterized as intense (Rollman & Lautenbacher, 1993). The cause of this syndrome and the symptoms in particular are still debated (Wall, 1993), although several theories have emerged. Many theories of causation are overlapping (Chaitow, 2001) and tend to implicate several body systems, including problems with neurochemical processing in the central nervous system (Russell, 2001), immune-system dysfunctions, problems with metabolism (Williamson, 1996), and problems with sleep (McCain, 1993). It has also been suggested that fibromyalgia might be a result of exposure to stressful situations (Merskey, 1993) or microtrauma (tiny tears that result from exercise or exertion) to the muscles (Bennett, 1993). As yet, there is no one theory that can explain the variety of symptoms seen in fibromyalgia (McCain, 1993). This lack of theoretical grounding is problematic because physicians might be reluctant to give a diagnosis when proof of cause is

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absent (Williamson). In addition, the variety of symptoms and possible causes of fibromyalgia might lead physicians to think of this syndrome as a "diagnosis of exclusion" rather than as a true syndrome for which the cause has not yet been determined (Goldenberg, 1990).

Fibromyalgia might be one of the most common musculoskeletal conditions seen by physicians in practice (McCain, 1993). Symptoms of this syndrome occur on a continuum, with some people experiencing mild symptoms and others experiencing severe symptoms (Bennett, 1993). Fibromyalgia symptoms can be experienced throughout the body, although some people find that they are focused more in one area (Hulme, 1995). Widespread pain and tenderness at specific locations on the body are characteristic symptoms of the disorder (Russell, 2001). Pain is often symmetrical, occurring in all areas of the body. Pain might begin in a small area and spread, over time, to encompass more of the body (Goldenberg, 1990). Many patients find that their pain occurs in consistent ways, with little variation in general location (McCain, 1993). Pain in fibromyalgia has been described using words such as *deep, throbbing, stabbing,* and *persistent* (Russell). Tenderness occurs in particular locations on the body known as tender points. Pain is felt in these areas when they are palpated. In addition to pain and tenderness, many people with fibromyalgia experience symptoms such as fatigue and poor sleep, stiffness (Yunus & Inanici, 2002), and a variety of secondary symptoms. This is a chronic disorder, and symptoms are recurrent, leading to a general invariability of problem and complaint presenting in an individual patient. Progression of the syndrome might wax and wane and can include greater pain than is experienced in other types of chronic pain syndrome. The symptoms of fibromyalgia make it difficult for patients to function on a daily basis or get any type of exercise. This, then, leads to breakdown of both muscle and aerobic capacity (McCain, 1993), further incapacitating the individual. This incapacitation begins a cycle that involves increasingly lowered ability to exercise and complete daily living tasks, which is further diminished as the individual gives up all exercise because of pain and becomes increasingly sedentary (Salt & Season, 2000).

Fibromyalgia is experienced in very different ways by different people. It can therefore be difficult to diagnose and treat (Williamson, 1996). People with similar levels of disease severity might experience very different levels of distress and impaired function (Keefe, 1998). Patients are often reluctant to tell their physicians all of their symptoms because they fear they will not be believed (Starlanyl & Copeland, 1996). Because fibromyalgia can be difficult to diagnose, many people experience symptoms for years before finding out why they are constantly in pain. Then they are faced with a diagnosis that might follow them for a lifetime. It seems only normal that some people become depressed at such news (Williamson, 1996). Furthermore, many people experience pain that is so severe it causes them to give up activities or make accommodations to get through the day, which can be an additional cause for depression (Starlanyl & Copeland). Many people attempt to get through the day as they always have—trying to perform all the activities and roles they used to be able to accomplish with ease. This can lead to a conflict between the desire to lead as normal a life as possible and a diminished physical ability to do so (Mannerkorpi & Gard, 2003).

