Brain Injury, February 2006; 20(2): 133–141

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ORIGINAL PAPER

Aquatics, health-promoting self-care behaviours and adults with brain injuries

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(Received 1 April 2005; accepted 20 September 2005)

Abstract

Primary objective: To determine the effect of an aquatic programme on the health promoting behaviours of adults with brain injuries.

Main outcomes and results: Eighteen individuals participated in the programme and were randomly assigned to an experimental ($n = 9$) or control group ($n = 9$). Health promoting behaviours, physical self-concept and self-esteem were measured pre- and post-intervention. Significant differences and large effect sizes were found between scores for the experimental group only, indicating an increase in health promoting behaviours, physical self-concept and self-esteem.

Conclusions: Results have useful implications for health professionals as exercise prescription may enhance health promoting behaviours and decrease health care costs after a brain injury.

Keywords: *Physical, activity, health, behaviors, aquatics, brain, injuries*

Introduction

With an estimated 1.5–2.5 million brain injuries occurring a year in the US, where 50 000–100 000 lead to permanent disability, brain injuries represent a serious public health issue [1–3]. The life expectancy of this population is also increasing due to an increase in medical support immediately post-brain injury [4]. However, the disabilities that an individual is faced with after an injury are diverse due to the neurologic damage and the subsequent deficits that accompany the initial insult to the brain [5–7]. Thus, damage to any part of the brain may lead to motor disorders, ranging from paralysis to poorly controlled movements including spasticity, hypotonia, ataxia and apraxia [8]. Secondary problems associated with brain injuries are often the result of immobility and include decreased vital capacity, strength, muscle tone, muscle function and increases in body fat [5, 9]. This loss of fitness, combined with decreased mobility, has been shown to raise the metabolic cost of functional activities such as walking [10, 11]. Consequently, an individual with brain injuries may have increased difficulty completing activities of daily living (ADLs), which influences their functional capacity and ability to complete other areas of the rehabilitation process independently [5, 12]. Therefore, the physical, social and environmental barriers that people with brain injuries are faced with leads to a downward spiral in overall health and well being [13].

Post-brain injury, numerous studies have indicated increases in depression [14, 15] and psychosocial parameters such as decreased self-esteem [16] and decreases in social contacts [17, 18]. A decrease in these mental and social states has been recognized to lead to an increase in the adoption of negative behaviours, such as inactivity, poor diet, isolation, smoking, alcoholism and drug addiction [14, 19].

Evidently, after a brain injury individuals are placed under a severe amount of stress due to the range and severity of the physical, cognitive and psychosocial disabilities. Stress is considered a dynamic transaction between the person and their environment as

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ISSN 0269–9052 print/ISSN 1362–301X online
DOI: 10.1080/02699050500443822

stress levels can change between situations [20]. Thus, an individual's stress level is determined by their perceived ability to meet the requirements of the environment [21, 22]. Initially the individual cognitively appraises a situation and then their perception of this appraisal determines their stress level [21]. Due to the nature of a brain injury, individuals will find themselves in increasingly challenging situations, which may potentially heighten acute and chronic stress levels. For example, the physical injuries a female experiences may mean that she cannot get dressed independently or climb the stairs in her home and a speech impediment may make it difficult and frustrating for her to converse clearly with a friend. This may cause her to appraise these predicaments negatively in the future, thus decreasing the likelihood that she will place herself in these situations again. Consequently, factors such as independence, functional capacity, components of fitness, social contacts, self-esteem, wellbeing and health may decrease due to this avoidant response.

Clearly, how an individual appraises, reacts and copes with the stressful situations they are faced with post-injury is highly important to their rehabilitation. Coping has been defined as an individual's 'cognitive and behavioural efforts to manage (reduce, minimize, master or tolerate) the internal and external demands of the person-environment transaction that is appraised as taxing or exceeding the resources of the person' ([23], p 572). Following a brain injury, individuals have been shown to adopt an avoidant-oriented approach [24] which may involve denial, behavioural and cognitive disengagement [25], distancing and escape [26] and avoidance and resignation [27]. This typically manifests itself as a defensive focusing and venting of emotions as well as social withdrawal [28]. However, it has been reported in studies of coping behaviour that approach-oriented active coping styles are the preferred way to handle stressors and problems encountered post-brain injury [25]. This involves people actively approaching the stressor with a positive reinterpretation of the stressful situation. For example, although the female (discussed earlier) has a speech impediment and has difficulty conversing clearly, instead of her withdrawing and avoiding social situations she will realize that she can still converse at some level. The female will then continue to expose herself to social situations again. Therefore, the challenge presented to health care professionals is ensuring that people adopt a more approach oriented-active coping style.

