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Perception and Responses to Different Forms of Aqua-Based Exercise Among Older Adults With Osteoarthritis

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Osteoarthritis (OA) is prevalent among older adults. Aqua-based exercise is often recommended as a therapeutic intervention. Limited evidence exists on the effectiveness of this form of exercise intervention. Perceptions of pain, mean, and maximum heart rate (HR) responses, ratings of perceived exertion (RPE), and subjective enjoyment to different forms of aqua-based exercise were investigated. Thirteen older adults with documented OA completed five aquatic exercise sessions: body-weight aqua-fitness (AF), body-weight aqua-jogging (AJ), resisted aqua-fitness (RAF), resisted aqua-jogging (RAJ), and hydrotherapy (HYD). HYD was rated most enjoyable with AF deemed as an acceptable alternative. Pain scores immediately postexercise were significantly lower than 24-hr postexercise for all exercises. Mean HR was higher during AJ than during AF and HYD, and higher during RAF than during HYD. Maximum HR was not significantly different during any sessions. SRPE was significantly higher for RAJ than for HYD, although similar for all other sessions. These data suggest similar pain and maximum HR responses to different modes of aqua-based exercise. AF may be an alternative to HYD as an enjoyable water-based exercise to remediate OA.

Keywords: aquatic exercise, aquatic therapy

The global population is aging at a rapid pace (Lopez, Mathers, Ezzati, Jamison, & Murray, 2006). Over the last 50 years, the population of the 65 years and older age group has increased steadily. In New Zealand, it is expected that older adults will make up one quarter of the population by 2051 (Statistics New Zealand, 2007). Similar trends have been predicted for North America where the percentage of adults aged 65 years or older is expected to rise to approximately 20% of the population by as early as 2030 (American Medical Association, 2003).

Advancing age is associated with an increased risk and incidence of a number of degenerative conditions, the most common being osteoarthritis (OA). Accord-

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ing to the World Health Organization (WHO), 45% of women over the age of 65 years have OA, with the primary symptom being joint pain and stiffness (Flores & Hochberg, 2003). Not surprisingly, the majority of adults 65 years and older with OA typically have not met the public health recommendations for type, quantity, and quality of physical activity (Fontaine, Heo, & Bathon, 2004). These lower levels of physical activity are associated with a loss of muscular strength, endurance, and balance, which together contributes to an increased risk of falls and lower perceived quality of life (Henwood & Bartlett, 2008). Consequently, older adults with OA are particularly susceptible to greater than age-related reductions in muscle strength, functional ability, balance, increased rates of comorbidities, and associated declines in independence and perceived quality of life.

The American College of Rheumatology recommends aqua-based exercise for older adults with OA (Westby, 2012). Water immersion has been associated with decreased pain symptoms, due to increased sensory input and decreased joint compression (Westby, 2001). Since pain is often cited as a primary barrier to exercise among adults with different forms of arthritis (Der Ananian, Wilcox, Watkins, Saunders, & Evans, 2008; Wilcox et al., 2006), aqua-based exercise may offer an ideal environment in which to exercise for this group. Aqua-based exercise is associated with reduced loading on the joints and a decrease in HR response compared with land-based exercise (Graef & Kruel, 2006). A review of literature related to OA and aqua-based exercise concluded that aqua-based exercise can result in comparable outcomes to land-based exercise for adults with knee or hip OA and rheumatoid arthritis (RA), despite a wide variability in characteristics among the reviewed aqua-based exercise programs (Batterham, Heywood, & Keating, 2011).

Despite these recommendations and the potential benefits of aqua-based exercise for older adults with OA, there is limited evidence-based knowledge relating to the effects of this form of exercise among this population. Many studies of aqua-based exercise for adults with OA have used exercise programs based around hydrotherapy (Fransen, Nairn, Winstanley, Lam, & Edmonds, 2007; Lund et al., 2008; Silva et al., 2008). Hydrotherapy typically is defined as any individualized, therapist-supervised program which focuses on strength and range of motion (ROM) exercises (Eversden, Maggs, Nightingale, & Jobanputra, 2007), usually conducted in warm water between 33.5–35.5 °C (or 92.3–95.9 °F; Becker, 2009). While hydrotherapy-based programs have been shown to improve physical function (Fransen et al., 2007) and reduce pain (Silva et al., 2008) among adults with OA, hydrotherapy classes are often expensive and not always widely available due to the requirement of specialized therapists and facilities with warm water temperatures.

Aqua-fitness and aqua-jogging classes are popular community modes of aqua-based exercise among older adults and are often more accessible and affordable than hydrotherapy classes. Aqua-fitness usually consists of partial weight-bearing aerobic and strengthening exercises performed (usually to music) while standing in the shallow end of a swimming pool. Aqua-jogging consists of simulated running in deep water while wearing a flotation device to keep the head above water (Reilly, Dowzer, & Cable, 2003). Both these types of aqua-based exercise are generally performed in a group and are overseen by an aquatic instructor. Pool temperatures are variable; however, classes often take place in public or competitive swimming pools many of which operate in a temperature range of 27–29 °C (80.6–84.2°F; Becker, 2009).

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Despite the popularity of aqua-fitness and aqua-jogging classes, few studies have compared these forms of aqua-based exercise to hydrotherapy. A study by Kaneda, Sato, Wakabayashi, Hanai, & Nomura (2008) did compare adaptations to walking exercises in waist-chest depth water with aqua-jogging among healthy older adults. Both exercise groups significantly improved reaction time following 12 weeks of twice weekly classes. In addition, the aqua-jogging group also significantly improved dynamic balance. The study did not analyze the participants' perceptions of these different exercise modes or whether they would be likely to adhere to such a program following cessation of the study.

To maintain the benefits of any exercise program, ongoing participation and long-term adherence is required. A study by Kang, Ferrans, Kim, Kim, & Lee (2007) found that long-term adherence to aqua-based exercise among older Korean women with OA or RA is affected by social cohesion and self-efficacy, as well as attraction to the task. It is therefore important to increase our understanding of perceptions among older adults with OA toward different modes of aqua-based exercise to ensure that appropriate programs are made available and encourage ongoing participation.

The purpose of this mixed-methods study was to compare the participants' perceptions of enjoyment, their self-reported pain, and direct heart rate responses, and ratings of perceived exertion elicited by five different types of aqua-based exercise in older adults who were diagnosed and suffer from OA. These data may allow us to develop more suitable and accessible forms of aqua-based exercise for older adults with OA, and ultimately the information may contribute to improved functional independence, healthfulness, and quality of life for older adults who suffer from OA.