There has been a great deal of research on the concomitance of fibromyalgia and psychological disorder. One unfortunate consequence is that fibromyalgia is

regarded by many, especially older, established physicians, as a strictly psychological illness. This can cause some to diagnose the disorder on behavioral, rather than physiological, findings (Wolfe, 1990). The belief that fibromyalgia is a psychological illness is compounded by the fact that there are few observable symptoms of the syndrome and no solid explanation for cause (Goldenberg, 1990), which has led to a general belief that the pain is all imagined or that the psychological disturbance caused the physical symptoms (Starlanyl & Copeland, 1996). Fibromyalgia is no longer believed to be a psychological illness, but it has far-reaching psychological effects.

It is difficult to determine whether psychological distress, such as depression and anxiety, is a cause or an effect of fibromyalgia. There is research and medical opinion to support both views (Chaitow, 2001). What might be occurring is a cycle in which pain begets psychological distress, which causes further pain. It is known that psychological symptoms do not necessarily cause fibromyalgia (Yunus & Inanici, 2002), but muscle pain, as in fibromyalgia, can lead to psychological change (Merskey, 1993). Whether their role is cause or effect, or both, psychological symptoms and emotional involvement do have an impact on the perception of pain and on immune function (Chaitow). At the very least, symptoms such as depression can result from a negative cognitive appraisal of an individual's own abilities in the face of pain (Patarca-Montero, 2002).

Assessment methods are used with fibromyalgia patients both to diagnose the syndrome and to track its course. Because it is difficult to measure pain in a standardized fashion (Chaitow, 2001), self-report, observation, and available physiological data are often used in assessment (Bradley, 1998). When self-report is used, it has been found helpful to incorporate visual analogue scales and body maps or diagrams as a way to measure pain and personal experience. Visual analogue scales allow an individual to rate pain on a scale from 0 to 100 (or similar). Body maps allow an individual to mark on a diagram exactly where her pain is felt and give some indication of severity. Research suggests that these data can be particularly useful and should be incorporated into more studies (Rollman & Lautenbacher, 1993). Monitoring such diagrams might prove to be a reliable method to track pain and outcomes in research studies (Russell, 2001). Other methods of measuring pain in fibromyalgia include the use of a calibrated thumb on tender points, measures such as the McGill Pain Questionnaire, and monitoring of facial expressions (Rollman & Lautenbacher).

Exercise

General Benefits of Exercise

Many people find that exercise is beneficial because it helps them be able to accomplish daily tasks that often require lifting and endurance. In people with disabilities and in older adults, a lack of endurance ability and strength occurs. Furthermore, people with disabilities might suffer from self-esteem problems because of both their inability to perform normal tasks and a decrease in physical ability. In contrast, exercise has been shown to release endorphins in the body, which can help improve mood in people suffering from low self-esteem and depression (Rosenstein, 2002). Use of exercise to increase strength and flexibility can also

lead to increased endurance (Hulme, 1995). Exercise allows for greater physical ability and the ability to work longer at difficult tasks, and it also produces changes in the body. It might activate opioid peptides to act as analgesics (McCain, 1990), which could lead to a decrease in perceived pain. Exercise might also lead to an increased level of serotonin in the brain (Williamson, 1996) and can be beneficial in encouraging sleep and increased energy (Salt & Season, 2000). Fitness is a combination of ability to complete daily and leisure tasks and having a good view on life. This type of overall fitness can be accomplished by exercise.

Benefits of Exercising in Water

A warm pool provides an environment in which circulation and relaxation are increased and pain is decreased (Hulme, 1995). Exercise in the water can often be very beneficial for individuals who lack motivation for regular aerobic exercise. It might be perceived as easier and less painful, which means that individuals can exercise for longer periods of time and eventually move to land-based activities (Koury, 1996) if they desire. Because exercising in water removes some of the problems associated with weight-bearing exercise, people might be more motivated to follow through with a program (Sanders, 2000). Water provides additional benefits for the body, such as decreasing stress on the heart because body heat is more easily dissipated by water, which means that the heart can focus on delivery of oxygen and not on dissipation of body heat (Sova, 1993). Exercise in water easily translates to exercise on land because a vertical position is used for most exercises and most movements involve the whole body (Baum, 1998). Individuals might find that they can do more exercises in the water than on land and that most or all muscle groups can be involved (Reed & Rose, 1985).