Other factors have been shown to influence which coping style a person adopts post-injury, such as locus of control and self-efficacy [29]. Locus of control refers to an individual's belief that their behaviour and the subsequent outcome are under their control (internal) or not (external) [20]. Following a brain injury, an individual's health locus of control (HLOC) is decreased due to the physical, emotional and psychological injuries experienced. This may include factors such as physical activity, stress management, spirituality, nutrition, interpersonal relationships and health responsibility [30]. This decrease in HLOC is often accentuated by the fact that people may blame the injury/accident on external factors such as chance or fate [29] and thus feel like they have no control over their well-being. However, it has been suggested that HLOC and the likelihood that individuals will participate in health promoting activities can be enhanced by increasing internal control [31], which ensures that people believe that their health is under their control and is a result of their own actions. Internal control is also dependent on an individual's level of self-efficacy, which determines whether an individual believes they are capable of performing a certain health behaviour, such as physical activity [20]. Self-efficacy effects the level of control an individual feels in an environment and low self-efficacy is associated with depression, anxiety, stress, helplessness, low self-esteem [32] and consequently negative health states [29]. Again, the challenge to health professionals is to find activities that may increase an individual's self-efficacy, their locus of control and ultimately their coping with the injury.

One health-promoting behaviour that research has repeatedly shown can positively impact physical and psychosocial variables is physical activity or exercise. Presently, exercise is not typically incorporated within the rehabilitation process for people with brain injuries, which currently includes activities such as physical, occupational, speech and vocational therapy. However, exercise is associated with numerous health benefits, including lower mortality rates, improved cardiorespiratory fitness and enhanced psychological well-being [20, 33, 34]. This is especially applicable to populations who have lower baseline levels of psychological or physical states, such as strength, depression, anxiety, self-esteem and stress [35]. There are also economic benefits to individuals with brain injuries exercising, as there is a decreased reliance on the health care community [4, 36]. Subsequently, exercise may provide a mechanism whereby individuals with brain injuries can positively impact the cognitive, physical and psychosocial deficits of their injury, as well as creating opportunities for social adjustment, independence and development of 'self' [37]. Through enhancing physiological and psychological functioning post-injury, exercise can ultimately enhance the functional capacity and quality of life of participants [38], thus decreasing the pressure on health care professionals to serve this growing population. Increasing independence may also reduce the demand for chronic and acute care services [39].

It has been proposed that by adopting health-promoting self-care behaviours that emphasize positive lifestyle practices improvements in health and quality of life may occur [30, 40, 41]. Physical activity or exercise is considered a health-promoting self-care behaviour [30]. Consequently, exercise was adopted as the independent variable and health-promoting behaviour for this study. More specifically, aquatic exercise was selected as the mode of exercise as it has been shown to increase physical, psychosocial, cognitive and leisure skill development post-injury [42–44].

Health promoting behaviours can be measured by the Health Promoting Lifestyle Profile-II (HPLP-II) [30]. The HPLP-II was based on the health-enhancement model, which views a health promoting lifestyle as a multi-dimensional pattern of self-initiated behaviours designed to maintain or enhance health and wellbeing [45]. The HPLP-II has been used extensively to measure health-promoting behaviours across a variety of populations [39–41]. As the adoption of health promoting behaviours may occur due to increases in self-esteem, it is also important to measure this construct.