Method

Participants

Thirteen community-dwelling older adults were recruited in response to advertising in community newspapers, medical centers, and the Arthritis New Zealand website. All participants were over 60 years of age (mean age 69.8 years ± 6.6) and had been diagnosed by radiography as having OA (mean length of time of OA symptoms 12.1 years ± 7.9). Twelve females and one male took part in the study. Participants with any level of circulatory disease obtained their physician's permission to participate in the study. The research was conducted with approval of the institutional research board, and all participants gave their written informed consent.

Fifteen participants initially enrolled to take part in the study. Only 13 completed the study by participating in all five exercise sessions and were used for the analyses. Attrition was due to cold pool temperature during AF ($n = 1$) and finding the first session (AF) too hard ($n = 1$).

Design

The study was a cross-sectional comparison of five forms of aqua-based exercise. Participants each took part in five different aqua-based exercise sessions that included a session of body-weight aqua-fitness (AF), body-weight aqua-jogging (AJ), hydrotherapy (HYD), resisted aqua-fitness (RAF), and resisted aqua-jogging (RAJ). Four groups of participants attended classes, which took place in partially randomized order as outlined in Table 1. Partial randomization was selected to

ensure that participants were not exposed to the resistance exercise options during either of the first two sessions. This was to give participants the opportunity to practice the basic movements before adding any resistance to the moves. Each class was separated by 48–72 hr.

Table 1 Order of Exercise Sessions

	Group 1	Group 2	Group 3	Group 4
Session 1	AF	AJ	HYD	AJ
Session 2	AJ	HYD	AJ	AF
Session 3	RAF	AF	AF	RAJ
Session 4	HYD	RAF	RAJ	RAF
Session 5	RAJ	RAJ	RAF	HYD

AF = aqua-fitness, AJ = aqua-jogging, HYD = hydrotherapy, RAF = resisted aqua-fitness, RAJ = resisted aqua-jogging

AF, AJ, RAF, and RAJ were chosen to reflect aqua-fitness and aqua-jogging classes similar to those available in community pools and attended by older adults with and without OA. The aqua instructor was experienced in all these different exercise modes as well as working with older adults. The hydrotherapy session was overseen by a physiotherapist who was experienced in delivering hydrotherapy sessions. This class consisted of a range of strengthening and ROM exercises similar to those previously reported in the literature (Fransen et al., 2007; Hinman, Heywood, & Day, 2007). Although hydrotherapy classes traditionally consist of a one-on-one session with a therapist, the hydrotherapy sessions in this study were conducted in small groups. Consequently, exercises were not individualized for each participant; however, there were a maximum of five participants in each exercise group. This protocol is similar to other studies which have investigated hydrotherapy-based exercise programs (Fransen et al., 2007; Silva et al., 2008). The exercise protocol for each session is outlined in Appendix A: Exercise Protocols.

Outcome Measures

Enjoyment. Participants were asked to rank a series of questions relating to enjoyment on a scale of 1 (least enjoyable) to 5 (most enjoyable) for each of the exercise sessions. These questions related to the exercises themselves, the social aspect, pool temperature, and the instructor. They were similar to and adapted from the relevant section of the exit questionnaire used by Cochrane, Davey, & Matthes Edwards (2005) for individuals with OA after an aqua-based exercise intervention. The questionnaire (Appendix B: Enjoyment Questionnaire) was given to participants to complete at the end of each exercise session.

Pain. Participants were asked to rate pain using the numerical rating of pain scale (NRS), which ranks pain severity from 0 (no pain) to 10 (worst possible pain) (Salaffi, Stancati, Silvestri, Ciapetti, & Grassi, 2004). Pain intensity is frequently measured using this method (Farrar, Young Jr, LaMoreaux, Werth, & Poole, 2001) and it has been reported as a valid and reliable measure of acute pain (Bijur, Latimer,

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& Gallagher, 2003). Participants were shown the NRS scale immediately before and after each session and asked to rank their pain accordingly. Participants were then contacted 24 hr after each session and again asked to rank their NRS pain level according to the scale they had taken home for the follow-up contact.

Heart rate. Heart rate (HR) was measured and recorded with a Polar heart-rate monitor (Polar RS 400, Kempele, Finland) and T31 coded transmitter every 5 s throughout each exercise session. HR data were transferred via infrared device onto Polar WebLink software; mean and maximum HR for each of the five exercise condition classes were calculated for each participant and used in the analysis.

Ratings of perceived exertion. A modified Borg scale of ratings of perceived exertion (RPE) was used with a scale of 0–10, where zero represents no effort (rest) and 10 is maximal effort. It has been suggested that this scale offers enhanced individual interpretation of exertion compared with the original scale of 6–20 (Borg & Kaijser, 2006). Participants were asked to rate each exercise session (SRPE) at the completion of the session. This procedure has been shown to be equally effective as having participants rate the session throughout (Egan, Winchester, Foster, & McGuigan, 2006).

Focus group. Participants were invited to attend a focus group upon completion of the five exercise sessions. The purpose of the focus group was to explore the participants' views of the exercise classes they experienced and to estimate whether they would be likely to attend any of those types of exercise classes on a regular basis. A focus group was chosen to allow exploration of participant's opinions, perceptions, and priorities while in a small group social environment (Kitzinger, 2005) because the investigators felt that a focus group would reflect the group social aspect of the aqua exercise classes more adequately than a one-on-one interview. The session was recorded using a digital voice recorder and later transcribed verbatim. Two researchers were present during the focus group, one who took notes of any silent agreement, disagreement, or obvious body language not captured on the audiotape recording, while the other researcher guided the conversation using semistructured probe questions (Appendix C: Focus Group Questions) to steer the discussion. Questions were developed using published guidelines (Krueger & Casey, 2000).

Data Analysis

As a number of the assumptions for the parametric tests in each variable were not satisfied, it was decided that five separate parametric and nonparametric tests would be applied. To minimize the chances of a Type 1 error, the significance level was adjusted to be 0.05/5 = 0.01. Repeated measures analysis of variance (ANOVA) with Bonferroni post hoc tests were calculated out for the quantitative parametric data that included HR mean, HR maximum, SRPE, and pain ratings. For the nonparametric data derived from the enjoyment questionnaire, Friedman's ANOVA was used to analyze each question. Wilcoxon signed ranks tests with a Bonferroni correction were used for subsequent post hoc analyses of the nonparametric measures.