Exercise in the water is also beneficial because of the body's buoyancy in water. People who cannot place weight on their joints might find that water allows them to exercise because the buoyancy removes force from the joints (Koury, 1996) and also allows for safer exercise. When the body is essentially weightless it becomes difficult to injure joints and muscles. Because of the body's buoyancy in water, only 10% of an individual's body weight is used in any given exercise (Rosenstein, 2002). Areas of the body that have already been damaged can be safely stretched and exercised in the water (Jetter & Kadlec, 1985), and the water can act as a support for injured areas, which makes it easier to move without pain and decreases force placed on the body (Bates & Hanson, 1996). Buoyancy also lessens gravity and makes it easier to perform exercises to increase flexibility (Sova, 1993). In addition, "muscles that are assisted by gravity in daily living are resisted by buoyancy in the water" (Sanders, 2000, p. 26), which leads to a better overall workout.

An additional benefit of exercise in the water is the resistance water provides, which slows movements in the water because one must push water around the body. The density of water increases the effectiveness of exercise and allows an individual to vary the amount of resistance encountered by varying movements in the water (Forster & Huey, 1993). Hydrostatic support, in which constant pressure is applied to the body, also occurs in the water and can help improve the respiratory system (Katz, 2003) and increase blood circulation throughout the body (Sova, 1993).

Specific Benefits for Fibromyalgia Patients

People with fibromyalgia are likely to associate increased pain with the beginning of an exercise program. This increase in pain often causes people to give up on fitness goals before achieving any real benefit, including reduced pain (Bennett, 1993). It is likely, however, that exercise is an integral component of any fibromyalgia management program. Richards and Scott (2002) found that participants in an exercise program received more benefit than those in a relaxation program (35% vs. 18% reporting that they were much better or very much better), with maintenance of those improvements, for some, lasting at least 12 months. Women with fibromyalgia find that some movement activities are easier after multimodal treatment that includes exercise (Gustafsson, Ekholm, & Broman, 2002). A third study found that participants in an exercise program were more physically fit and had less pain at tender points than participants in a relaxation program (Martin et al., 1996).

Despite its numerous benefits, the prospect of exercising can be very intimidating for many people with fibromyalgia. Exercising in the water, in particular, can be a very safe way for a person with fibromyalgia to gain strength and flexibility and eventually become comfortable with the idea of other forms of exercise (Chaitow, 2001). Water can help reduce pain, reduce the possibility of microtrauma to muscles, and increase the ability to move easily (Bates & Hanson, 1996). Even so, many people struggle to overcome their own resistance to exercise (Mannerkorpi & Gard, 2003) because they believe that their pain will only get worse as they begin to exercise (Salt & Season, 2000). If individuals continue to exercise regardless of pain, eventually the exercise will get easier and pain will be reduced. Symptoms will decrease in severity, and people will begin to be more accustomed to exercise. In order to avoid the risk of exercise-induced pain, exercise programs for people with fibromyalgia should begin gradually and increase in intensity slowly. Individuals should increase exercise at their own rate and according to their own needs (Bates & Hanson). In the end, individuals might find that more frequent exercising reduces daily feelings of pain and stiffness (Hulme, 1995).

This reduction in daily feelings of pain is important because many people with fibromyalgia push themselves beyond their physical capacity every day in an attempt to continue living their lives and completing tasks as they had in the past. Two benefits of exercise are that, first, it can encourage individuals to learn more about their own abilities, and, second, people might learn how to reduce microtrauma as a result of exercise (Bennett, 1993). It also encourages individuals to take note of their own limitations and learn to adapt to them (Mannerkorpi & Gard, 2003). Aquatic exercises can be designed to encourage independence and self-reliance. Making an individual an active participant in the exercise empowers them and can help increase chances of improvement (Koury, 1996).