Research indicates that exercise can have a positive effect on the physical self-concept and self-esteem of people without disabilities [46], elderly populations [47, 48] and clinical populations [49, 50]. One measure of physical self-concept and self-esteem is the Physical Self-Description Questionnaire (PSDQ) [51]. The PSDQ measures self-esteem, which is an individual's perception of their self. Self-esteem can be further broken down to include physical self-concept, which includes physical ability and physical appearance. Marsh and colleagues have conducted numerous investigations examining the impact of physical activity on physical self-concept in adolescents, adults and the elderly [51–53]. Results indicate that participation in a physical activity programme can lead to improvements in components of physical self-concept. Therefore, the PSDQ was used to measure changes in self-esteem, which research has shown to be an antecedent for the adoption of health promoting behaviours [29, 40, 48, 52]. Thus, if individuals in the current study report an increase in health promotion behaviours then it would be expected that individuals would also experience increases in self-esteem and control. Thus, results would be in accordance with Shaw's [29] framework of coping, illness behaviour and outcomes.

Therefore, the purpose of this study was to determine if regular participation in an aquatic programme can enhance an individual's health-promoting self-care behaviours. The hypothesis states that participation in the aquatic programme will increase the participant's self-esteem and thus health-promoting self-care behaviours.

Method

Participants

A stratified random sampling technique was adopted. This involved obtaining a list of individuals who were all outpatients at the centre, above level 6 on the Ranchos Los Amigos Scale of Cognitive Functioning and had experienced the brain injury more than 1 year prior to the initiation of the

Table I. Participant demographics.

Participant	Gender	Age (years)	Group	TSI (months)	Medical information/physical functioning
1	M	43	Control	51	Walking frame for mobility, moderate spasticity in right side
2	M	30	Control	42	Mild spasticity in right side
3	M	37	Control	31	Wheelchair for mobility, moderate spasticity in right side
4	M	28	Control	65	Wheelchair for mobility, mild spasticity in right side, moderate ataxia
5	M	32	Control	19	Mild spasticity in right side, mild ataxia
6	F	47	Control	29	Wheelchair for mobility, severe spasticity in right side, severe ataxia
7	F	33	Control	37	Walker, speech impediment, mild spasticity
8	F	29	Control	42	Moderate spasticity, wheelchair for mobility
9	F	34	Control	55	Walking frame for mobility, moderate spasticity in right side
10	M	42	Exercise	17	Wheelchair for mobility, blind, speech impediment, mild spasticity
11	M	25	Exercise	60	Cane for walker, moderate spasticity in right side
12	M	46	Exercise	26	Wheelchair for mobility, severe spasticity in right side
13	M	46	Exercise	61	Cane for walker, mild spasticity in right side
14	M	41	Exercise	44	Wheelchair for mobility, severe spasticity in right side, severe ataxia
15	F	40	Exercise	39	Mild spasticity in right side
16	F	29	Exercise	29	Severe memory deficits, mild spasticity in right side, mild ataxia
17	F	33	Exercise	38	Wheelchair for mobility, severe spasticity in right side
18	F	38	Exercise	49	Cane for walker, spasticity in right side, moderate ataxia

TSI: Time since injury.

programme. These steps were taken in an attempt to ensure that the group was as homogenous as possible, that instructions to questionnaires could be understood clearly and that the sample was representative of people with brain injuries who live out in the community. Participants were then randomly sampled from the list to either the exercise group or control group. The age of individuals in the exercise group ranged from 25–46 ($M = 37.78$, $SD = 4.05$) and time since injury ranged from 17–61 months ($M = 40.33$, $SD = 14.67$). The age of individuals in the control group ranged from 28–47 ($M = 35.33$, $SD = 3.78$) and time since injury ranged from 19–65 months ($M = 41.22$, $SD = 14.17$). Participants within both groups were not involved in any other form of physical activity throughout the duration of the programme (see table I for participant demographics).

Measures

The Health Promoting Lifestyle Profile II (HPLP-II) [30] was used to assess health promoting self-care behaviours. The HPLP-II measures self-promoting self-care behaviour conceptualized as a multi-dimensional pattern of self-initiated actions and perceptions that maintain or enhance the individuals level of wellness, self-actualization and fulfilment [30, 40]. The 52-item instrument incorporates a 4-point likert response scale ranging from '*never*' to '*routinely*'. The scale measures the frequency of self-reported health promoting behaviours in the areas of health responsibility (Cronbach $\alpha = 0.86$), physical activity (0.85), nutrition (0.80), spiritual growth (0.86), inter-personal relations (0.87), stress management (0.79) and total scale (0.94). The HPLP II was administered pre- and post-programme to all participants.