Focus group data were analyzed using Krueger's framework analysis (Krueger, 1994) as a general guide for interpretation. Five key stages of analysis are outlined: familiarization, identifying a thematic framework, indexing, charting, and mapping and interpretation (Rabiee, 2004). This approach allows themes to develop from the conversation as well as the research questions (Rabiee, 2004).

Results

Enjoyment

Participants ranked 6 questions each on a scale of 1–5 relating to their enjoyment of different aspects of each exercise session. The HYD session scored significantly higher overall on enjoyment than the AF, AJ, and RAF sessions. A breakdown of questions revealed that the HYD session also scored significantly higher than several other sessions for the relaxation aspect of the session, and pool temperature (see Table 2).

Pain

None of the aqua-based exercise sessions resulted in any significant differences in pain ratings pre, post- or 24-hr postexercise. When AF, AJ, RAF, RAJ, and HYD scores were pooled, however, pain was significantly lower immediately postexercise than 24-hr postexercise ($p = .02$; see Figure 1).

Heart Rate

Mean HR during AJ was significantly higher than during HYD. There were no significant differences among maximum HR achieved during any of the sessions. Mean and maximum HR values for each exercise mode are presented in Figures 2 and 3, respectively.

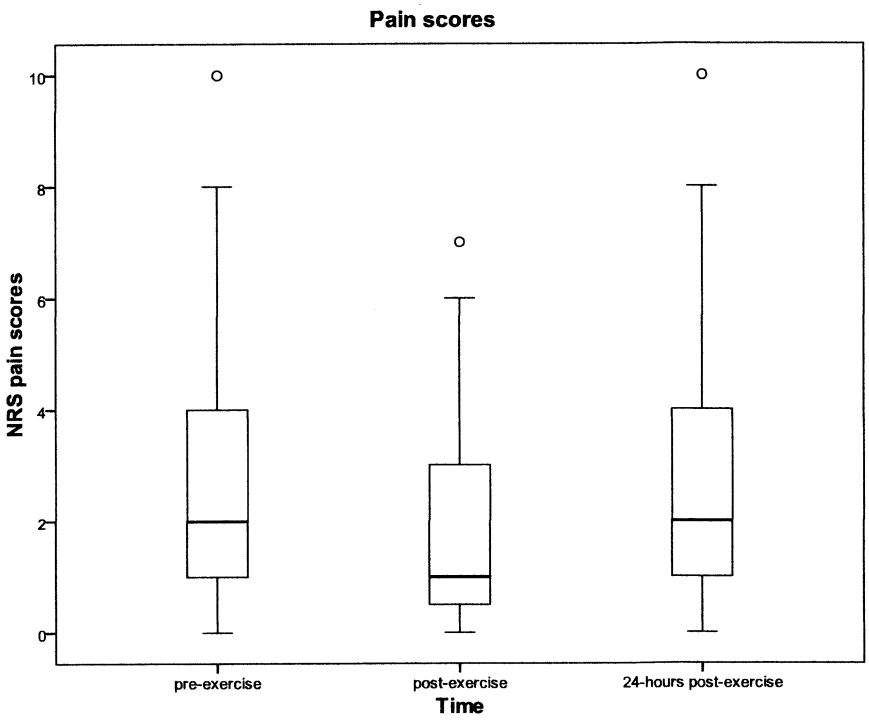

Figure 1 – NRS pain ratings immediately before exercise, immediately postexercise and 24 hours postexercise.

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Table 2 Mean Enjoyment Rating for Each Exercise Session

	AF (A)	AJ (B)	HYD (C)	RAF (D)	RAJ (E)	Chi-Square	Sig
Overall enjoyment (out of 30)	24.85 ± 3.36 A-C**	24.46 ± 3.07 B-C**	28.21 ± 2.23 C-D**	25.77 ± 2.72	26.07 ± 3.27	19.3	.001*
Exercises with equipment	4.1 ± .68	3.77 ± .83	4.5 ± .65	4.2 ± .699	3.93 ± .917	7.07	0.13
Strength/range-of-movement exercises	4.25 ± .64	3.79 ± .80	4.43 ± .76	4.14 ± .66	4.07 ± .73	9.39	0.05
Relaxation	4.46 ± .52	3.99 ± .62 B-C**	4.71 ± .47	4.57 ± .51	4.43 ± .65	17.92	0.001*
Social	4.29 ± .91	4.43 ± .65	4.93 ± .27	4.57 ± .51	4.71 ± .61	11.24	0.024
Pool temperature	3.07 ± 1.59 A-C**	4.07 ± 1.0 B-C**	4.71 ± .61 C-D**	3.57 ± 1.16	4.21 ± 1.12	20.99	0.000*
Instructor	4.64 ± .84	4.71 ± .47	4.93 ± .27	4.71 ± .61	4.71 ± .61	5.54	0.236

Note. *Friedman's ANOVA, ($p < .01$); **Wilcoxon signed-rank test, ($p < .005$).

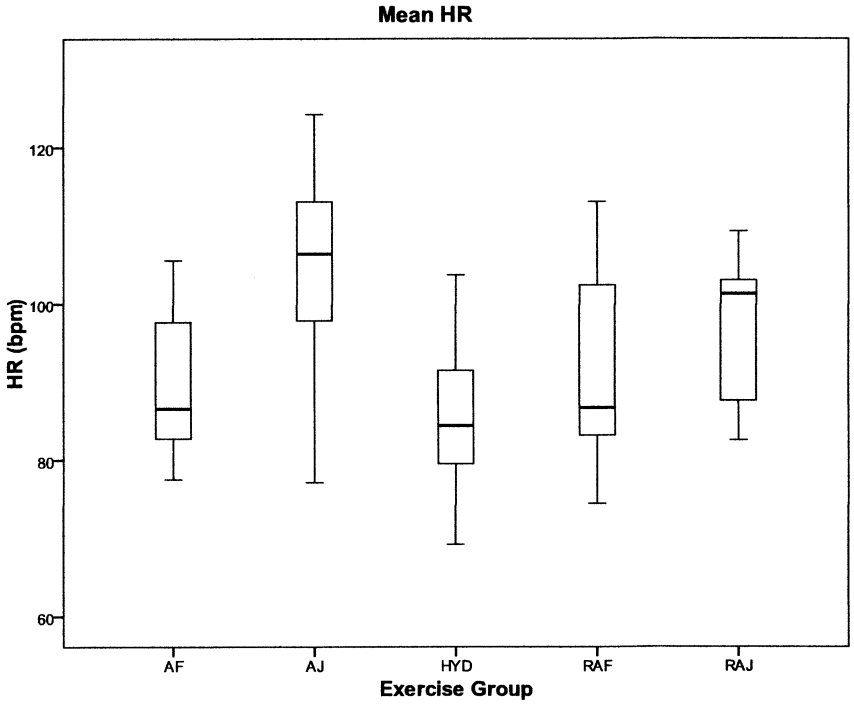

Figure 2 – Mean HR for each exercise mode.