Exercise in water also allows individuals to move more quickly through levels of intensity. This ease of use allows individuals to feel encouraged and successful, which increases the chances that they will continue to exercise (Koury, 1996). In addition, people will increase their ability to continue exercising, which decreases the chance of future injury to or aggravation of muscles (Bennett, 1993). A final, and important, benefit of exercise in the water is a "positive experience of the body,"

which allows participants to feel good about themselves and their performance during exercise sessions (Mannerkorpi & Gard, 2003).

In addition to providing physical benefits, exercise in the water might allow participants to experience positive psychological outcomes. Participants in a stretching and aerobic-exercise program that was conducted in a pool had significantly better scores on the Beck Depression Inventory, less anxiety, and more positive Mental Health Inventory scores than those in a control group. General self-efficacy was also higher for participants in the exercise program (Gowans et al., 2001). Similarly, Gustafsson et al. (2002) found that a multidisciplinary program including fitness training in water yielded positive changes at a 3-month follow-up. Busch, Schachter, Peloso, and Bombardier (2002) found that exercise in general led to improved well-being and increased pain threshold for tender points, by about 17% and 35%, respectively.

The overall positive outcomes of exercise in general, and water aerobics in particular, could benefit from additional study, particularly because outcomes of previous research in these areas have been inconclusive or contradictory in some cases. Littlejohn and Walker (2002) reported on two reviews of the use of exercise in treating fibromyalgia and noted that there is no consensus among researchers on outcome or on what types of exercise will prove most beneficial. Burckhardt (2006) reviewed a number of interventions for women with fibromyalgia and found mixed results. Some studies reviewed reported less pain after an exercise intervention, some showed no change, and some involved two methods of treatment that could account for observed change. Ultimately, Burckhardt concluded that the evidence for a multidisciplinary approach to treating fibromyalgia was moderate to strong.

Evidence points to the importance of exercise in treating the physical and psychological symptoms of fibromyalgia. There is little consensus, however, on overall outcome and type of exercise to be used. Water aerobics, with its ease of use and decreased body stress, seems an ideal form of exercise for individuals who are unaccustomed to physical exertion or who experience pain when exercising. Based on previous research on fibromyalgia, its effects, and its treatment, we hypothesized that participation in a structured water aerobics program would benefit individuals with fibromyalgia by (a) decreasing overall pain and (b) improving positive and decreasing negative psychological state. In particular, we hypothesized that individuals who participated in a structured water aerobics program would indicate that they experienced pain in fewer locations and with less intensity after participation. This was measured by self-report on a body map that allowed participants to mark specific locations and intensities of pain and on a visual analogue scale (Hayes & Patterson, 1921) on which they indicated their overall level of pain. We also hypothesized that participants in the water aerobics program would indicate, through use of the Beck Depression Inventory (BDI; Beck, Ward, Mendelson, Mock, & Erbaugh, 1961) and the Affects Balance Scale (Bradburn, 1969), decreased symptoms of depression and an increased degree of positive affect after participation. We expected that these changes would be maintained through the 3-month follow-up.

Method

Participants

Thirteen participants were recruited by contacting local physicians, fibromyalgia support groups, and therapy providers. All participants had a primary diagnosis of fibromyalgia and indicated a willingness to participate in water-based exercise that did not involve water deeper than the level of the neck when standing. Twelve participants were female and one was male. All identified themselves as European American, and they ranged in age from 34 to 58 years.

Measures

Level of Pain. Participants were asked to complete a body map indicating sites of pain and subjective amounts of pain. Pictures of generic bodies were provided with stickers of three colors (for three differing levels of pain), and participants were asked to place stickers where they felt minor, significant, and major pain on a regular (day-to-day) basis. For purposes of analysis, the results from the body maps were reduced to one number by multiplying each sticker by a coefficient (1 for *minor,* 2 for *significant,* 3 for *major pain*) and then adding the numbers for the stickers together. Participants were asked to complete the body maps so that the researcher could obtain a picture of where pain was felt and, individually, how participants perceived the intensity of their local pain. Participants were also asked to complete a visual analogue scale (VAS; Hayes & Patterson, 1921), marking their level of overall pain on a numerical scale. The VAS has been analyzed in a number of situations and has been found to be a valid and reliable measure (see Gallagher, Liebman, & Bijur, 2001; Scott & Huskisson, 1976; Todd, Funk, & Funk, 1996).