Six sub-scales of the PSDQ [51] were used to assess self-esteem and physical self-concept. Marsh [52] suggests that the validity of the PSDQ can be maintained if only certain sub-scales are used and if no total score is given. Therefore, only six of the 11 original sub-scales were considered appropriate considering the participants involved, the activities they would be completing and purpose of the study. Sub-scales have been shown to have high α-coefficients in the general population [51] and in individuals with a brain injury [44]. Sub-scales utilised included strength (0.93), body fat (0.96), endurance (0.95), co-ordination (0.93), flexibility (0.92) and self-esteem (0.96). The modified PSDQ consisted of 38 questions with each item being scored on a likert response scale ranging from 1 ('*False*') to 6 ('*True*'), depending on the extent to which the individual feels the statement is indicative of them. The PSDQ was completed pre- and post-programme for all participants.

Procedure

Before the programme began, physicians approval to participate in the exercise programme and approval from the Institutional Review Board was received. The researcher then met with the participants to discuss goals, the extent of the injury and special considerations. During this time, participants completed the HPLP-II and PSDQ. After this initial assessment, participants completed three 1-hour exercise sessions in the pool. During these sessions, the principal researcher determined which activities the participant enjoyed most and suitable exercise intensities. After completion of these pre-programme assessments the 8-week aquatics or control programme followed.

The exercise sessions were completed three times a week for 8 weeks and each session lasted 1-hour. Exercise sessions included both aerobic and resistance training components. Throughout the programme, participants wore Polar Heart rate monitors to ensure that heart rate was kept within 50–70% of the individuals maximum heart rate. Heart rate was determined using the Karvonen method [34].

The control group participated in an 8-week vocational rehabilitation class, which was based around improving reading and writing skills post-injury. Classes involved working on resumes, letters to friends, diary entries, etc, depending on the individuals needs. This was a typical programme offered at the rehabilitation centre, although none of the control group had previously been enrolled in the class.

Data analysis

The statistical analysis was produced using Statistical Package for Social Sciences (SPSS 12.0V) for Windows (SPSS Inc. 2003). Paired *t*-tests were used to calculate the statistical difference between pre- and post-scores for the HPLP-II and PSDQ. However, effect sizes (ES) were also completed which is recommended when the sample size is small [54–56] and statistical meaningfulness needs to be determined [57]. Effect size reports the amount of total variance accounted for by the independent variable in standard deviation units. Thus, an $ES = 0.50$ indicates that half a standard deviation separates the scores between each group. An $ES = 0.20–0.50$ is considered a small effect, 0.50–0.80 medium and greater than 0.80 large [58]. The sum of pre- and post-scores for the control group and experimental group were also plotted to

Table II. Experimental group: pre–post-programme scores for the HPLP-II.

Variable	Pre-testing, *M* (SD)	Post-testing, *M* (SD)	Effect size
Health responsibility	2.38 (0.59)	2.92 (0.74)	0.91*
Physical activity	2.32 (0.46)	2.89 (0.46)	1.24*
Nutrition	2.36 (0.41)	2.63 (0.59)	0.66*
Spiritual growth	2.52 (0.45)	2.89 (0.42)	0.82*
Inter-personal relationships	2.64 (0.33)	3.01 (0.38)	1.12*
Stress management	2.76 (0.76)	2.82 (0.69)	0.06

$^{*} = p < 0.05$.

Table III. Control group: pre–post-programme scores for the HPLP-II.

Variable	Pre-testing, *M* (SD)	Post-testing, *M* (SD)	Effect size
Health responsibility	2.36 (0.74)	2.43 (0.71)	0.09
Physical activity	2.37 (0.52)	2.31 (0.65)	0.11
Nutrition	2.52 (0.71)	2.46 (0.85)	0.08
Spiritual growth	2.55 (0.71)	2.63 (0.64)	0.12
Inter-personal relationships	2.60 (0.45)	2.58 (0.51)	0.04
Stress management	2.65 (1.09)	2.72 (1.04)	0.06

Table IV. Experimental group: pre–post-programme effect sizes for the PSDQ.