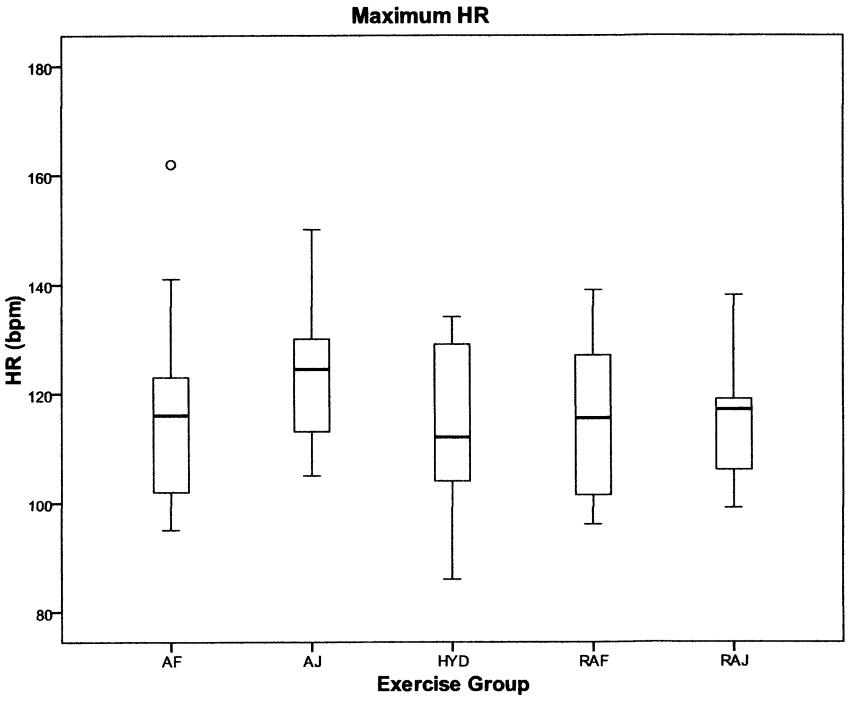

Figure 3 – Maximum HR for each exercise mode.

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SPRE

SRPE values were similar across all five exercise conditions. The only exception was the significantly greater SPRE for RAJ than for HYD. SRPE mean values are displayed in Figure 4.

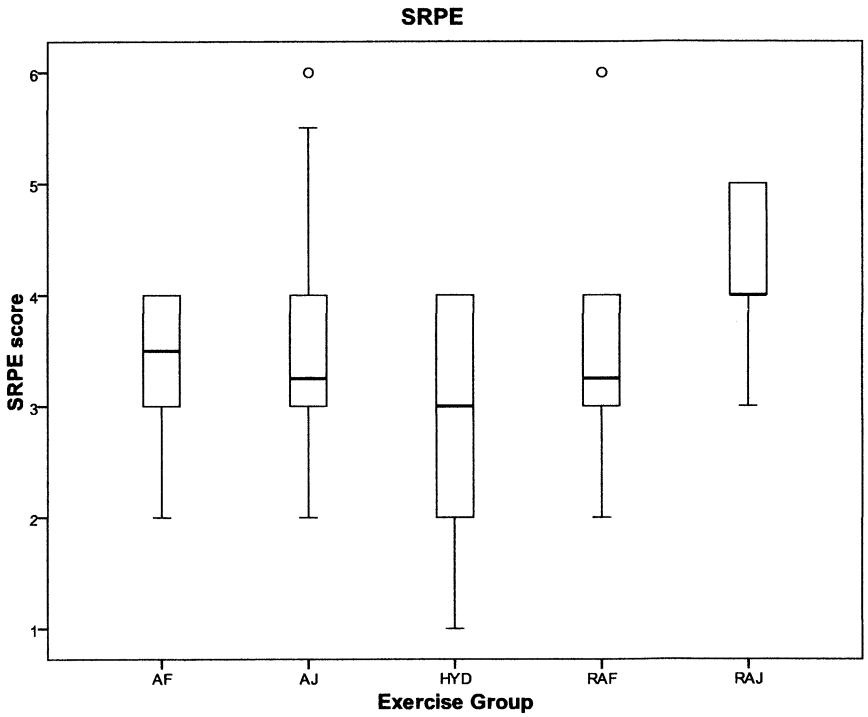

Figure 4 – SRPE scores for each exercise mode.

Focus Group

Eight of the thirteen participants, attended the focus group session that sought to further explore perceptions and preferences among participants relating to the different modes of exercise. The mean age of those who attended the focus group was 71.6 years ± 7.6. Participants had OA symptoms for an average of 16.4 years ± 6.8. All of those who attended the focus group were female.

Equipment used during the resisted exercise sessions included flotation noodles and barbells. Participants enjoyed using the noodles in the water but found the dumbbells too difficult, with many finding them too hard to hold on to as indicated by the following focus group responses: "The noodles were kinder; the barbells were very hard . . . " and " . . . for hands, for people who have arthritis in their hands, holding onto them [barbells], that was quite hard."

During the aqua-jogging sessions, participants wore a flotation belt. Several participants stated that they found the belts uncomfortable: "Oh, I didn't like the belts at all" and "You felt like you were being cut in half because they were really tight."

The social aspect was identified as an enjoyable feature of the classes. Although there was little differentiation between the different exercise modes, the focus group discussed the importance of social support and highlighted the importance of being with others who have OA: "Yes, and you all had the same goals, symptoms, do you know what I mean? And, you were all there for the same reason . . . " and " . . . everybody was helping each other, yeah support, I think, there was good support."

Two participants indicated that they felt the aqua-jogging sessions were less social than the other classes: "[During aqua-jogging], we became isolated." and "I found it [aqua-jogging] quite competitive."

Water temperature and the facility both were considered important. The hydrotherapy pool had a ramp and handrail, which made access into and out of the pool easier. Most participants commented on the handrail and ramp and expressed a preference for the hydrotherapy pool, although one participant acknowledged that the warmer hydrotherapy pool may not be suitable for the aqua-fitness or aqua-jogging sessions: "The water was warmer, the actual pool was nice and I liked the ramp"; "It was easier . . . the [pool name] ones were easier to get into because of the ramp"; and "The aqua-aerobics . . . in the [hydrotherapy] pool I think you'd get too hot . . . I mean the water wasn't that hot over here but once you moved it was good."