Psychological State. To assess for mood and other psychological disturbances, participants were asked to complete the BDI (Beck et al., 1961), which asks respondents to endorse various items that might indicate a depressed mood to quantify depressive symptomatology. The BDI has been shown to have a high split-half reliability and a significant relationship between total scores and scores on individual categories, suggesting high reliability. In addition, the BDI is valid, having shown a significant relationship between its scores and scores on depth-of-depression scales (Beck et al.).

Participants were also asked to complete the Affects Balance Scale (Bradburn, 1969), which requires one to answer questions about both positive and negative affect and provides a broader picture of mood. Bradburn described the Affects Balance Scale as a good indicator of current psychological well-being and noted that several items were included in the measure to ensure a more valid measure overall.

Intervention

All participants were asked to attend one of several orientation sessions held on the campus 1 week before starting the study, at which time they were asked to

give informed consent to participate. Participants were asked to complete a brief demographic questionnaire with information about their age, ethnicity, time since diagnosis, level of fitness, and expectations for the study. They were also asked to complete the measures described in the preceding section. After the orientation session all participants were assigned to water aerobics classes based on their availability.

The participants attended two water aerobics sessions per week for 10 weeks, with the primary investigator acting as instructor and lifeguard. Each session began with light stretching. The first two sessions were 20 min long, with participants having the option to stay an additional 30 min to complete their own workouts. Early sessions focused on warm-up stretching, mild aerobic activity, and minimal strength training. Water-training tools, such as barbells and water noodles, were available for use. Each session ended with light stretching. Each week, sessions were lengthened by 4 min until 50-min sessions were achieved. The sessions were lengthened by increased repetitions of exercises and the addition of new exercises. Attention was given to participants' individual needs, and substitutions were made for exercises that were too difficult or painful.

Participants in the study were encouraged to go about their daily lives as they normally did. Because of the extended nature of this study, and because exercise seems to play a vital role in recovery, participants were not discouraged from beginning other fitness regimens. As part of the pre- and postintervention demographic questionnaire, participants were asked to rate their level of fitness and what they had done to achieve that level.

After completion of the 10-week intervention, participants were again asked to complete the brief demographic measure discussed previously, as well as all other measures. They were given an opportunity to ask any questions they had about the study. They were also informed of ongoing water aerobics courses available on campus.

Follow-up measures were completed by mail. Six months after the completion of the water aerobics program, participants received a packet in the mail with the measures in it. They were instructed to complete the measures and return them in the postage-paid envelope no later than 2 weeks after receipt. Participants were contacted with a postcard 1 week after the initial mailing to remind them to complete the measures. Any participants who had not returned their packets by that time were contacted by telephone to see if they had questions or concerns and to remind them to complete and return the measures.

Results

Eleven participants completed the study through the 3-month follow-up. Two individuals left the study, citing difficulty committing the time required to the program. One participant's posttest and follow-up paperwork were completed incorrectly so her data were excluded from final analysis. Of the remaining 10 participants, 9 were female and 1 was male. The individuals included in analyses reported a mean age of 46.9 years, a mean age at diagnosis of 41.9 years, and a mean age at pain onset of 29.0 years. Three individuals reported pain beginning before adulthood. Participants reported engaging in an average of 2.9 different types of treatments for their symptoms, including medication, psychotherapy, and physical therapy.