Variable	Pre-testing, *M* (SD)	Post-testing, *M* (SD)	Effect size
Self-esteem	3.66 (0.34)	4.37 (0.54)	2.09*
Co-ordination	1.94 (0.50)	3.27 (0.54)	2.66*
Body fat	2.33 (1.42)	3.05 (1.58)	0.51*
Strength	3.55 (0.87)	4.27 (0.65)	0.83*
Flexibility	3.77 (0.85)	4.61 (0.72)	0.99*
Endurance	2.27 (0.36)	3.11 (0.22)	2.33*

$^{*} = p < 0.05$.

visualize the difference in raw scores for the HPLP-II and PSDQ.

Results

For the experimental group (see Table II) results from the HPLP-II indicate significant differences and large effect sizes for health responsibility, $t(9) = -2.675$, $p < 0.05$, 0.91; physical activity, $t(9) = -3.109$, $p < 0.05$, 1.24; nutrition, $t(9) = -4.199$, $p < 0.01$, 0.66; spiritual growth, $t(9) = -4.013$, $p < 0.01$, 0.82; and inter-personal relationships, $t(9) = -7.791$, $p < 0.001$, 1.12. No significant difference was found for stress management, $t(9) = -1.078$, $p = 3.12$, 0.06. No significant differences were found for the control group across all variables of the HPLP-II (see Table III).

Table V. Control group: pre–post-programme effect sizes for the PSDQ.

Variable	Pre-testing, *M* (SD)	Post-testing, *M* (SD)	Effect size
Self-esteem	3.78 (0.47)	3.82 (0.53)	0.08
Co-ordination	1.84 (0.64)	1.87 (0.71)	0.04
Body fat	2.65 (0.84)	2.71 (0.71)	0.07
Strength	3.35 (0.74)	3.41 (0.68)	0.08
Flexibility	3.51 (0.71)	3.42 (0.83)	0.12
Endurance	2.17 (0.52)	2.21 (0.63)	0.07

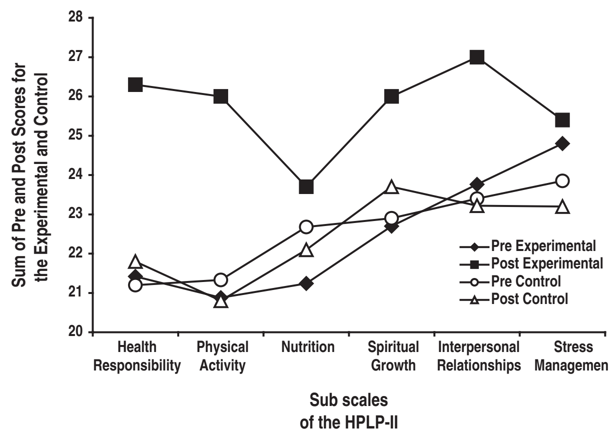

Figure 1. Graph plotting the sum of pre- and post-scores of the HPLP-II for the experimental and control groups.

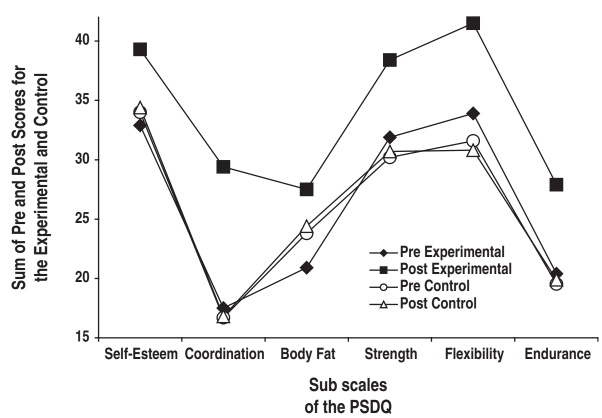

Figure 2. Graph plotting the sum of pre- and post-scores of the PSDQ for the experimental and control groups.

For the experimental group (see Table IV), results from the PSDQ indicate significant differences and moderate-to-large effect sizes for self esteem, $t(9) = -8.500$, $p < 0.001$, 2.09; co-ordination, $t(9) = -5.237$, $p < 0.001$, 2.66; body fat, $t(9) = -5.200$, $p < 0.001$, 0.51; strength, $t(9) = -9.798$, $p < 0.001$, 0.83; flexibility, $t(9) = -6.547$, $p < 0.001$, 0.99; and endurance, $t(9) = -6.547$, $p < 0.001$, 2.33. No significant differences were reported for the control group (see Table V).