Most participants rated both instructors highly although two participants had more confidence in the physiotherapist who took the hydrotherapy session and felt that she was more aware of their needs and the limitations of OA:

> "The only thing you can really say, and it's not a criticism, but that it depends on the leader and who was taking the class. Now when we went with the physiotherapist who obviously understood arthritis and the effect of arthritis on certain parts of the body then obviously her exercises were totally different to the ones who are just the . . . either sports or PE specialists who wanted you to go as fast as you could with a piece of equipment that quite honestly was not correct especially for people with arthritis."

Participants were asked to discuss the exercise sessions and how these affected their arthritis symptoms. Most participants felt that in general the sessions were beneficial; however, some did feel that the intensity was too high and that having sessions so close together would be difficult to maintain:

> "My whole body felt alive and everything felt . . . happy, so what is it . . . endorphins or something."

> "It was sore to start off with and after sort of about 48 hours it did calm down . . . and then you work to your limit."

> "I think as far as the arthritis went, if you kept at that pace for any length you'd probably do more harm than good, personally, I think if you really went full on like that all the time, you probably need more gentle exercise with arthritis . . . depending where it is of course."

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"I think you could maintain it better if it was probably a little bit gentler."

Participants were asked to discuss anything they particularly disliked about the sessions. Cold water and music that was too loud were the main themes: "I didn't like the cold water"; "The music, it was awfully loud"; and "I just couldn't stand the music . . . I felt it particularly over here [facility] extremely loud."

In general participants enjoyed the feeling of being able to move more freely in the aquatic environments: "I loved that feeling of being free to move" and "Well, I haven't done that for years because I can't you know walk without pain, but you get in the water, and you could really move."

When asked if they would prefer to continue with aqua-fitness or aqua-jogging, almost all indicated that they preferred the aqua-fitness: "It would be aqua aerobics (fitness)"; "I didn't like the jogging"; and "I don't really like it [aqua-jogging], but I think it would do me good!"

Discussion

The key aims of this study were to compare five different forms of aqua-based exercise and establish which, if any, older adults with OA most enjoyed and might be likely to attend on a regular, ongoing basis. The study also aimed to address whether a hydrotherapy-based session, led by a therapist, was considered comparable to other modes of aqua-based exercise, since hydrotherapy classes, while frequently recommended, are often less accessible and more expensive than other types of aqua-based exercise. To achieve these aims, we performed a mixed-method study involving the collection of psycho-physiological data as well as the participants' views on many aspects of the aqua exercise classes. By comparing the data for the five aqua exercise conditions in the current study to the literature for our outcome measures described below, we hoped that aqua instructors and facilities managers may be better informed in order to accommodate the needs of older adults with OA.

Implications From Questionnaire Results

The questionnaires revealed that the HYD session scored highest overall for enjoyment and significantly higher than both the AF and AJ sessions. A breakdown of the questions revealed that the HYD session scored highest for every question and significantly more for pool temperature and the relaxation aspect of the session. Pool temperature during the HYD sessions was between 32–33 °C (89.6–91.4 °F), whereas it ranged from 26–30 °C (78.8–86 °F) for the other sessions.

Sessions during which the pool temperature was below 29 °C (84.2 °F) scored lowest. In fact, for one participant the pool temperature of 26 °C (78.8 °F) was sufficient reason to pull out of this study. The importance of water temperature in our study agrees with Bunning & Materson (1991) who reported that compliance to an aqua-based exercise program decreases among people with OA when the water temperature drops below 29 °C (84.2 °F). It is likely that the warmer pool temperature during the HYD sessions contributed to participants scoring this session highest for relaxation.

Implications From Focus Group Results

During the focus group, participants noted that there was no loud music during the HYD session, which may have also have added to the sense of a more relaxed session. Music is widely used during aqua-fitness and aqua-jogging classes to motivate and aid synchronization of participants, as well as pace the velocity of movements (Barbosa et al., 2010). While some participants in the current study stated that they enjoyed the music, several indicated that they had found it too loud. One participant wore earplugs because she found the sessions too noisy, and several others agreed that they preferred the music to be more subdued.

Previous studies have identified that the social aspect of aqua-based exercise is extremely important, especially among older adults with OA (Fisken, Keogh, Waters, & Hing, in press; Kang et al., 2007). While there was a trend for the HYD session to be scored higher for the social aspect than the AF and AJ sessions, post hoc analysis found no significant differences among these exercise sessions. Further, there were no significant differences in the rating of the social aspect due to session order. Discussion during the focus group revealed that several participants felt the AJ and RAJ sessions were less social than the AF, RAF, and HYD sessions and that the AJ and RAJ sessions were too competitive. Participants stated that they liked exercising with others who were similar in age and had the same symptoms, as this increased the feeling of support among them. Previous literature intimated that this was characteristic of physically active older adults (Henwood, Tuckett, Edelstein, & Bartlett, 2011) and adults with OA (Cochrane et al., 2005). This would support the likely appeal of aqua-based exercise classes specifically for older adults with OA.

Previous studies have indicated that many adults with arthritis consider that a lack of qualified instructors who understand their physical limitations is a major barrier to aqua-based exercise (Wilcox et al., 2006), whereas other studies have identified the instructor as a potential motivator to participate in this form of exercise (Fisken et al., in press). Although the questionnaire in the current study did not identify any significant differences between instructors during any of the exercise sessions, two participants who took part in the focus group expressed a greater degree of confidence in the knowledge of the qualified physiotherapist who took the HYD session than the fitness instructors who led the other classes. A greater understanding of the symptoms and limitations of OA among aqua-exercise instructors may help to increase confidence and possibly adherence to instructor-led aqua-based exercise classes among participants with OA.

There were no significant differences in the pre-, post- and 24-hr postexercise pain levels for each of the five different exercise sessions. When data were pooled across the exercise sessions, pain scores were significantly lower postexercise than 24-hr postexercise. Cochrane et al., (2005) found a reduction in self-reported pain following a one-year aqua-based intervention among older adults with OA. Collectively, these results suggest that ongoing participation in different forms of aqua-based exercise may offer some degree of pain relief for those with OA.