To address the hypothesis that water aerobics would lead to a decrease in pain, the results from the VAS and the body map were analyzed using a repeated-measures MANOVA. Significant results were found for the VAS, $F(2, 10) = 31.57$, $p < .01$, in that participants, as a group, experienced significantly decreased pain immediately after participating in the study and at follow-up. The effect size for this analysis was 0.89. VAS scores decreased from pretest to posttest and showed no change between posttest and follow-up, indicating that participants experienced some lasting decrease in overall pain after the study. Means and standard deviations for VAS scores at preintervention, postintervention, and 3-month follow-up are reported in Table 1. Analysis of the body map showed that perceptions of location-specific pain did not change from pretest to posttest or at follow-up, $F(2, 10) = 2.79$, $p > .05$.

The hypothesis that participation in water aerobics would lead to decreased depression and increased positive affect was addressed by analyzing the BDI and the Affects Balance Scale using another repeated-measures MANOVA. Significant changes in psychological state were observed, in that participants indicated significantly decreased depression scores as measured by the BDI, $F(2, 9) = 12.32$, $p < .01$, after treatment. The effect size for this analysis was 0.78. Again, a pattern of decrease in scores from pretest to posttest and no change between posttest and follow-up were observed. It is noteworthy that mean scores on the BDI (see Table 2) decreased from a moderate clinical level to a nondepressed level after treatment. No significant changes were observed on the Affects Balance Scale, $F(2, 10) = .03$, $p > .05$, from pretest to posttest and follow-up. See Table 3 for descriptive statistics for nonsignificant measures.

Discussion

Results of this study indicated a significant decrease in overall levels of pain and depressive symptomatology but little change in location of pain and overall affect. Although limitations to this study make it difficult to determine with

Table 1 Visual Analogue Scale Descriptive Statistics

Time	*M*	*SD*
Preintervention	2.98	0.66
Postintervention	1.90	0.83
3-month follow-up	2.13	1.05

Table 2 Beck Depression Inventory Descriptive Statistics

Time	*M*	*SD*
Preintervention	17.11	7.27
Postintervention	9.44	6.73
3-month follow-up	9.89	4.94

Table 3 Descriptive Statistics for Nonsignificant Measures

Measure	Time	*M*	*SD*
Body map	preintervention	19.60	6.90
	postintervention	14.60	8.25
	3-month follow-up	19.80	7.70
Affects Balance Scale	preintervention	5.20	2.20
	postintervention	5.00	1.15
	3-month follow-up	5.00	1.94

certainty that participation in a water aerobics program can provide fibromyalgia patients with respite from pain or depression, there is compelling evidence to suggest further study of this matter. As a group, participants in this study decreased their levels of depression and pain and maintained the decrease through the 3-month follow-up. These results are consistent with those from other studies that found that participation in exercise programs could benefit patients to the extent that many of them reported subclinical levels of pain at tender points after intervention (Wigers, Stiles, & Vogel, 1996).

The fact that further significant results, such as decreases in the number of locations of pain and increases in positive affect, were not obtained was surprising because the participants in the study stated that they were quite pleased with the changes they saw in their lives, and several individuals commented that they felt better physically and perceived themselves to be happier, as well. Approximately half the participants in the study continued to take a water aerobics course during the next semester and remarked to the instructor that they continued to see physical and mental improvements.

Because the information reported to the instructor is different from that reported in the measures, we hypothesize that the method and measures chosen for this study might have been less than ideal in and of themselves. For example, it is possible that paper-and-pencil self-report measures allowed participants too much time to think about aches and pains and depressive symptoms, leading to inflated responses as compared with those that might have been gathered through semistructured interviews. It is also possible that some of the measures used did not adequately tap the changes that participants saw in themselves. Open-ended questions about overall change and the experience of participating in the study might have yielded different results. Alternatively, measuring change more frequently, such as every 2 weeks, might have led to a more accurate picture of participant status. The changes that participants experienced over time might have been so subtle or gradual that they had difficulty remembering them or knowing how to note them on pain items. The most likely reason for failing to reach statistical significance in this area was the low statistical power caused by small sample size.