Figures 1 and 2 plot the difference between the sum of scores for the HPLP-II and PSDQ for the experimental and control group.

Discussion

First, results of the PSDQ will be discussed as changes in physical self-concept and self-esteem are considered antecedents for changes in health-promoting behaviours [29, 59]. Results from the PSDQ indicated improvements in physical self-concept and self-esteem pre- to post-programme. The enhanced self-esteem generated through participation in the exercise programme would increase an individual's locus of control in this health behaviour. These changes may ultimately lead to changes in an individual's ability to cope with stressful situations post-injury. Due to the increases in self-esteem and suggested changes in locus of control and coping mechanisms that result from physical activity participation, exercise programmes need to be considered as an integral component of the rehabilitation process. Increases in self-esteem and locus of control that accompany exercise participation may have a positive impact on other areas of rehabilitation. For example, due to the skills learned within the exercise setting, participants will be more prepared to adapt and appropriately respond to the numerous physical and social barriers they face while completing everyday activities within the community [16]. Individuals may also respond more positively to stressful situations due to more approach-oriented active coping mechanisms. Perhaps the performance level of people with brain injuries within social situations may be enhanced due to the increased self-esteem and locus of control generated by participation in a physical activity programme. This is due to the fact that the individual would be able to cope better with stressful events they face because they perceive themselves as being more physically able [60].

As mentioned in the literature review, enhanced self-esteem is considered an antecedent for the adoption of health promoting behaviours [59]. Therefore, due to the increases in self-esteem reported by the PSDQ, increases in the participation of health promoting behaviours would be expected. Results for the experimental group indicate significant increases in the health responsibility, physical activity, nutrition, spiritual growth and inter-personal relationships sub-scales after completion of the exercise programme. This suggests that individuals within the programme demonstrated an increased likelihood to engage in these health-promoting behaviours compared to the control group. The meaningful increase in the physical activity sub-scale was attributed to the fact that the participants were exercising three times a week. Participation in this health-promoting behaviour will have enhanced self-esteem, leading to greater locus of control in the physical activity domain. By completing the exercise programme, individuals may have become more conscious of other healthy lifestyle behaviours such as diet and nutrition, perhaps due to the connection between diet, exercise and physical appearance. This increase was not recorded for the control group. This has important implications for health professionals as participation in an exercise programme may lead an individual to adopt other health promoting behaviours, which will increase the overall health and wellbeing of the individual. Also, increases in self-esteem and locus of control in the physical activity domain may transfer to other health behaviours and areas of rehabilitation, which explains the increases in other health promoting behaviours measured by the HPLP-II. Again, this emphasizes the importance of exercise in the rehabilitation of people with brain injuries.

Another interesting finding is the increased likelihood that individuals would actively pursue inter-personal relationships. The significant difference was attributed to the fact that the exercise environment exposes participants to a greater number of situations where social interaction was possible. For example, individuals would interact with instructors during sessions, other group members and their caregivers, as well as other people at the university. Increased social interaction is a highly important component of an individual's rehabilitation [17, 19, 37], as people with brain injuries typically have decreased social contacts post-injury [18]. Enabling people with brain injuries to interact with their non-disabled peers is also an important part of the rehabilitation process [61], which was demonstrated through participation in this programme. As Kwan and Sulzberger [36] recognize, a large problem with current socialization rehabilitation techniques is transferring skills learned in rehabilitation settings to 'real life' situations. Results from this study would suggest that the aquatic exercise arena can provide an environment where these vital social skills can be practised and developed and new friendships can be established. This also has important implications for the overall coping of the individual as people with greater levels of social support are more likely to make better mental and physical adjustments to the injury [29, 62]. It is suggested that people with greater social support are able to 'buffer' stressful events more successfully than people without social support [63]. Cohen and McKay [64] suggest that the ability to 'buffer' these stressful events is made possible by inter-personal relationships that provide tangible or material support, appraisal support, self-esteem and belonging support. Each of these relationships is available in the exercise environment. For example, tangible support is available through the instruction of the trainers and the adapted equipment available in the aquatic environment. During aquatic sessions, appraisal support was also exchanged between participants, instructors and caregivers, as information was shared regarding the individuals ability to cope with certain activities and exercises. For example, feedback was given when an individual improved their walking distance in the swimming pool, especially if the improvement in walking ability was seen to transfer to walking ability outside the pool. Finally, by exercising and being successful the individuals received self-esteem support as well as feeling a sense of belonging to a group after participation over a period of time. This was particularly visible within the group when one individual would achieve something during a session (e.g. swim two lengths unassisted for the first time) as they would receive appraisal support from instructors and other group members. This would then positively influence their self-esteem and feelings of belonging to the group. Group exercise environments also encourage group support and can serve as a motivating factor for self-improvement [60].