The role of the aqua instructor in observing and listening to how their older clients, especially those with conditions like OA, respond to these activities should not be ignored. This was highlighted by the results of the focus group whereby some participants in the current study expressed reservations regarding the pace and intensity of the program undertaken, the use of equipment such as hard-to-

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grasp barbells, and, in particular, the relative proximity of classes to each other (e.g., that two days was insufficient for these adults with OA to recuperate from a novel session). Several participants felt that the resisted exercise classes were too demanding, despite the similar HR response and SRPE rating among sessions. Such concerns suggested that aquatic exercise instructors and therapists need to be able to provide multiple options for their clients in regards to movements performed, use of resistance equipment, and speed of movements so that the newer, less well-conditioned, and older clients do not perceive the classes to be too hard or painful and stop attending.

Implications From Physiological Variables

Mean HR achieved during AJ was significantly higher than HYD. SRPE scores indicated that participants also rated the HYD session as requiring the lowest exertion, with RAJ requiring the highest level of exertion. These complementary results provide support for the validity of both HR and SRPE measures. Previous research with young, healthy participants found that adding dumbbells to aqua-based exercise activities increased maximum HR and SRPE (Costa, Afonso, Bragada, Reis, & Barbosa, 2008). It may have been expected that the resisted exercise sessions would have resulted in the highest values for mean and maximum HR and scored highest for SRPE.

In the current study, there may be a number of possible reasons for why the data did not support such a hypothesis. One possible explanation could reflect comparable energy expenditure in both forms of exercise due to similarities in the work performed in a given period of time (i.e., power) via the work-energy relationship. The resisted exercise classes included the use of equipment to increase drag, such as dumbbells and noodles. While the increased drag force during the resisted exercise sessions would have required a greater muscular force output, the velocity of movement was reduced based on the force-velocity relationship from the greater density of the water medium. As power is the product of force and velocity, the increased force but reduced velocity of movement found in the resistance aqua conditions would have likely resulted in similar muscular power outputs in the resisted and bodyweight versions (Brody & Geigle, 2009). Based on the work (power)-energy relationship, this could therefore have contributed to the similar HR responses during the resisted and unresisted exercise sessions.

The disparity in HR response and SRPE between the current study and that found by Costa et al., (2008) may be due to the different populations measured and the difference in methodologies. The study by Costa et al., (2008) measured responses to 6-min exercise bursts, with or without dumbbells, rather than an exercise class as a whole. Furthermore a number of factors influence HR response during aqua-based exercise such as depth of immersion and water temperature. Therefore HR responses across these studies should be interpreted with some caution due to possible interstudy differences in these factors (Brody & Geigle, 2009). Despite this limitation, they do provide some insight into the exercise intensity of the different modes of aqua-based exercise used in this study. The similar HR responses measured across the exercise types in the current study would tend to indicate that these different modes of aqua-based exercise may offer comparable cardiovascular/physiological adaptations and associated long-term health benefits.

Limitations

Limitations to our findings included the relatively small sample and potential variability of baseline fitness parameters among participants. Pool temperatures between the aqua-fitness and aqua-jogging sessions were not always consistent and could be relevant because pool temperature is considered an important determinant of adherence to aqua-based exercise among older adults, with and without OA (Fisken et al., in press). The order of exercise sessions was not completely randomized, with the resisted conditions performed after the unresisted conditions. Statistical analysis revealed no order effect on the outcome measures. Finally, participants who volunteered to participate in the focus group may have had different perceptions or opinions from those who did not take part.

Conclusion

In a review of literature (Rahmann, 2010), it was reported that aqua-based exercise is often recommended for people with OA but that there is no evidence to establish whether a physiotherapist-supervised hydrotherapy program is more effective than a generic aqua-based exercise program at improving strength and function. Although the current study did not examine the long-term physiological effects of hydrotherapy or other modes of aqua-based exercise, it did give some insight into pain response, heart rate response, ratings of perceived exertion, and preference between different types of aqua-based exercise among older adults with OA. Our results indicate that while hydrotherapy uniformly was considered the most enjoyable and beneficial form of aqua-based exercise, aqua-fitness was also deemed an acceptable and enjoyable form of aqua-based exercise for older adults with OA. Similar pain, HR responses, and SRPE ratings across the different modes of aqua-based exercise suggest that potential long-term benefits from these forms of aquatic exercise may be comparable, which is promising given the relative popularity of aqua-fitness and aqua-jogging classes. Our results and those of other studies indicate that long-term adherence to aqua-based exercise is likely to be affected by variables such as pool temperature, instructor knowledge, exercising with a similar-age population, music which is not too loud, and the provision of a program which is not too physically demanding and uses equipment such as noodles appropriate for the population. The potential long-term benefits of different modes of aqua-based exercise for older adults with OA warrant further investigation.

References

American Medical Association. (2003). Public health and aging: Trends in aging—United States and worldwide. *Journal of the American Medical Association, 289*(11), 1371–1373. PubMed doi:10.1001/jama.289.11.1371

Barbosa, T.M., Sousa, V.F., Silva, A.J., Reis, V.M., Marinho, D.A., & Bragada, J.A. (2010). Effects of musical cadence in the acute physiologic adaptations to head-out aquatic exercises. *Journal of Strength and Conditioning Research, 24*(1), 244–250. PubMed doi:10.1519/JSC.0b013e3181b296fd

Batterham, S.I., Heywood, S., & Keating, J.L. (2011). Systematic review and meta-analysis comparing land and aquatic exercise for people with hip or knee arthritis on function,

mobility and other health outcomes. *BMC Musculoskeletal Disorders, 12,* 123. PubMed doi:10.1186/1471-2474-12-123

Becker, B.E. (2009). Aquatic therapy: scientific foundations and clinical rehabilitation applications. *Physical Medicine and Rehabilitation, 1*(9), 859–872 10.1016/j.pmrj.2009.05.017. PubMed

Bijur, P.E., Latimer, C.T., & Gallagher, E.J. (2003). Validation of a verbally administered numerical rating scale of acute pain for use in the emergency department. *Academic Emergency Medicine, 10*(4), 390–392. PubMed doi:10.1111/j.1553-2712.2003.tb01355.x

Borg, E., & Kaijser, L. (2006). A comparison between three rating scales for perceived exertion and two different work tests. *Scandinavian Journal of Medicine & Science in Sports, 16*(1), 57–69. PubMed doi:10.1111/j.1600-0838.2005.00448.x

Brody, L.T., & Geigle, P.R. (Eds.). (2009). *Aquatic exercise for rehabilitation and training*. Champaign, IL: Human Kinetics.