Other limitations of this study include the small number of participants, which likely resulted in too small an effect size to observe differences if they existed; the lack of a control group; and the limitations associated with working in a rural area. Although the original goals of this study included recruiting 60 participants and assigning them to one of three groups (water aerobics, lap swimming, and

wait-list control), and although over 100 physicians, support-group coordinators, and therapists were contacted to recruit participants for this study, only 13 individuals responded for the study. The study was therefore circumscribed to account for fewer participants, resulting in all participants being assigned to the water aerobics group. This resulted in limited generalizability and two other concerns. Rosenthal (1965) raised the concern of volunteer study participants, noting that those who volunteer for studies might be more motivated, more interested in the study, and possibly more concerned about their own outcomes as a result of the study. It is possible that a large population of individuals with fibromyalgia is available in the local area, but only the 13 most interested and motivated individuals agreed to participate. There is also a concern that results might be caused by a placebo effect. Participants might have experienced a decrease in pain and depression simply as a result of participating in a study. Nonetheless, the fact that participants maintained improvement for 3 months suggests that mere placebo effect is unlikely. Because of these concerns, and because of the small, rural, population from which the sample was drawn, it is difficult to determine what exactly led to the benefit obtained by individuals in the study.

We hypothesize that the lower numbers of individuals interested in participating might have resulted from one of several factors. It is possible that many potential participants were concerned about anticipated pain associated with exercise or that some might have been reluctant to participate in a water program. Others might have lacked sufficient motivation to participate in a 10-week study.

Despite the low number of participants and the limited generalizability of the results, this study did provide promising results, as supported by the magnitude of the effect sizes observed. To expand and improve on this study, future studies in this area should consider varied recruitment strategies, an urban or suburban location, and a different method of data collection. Previous research supports the idea that a water-based exercise program that gradually increases in intensity should provide relief from both physical and mental symptoms associated with fibromyalgia, and those findings are supported by the results of the current study. Participants for this study were recruited largely through medical or community mental health clinics. Future recruitment should consider direct advertising in media outlets, contacting physical and massage therapists, and reaching out to holistic health professionals. It is also likely that more participants could be obtained in urban or suburban areas, allowing future studies to conduct comparisons between active interventions and control groups. Finally, use of semistructured interviews and open-ended questions designed to allow participants to elaborate on the pros and cons of their experience would yield richer and more valuable results.

For individuals interested in further research, program development, or referral to a water aerobics program, there are a few practical considerations about the exercise program. In developing the program, one of the main goals was to increase exercises gradually, by increasing the length of time spent on activities and by adding new activities. Time management was a concern in this process because it becomes difficult for the instructor to watch the time it takes to complete an exercise while ensuring that all participants are completing the activity safely and correctly. To accommodate this concern, increases in exercise time and addition of new exercises were staggered between cardio and strength exercises, resulting in an uneven but steady progression through the program.

Implementing the program provided some real insights into the ways that impact can have varying effects on individuals with fibromyalgia. For some participants, 20 min of low-impact exercise in water was very difficult to accomplish and seemed particularly grueling. For them, a gradual increase of 4 min per week in exercise time was difficult but something they could accomplish. Other individuals had no difficulty with 20 min of exercise, and some could have started the program with 50 min. Future studies, or new programs, should consider matching participants based on reported physical fitness or ability and tailoring the program's beginning points to those fitness or ability levels. Different groups can begin with differing amounts of exercise time and intensity, allowing participants to further customize their own exercise experiences.

Pending additional study, and based on research conducted by others in this area, it seems reasonable to conclude that participation in a water aerobics program could provide benefit to patients with fibromyalgia, both psychologically and physically. Although the actual benefit obtained, as well as how long the benefit can be maintained, is unclear, patients generally reported a positive experience with exercise in the water and indicated that they knew others with fibromyalgia whom they would like to introduce to water aerobics. Water aerobics could be considered by both mental health practitioners and physicians as an exercise alternative for patients suffering from fibromyalgia.

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