An increase in the likelihood that individuals participate in health promoting behaviours has also been associated with increases in self-esteem [59]. As results from this and other studies indicate, increases in self-esteem have been associated with participation in aquatics programmes [42, 44, 65]. Increases in health promoting behaviours may be attributed to the enhanced self-esteem of participants. Bandura [59] suggests that this process is the result of an individual having an increased perception of themself, thus they feel motivated to maintain themself. This enhanced perception of ability motivates an individual to choose and perform more challenging tasks, invest more effort and persist longer when trying to reach desired goals [29, 66]. If people with a brain injury have an increased perception of self, physically or socially, through participation in the aquatics programme, then they will be motivated to maintain or improve that level of functioning. Again, this goes some way to explaining the increase in health promoting behaviours for the experimental group. As the control group did not experience increases in self-esteem, then they may have been less motivated to complete the health promoting behaviours measured by the HPLP-II.

An interesting finding for the HPLP-II was the non-significant difference for stress management reported by the exercise group. Despite the fact that participants were participating in an exercise programme, an activity that has repeatedly been shown to decrease stress [20], individuals did not consider themselves any more likely to engage in stress-relieving behaviours. This was attributed to the possibility that, due to the severe amount of stress that an individual is placed under post-brain injury [14, 67], people with brain injuries may experience and react to different stress levels in different ways. Thus, individuals may have different means of coping with stress when compared to people without brain injuries. For example, within the rehabilitation setting individuals may be informed about effective types of stress management techniques and how to implement them. These may differ from those referred to within the HPLP-II such as meditation (question 41) or imagery (question 23). Thus, participants may have answered those particular questions inaccurately, as they would in fact be employing different stress management techniques to cope with their stress, such as breathing or exercise, instead of the measures listed on the HPLP-II. Perhaps then the sub-scale is not sensitive enough to work effectively for clinical populations and modifications for this population need to be made. Also, participants may not have been aware of the fact that regular exercise acts as an effective means of decreasing stress levels within individuals [20], thus they would not consider themselves likely to participate in stress management techniques.

Conclusions and applications for health professionals

In conclusion, an individual's ability to cope with stressful situations is paramount to their successful rehabilitation, which is a difficult task following the significant physical, psychosocial and emotional changes that occur post-brain injury. However, results from this study suggest that aquatic exercise can positively impact some of the injuries and increase the likelihood that individuals will participate in health promoting self-care behaviours. The significance of these results is emphasized by the recognition that the effectiveness of coping can be gauged by the number of health behaviours a person completes and their overall wellbeing, which is measured by psychological and social functioning [29]. By providing physical activity programmes that may enhance an individuals self-esteem, it may be possible to positively impact an individuals health-promoting self-care behaviours by increasing an individuals locus of control in a particular area. Results from this study indicate that people would show an increased likelihood to participate in physical activity, nutrition and inter-personal relationships. This has important implications for health care professionals who have to impact the primary and secondary injuries an individual is faced with post-brain injury. If health professionals can encourage participation in an aquatic environment, several of the deficits that result from a brain injury may be positively impacted, thus lessening the burden on health care professionals and decreasing the economic cost of rehabilitation. It has also been suggested that participation can lead to families being less 'burned out' if the family is responsible for full-time care of the individual [36], as individuals receive a break from caring. Involvement in regular exercise may also decrease an individual's reliance on the health care community, which has numerous economical benefits [4]. For example, there would be less need to provide ongoing, expensive care to depressed and chronically unhealthy persons with brain injuries. Finally, the exercise environment provides people with a purpose and motivation, as well as ensuring that they are happier and healthier people [36].

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