Bunning, R.D., & Materson, R.S. (1991). A rational program of exercise for patients with osteoarthritis. *Seminars in Arthritis and Rheumatism, 21*(3), 33–43. PubMed doi:10.1016/0049-0172(91)90038-2

Cochrane, T., Davey, R.C., & Matthes Edwards, S.M. (2005). Randomised controlled trial of the cost-effectiveness of water-based therapy for lower limb osteoarthritis. *Health Technology Assessment, 9*(31), 1–135. PubMed

Costa, G., Afonso, S., Bragada, J.A., Reis, V.M., & Barbosa, T.M. (2008). Comparison of acute physiological adaptations between three variants of a basic head-out water exercise. *Brazilian Journal of Kinanthropometry and Human Performance, 10,* 323–329.

Der Ananian, C., Wilcox, S., Watkins, K., Saunders, R.P., & Evans, A.E. (2008). Factors associated with exercise participation in adults with arthritis. *Journal of Aging and Physical Activity, 16*(2), 125–143. PubMed

Egan, A.D., Winchester, J.B., Foster, C., & McGuigan, M.R. (2006). Using session RPE to monitor different methods of resistance exercise. *Journal of Sports Science and Medicine, 5,* 289–295. PubMed

Eversden, L., Maggs, F., Nightingale, P., & Jobanputra, P. (2007). A pragmatic randomised controlled trial of hydrotherapy and land exercises on overall well being and quality of life in rheumatoid arthritis. *BMC Musculoskeletal Disorders, 8*, 23. PubMed

Farrar, J.T., Young, J.P., Jr., LaMoreaux, L., Werth, J.L., & Poole, R.M. (2001). Clinical importance of changes in chronic pain intensity measured on an 11-point numerical pain rating scale. *Pain, 94*(2), 149–158. PubMed doi:10.1016/S0304-3959(01)00349-9

Fisken, A., Keogh, J., Waters, D. L., & Hing, W. A. (2012). Perceived benefits, motives and barriers to aqua-based exercise amongst older adults with and without osteoarthritis. *Journal of Applied Gerontology,* advance online publication. doi:10.1177/0733464812463431

Flores, R.H., & Hochberg, M.C. (2003). Definition and classification of osteoarthritis. In K.D. Brandt, Dohert, M. and Lohmander, L.S. (Ed.), *Osteoarthritis* (2nd ed.). Oxford: Oxford University Press.

Fontaine, K.R., Heo, M., & Bathon, J. (2004). Are US adults with arthritis meeting public health recommendations for physical activity? *Arthritis and Rheumatism, 50*(2), 624–628. PubMed doi:10.1002/art.20057

Fransen, M., Nairn, L., Winstanley, J., Lam, P., & Edmonds, J. (2007). Physical activity for osteoarthritis management: a randomized controlled clinical trial evaluating hydrotherapy or Tai Chi classes. *Arthritis & Rheumatism. Arthritis Care and Research, 57*(3), 407–414. PubMed doi:10.1002/art.22621

Graef, F.I., & Kruel, L.F.M. (2006). Heart rate and perceived exertion at aquatic environment: differences in relation to land environment and applications for exercise prescription - a review. *Revista Brasileira de Medicina do Esporte, 12*(4), 198e–204e. doi:10.1590/S1517-86922006000400011

Henwood, T., Tuckett, A., Edelstein, O., & Bartlett, H. (2011). Exercise in later life: the older adults' perspective about resistance training. *Ageing and Society, 31*(8), 1330–1349. doi:10.1017/S0144686X10001406

Henwood, T.R., & Bartlett, H.P. (2008). Measuring the impact of increased exercise on quality of life in older adults: the UQQoL, a new instrument. *European Journal of Ageing, 5*(3), 241–252. doi:10.1007/s10433-008-0084-6

Hinman, R.S., Heywood, S.E., & Day, A.R. (2007). Aquatic physical therapy for hip and knee osteoarthritis: results of a single-blind randomized controlled trial. *Physical Therapy, 87*(1), 32–43. PubMed doi:10.2522/ptj.20060006

Kaneda, K., Sato, D., Wakabayashi, H., Hanai, A., & Nomura, T. (2008). A comparison of the effects of different water exercise programs on balance ability in elderly people. *Journal of Aging and Physical Activity, 16,* 381–392. PubMed

Kang, H.S., Ferrans, C.E., Kim, M.J., Kim, J.I., & Lee, E.O. (2007). Aquatic exercise in older Korean women with arthritis. Identifying barriers to and facilitators of long-term adherence. *Journal of Gerontological Nursing, 33,* 48–56. PubMed

Kitzinger, J. (2005). Focus group research: using group dynamics to explore perceptions, experiences and understandings. In I. Holloway (Ed.), *Qualitative Research in Health Care*. Maidenhead: Open University Press.

Krueger, R.A. (1994). *Focus groups: a practical guide for applied research* (2nd ed.). Thousand Oaks, Calif.: Sage.

Krueger, R.A., & Casey, M.A. (2000). *Focus Groups* (3rd ed.). Newbury Park, CA: Sage Publications.

Lopez, A.D., Mathers, C.D., Ezzati, M., Jamison, D.T., & Murray, C.J.L. (2006). *Global burden of disease and risk factors*. USA: Oxford University Press.

Lund, H., Weile, U., Christensen, R., Rostock, B., Downey, A., Bartels, E.M., . . . Bliddal, H. (2008). A randomized controlled trial of aquatic and land-based exercise in patients with knee osteoarthritis. *Journal of Rehabilitation Medicine, 40*(2), 137–144. PubMed doi:10.2340/16501977-0134

Rabiee, F. (2004). Focus-group interview and data analysis. *The Proceedings of the Nutrition Society, 63*(4), 655. PubMed doi:10.1079/PNS2004399

Rahmann, A.E. (2010). Exercise for people with hip or knee osteoarthritis: a comparison of land-based and aquatic interventions. *Open Access Journal of Sports Medicine, 1,* 123–135. PubMed doi:10.2147/OAJSM.S6941

Reilly, T., Dowzer, C., & Cable, N.T. (2003). The physiology of deep-water running. *Journal of Sports Sciences, 21,* 959–972. PubMed doi:10.1080/0264041031000164136 8

Salaffi, F., Stancati, A., Silvestri, C.A., Ciapetti, A., & Grassi, W. (2004). Minimal clinically important changes in chronic musculoskeletal pain intensity measured on a numerical rating scale. *European Journal of Pain (London, England), 8,* 283–291. PubMed doi:10.1016/j.ejpain.2003.09.004

Silva, L.E., Valim, V., Pessanha, A.P.C., Oliveira, L.M., Myamoto, S., Jones, A., & Natour, J. (2008). Hydrotherapy versus conventional land-based exercise for the management of patients with osteoarthritis of the knee: A randomized clinical Trial. *Physical Therapy, 88*(1), 12–21. PubMed doi:10.2522/ptj.20060040

Statistics New Zealand. (2007). *New Zealand's 65+ population: A statistical volume*. Wellington. Retrieved October 25 2012 from www.stats.govt.nz

Westby, M. (2012). Exercise and arthritis. Retrieved October 25 2012 from www.rheumatology.org/practice/clinical/patients/diseases_and_conditions/exercise.asp

Westby, M.D. (2001). A health professional's guide to exercise prescription for people with arthritis: A review of aerobic fitness activities. *Arthritis Care and Research, 45*(6), 501–511. PubMed doi:10.1002/1529-0131(200112)45:6<501::AID-ART375>3.0.CO;2-Y

Wilcox, S., Der Ananian, C., Abbott, J., Vrazel, J., Ramsey, C., Sharpe, P.A., & Brady, T. (2006). Perceived exercise barriers, enablers, and benefits among exercising and nonexercising adults with arthritis: Results from a qualitative study. *Arthritis and Rheumatism, 55,* 616–627. PubMed doi:10.1002/art.22098

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Appendix A: Exercise Protocols

AF: Body-Weight Aqua-Fitness	
• All exercises performed in time to music • Session approximately 50–60 min • Pool temperature varied between 26–30 °C • Water level at or near chest level	Warm up (5–10 mins): • Marching on the spot, walking forward and backward, side-stepping, chest presses, and arm raises Body of program: • Each music track was used to vary exercises and emphasis on aerobic or strengthening exercises. Aerobic exercises were performed alternatively with strength exercises for approximately 30–35 min Aerobic exercises: • Heel jacks • Rocking horse • Cross country ski • Running in place • Jumping jacks Strengthening exercises: • Squats • Standing flex hip • Lunges • Chest press • Tricep pushdowns • Bicep curls • Cool down (5 mins) • Exercises as warm up, reducing pace • Stretches (5mins) • Upper and lower body static stretches
RAF: Resisted Aqua-Fitness	
• All exercises performed in time to music • Session approximately 50 mins • Pool temperature varied between 28.5–30 °C • Water level at or near chest level	• Structure and exercises as AF • Faster music tracks used for the aerobic exercises • Strengthening exercises used noodles, barbells, and dumbbells to increase resistance

AJ: Aqua-Jogging	
• Session approximately 50–60 mins • Pool temperature ranged from 29–30 °C • All exercises performed wearing a flotation belt to prevent feet from touching the bottom of the pool	Warm up (10 mins): • Simulated walking up and down length of pool using arms to assist movement, gradually increasing pace to running Body of program: • Each of the following intercepted with 2–3 lengths of aqua-jogging at a moderate pace • Aqua-jogging focusing on cupping hands and pushing down with feet: 3 lengths • Aqua-jogging focusing on running with high knees: 4 lengths • Cross country ski, scissor straight arms and legs: 2 lengths • Cycle: sitting as if in a recliner cycle and use arms to assist movement through the water: 3 lengths • Rock climb: 3 lengths • Aqua-jogging with breast-stroke arms: 4 lengths • Aqua-jogging moderate-fast paced length alternated with recovery length, 3× sets Cool down: • Simulated walking up and down length of pool reducing pace: 3 lengths
RAJ: Resisted Aqua-Jogging	
• Session approximately 50 mins • Pool temperature ranged from 29–30 °C • All exercises performed wearing a flotation belt to prevent feet from touching the bottom of the pool	• Structure and exercises as AJ • Following the warm-up, noodles and dumbbells were added to increase resistance and drag

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HYD: Hydrotherapy	
• Session approximately 45 mins • Pool temperature 32–33 °C • Water approximately waist height	Warm-up: • Walking forward, backward and sideways gradually increase pace and arm movements. Walk round the pool on heels then on toes. Exercises: • 1 set of 10 repetitions per exercise (may be performed holding onto side of pool for balance) • Hip flexion • Hip extension • Pushups against side of pool • Hip adduction • Hip abduction • Shoulder abduction • Knee cycling, 30 s each leg • Chest press, shoulders/arms submerged • Double leg squat • Trunk rotation • Trunk control in standing position: lift alternate legs for balance practice, then reach across to touch knee with opposite hand Cool down • Circle ankles, knees and hip, and shoulders slowly • Upper and lower body static stretches • Relax in supine position with flotation devices

Appendix B: Enjoyment Questionnaire

Exercise Evaluation

We would like to obtain your feedback on this exercise session and give you the opportunity to comment on various aspects of the session.

Please answer the following questions on today's exercise session.

1. Which aspects of the exercise class did you enjoy the most?

Try to indicate your level of enjoyment using numbers 1,2,3,4, or 5 where the 1 = least enjoyable, and the number 5 = most enjoyable.(please put a circle around the appropriate number).

	Least enjoyable		Most enjoyable		
i. The exercises using floats/other equipment	**1**	**2**	**3**	**4**	**5**
ii. The strength and range of movement exercises	**1**	**2**	**3**	**4**	**5**
iii. The relaxation/recovery parts of the session	**1**	**2**	**3**	**4**	**5**
iv. The social aspect	**1**	**2**	**3**	**4**	**5**
v. The water temperature	**1**	**2**	**3**	**4**	**5**
vi. The instructor	**1**	**2**	**3**	**4**	**5**

2. Would you be likely to regularly attend an aqua class similar to the one today if it was available?

3. Was there any aspect of today's exercise session that you particularly liked?

4. Was there any aspect of today's exercise session that you particularly disliked?

5. Is there anything else about today's session that you would like to comment on?

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Appendix C: Focus Group Questions

1. Has anyone in the group not previously tried aqua-exercise before taking part in this study?

2. In general, what did you think of the aqua exercise sessions you took part in?

3. What did you think of the facilities where the exercise sessions took place?

4. What did you think of the aqua instructor/hydrotherapist?

5. Do you think you would attend any of these sessions on a regular basis if available?

- Which one(s) would you be most likely to attend?
- What did you specifically like about that/those classes?
- Which one(s) did you least like?
- What did you specifically dislike about that/those classes?

6. Did you feel that taking part in any of the aqua exercise sessions helped your arthritis symptoms?

7. Did you feel that taking part in any of the aqua exercises sessions benefited you in any other way?

8. Did you feel that there were any negative aspects to taking part in the aqua exercise sessions?

9. We wanted you to help us to evaluate the aqua exercise classes you took part in. Is there anything that you came wanting to say but didn't get the chance to say?