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Yoga as a means to negotiate physical activity constraints in middle-aged and older adults

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Abstract

In spite of the known benefits of physical activity participation, many adults still do not engage in physical activities. It is important to understand mechanisms that may facilitate the negotiation of physical activity constraints. Using the International Classification of Functioning, Disability, and Health as the conceptual framework, this study analyzed secondary data from two yoga trials to explore potential mechanisms related to physical activity constraint negotiation. The results of data analysis support the idea that negotiation occurred both in mental body functions and in the environment. The Broaden and Build Theory of Positive Emotions provides further explanation for the negotiation of mental functions and environment. Yoga, an activity known to enhance positive emotions, may reduce constraints through broadening the individual's experience and opening the individual's mind to new opportunities and activities.

Keywords: Broaden and Build Theory of Positive Emotions; Hatha yoga; International Classification of Functioning, Disability, and Health; physical activity constraints.

Introduction

Participation in physical activity is an effective means for promoting healthy living for middle-aged and older adults. In fact, physical activity is the primary non-pharmaceutical treatment prescribed for increasing health and wellness (1). Physically active adults live between 1.5 and 3.5 years longer than age-matched sedentary peers (1, 2). Physical activity has been linked to a decreased risk of coronary heart disease, high blood pressure, stroke, type 2 diabetes, and certain cancers. Physical activity has also been shown to be an effective predictor and enhancer of quality of life, as well as an important key to reducing the risk of disability in older adults (1).

In spite of the well-publicized adverse affects of a sedentary lifestyle (3) and evidence that even moderate increases in physical activity can produce improvement in function and well-being, many adults often identify barriers or constraints to becoming physically active. Physical activity constraints are factors or perceptions that cause an individual to reduce or cease participation in physical activity (4–9). In addition to functional impairments that may constrain physical activity participation (i.e., stroke, heart disease, breast cancer, etc.), other constraints may include fear of falling, fear of personal safety, lack of time, lack of services, lack of awareness of services, and self-consciousness. It is important to investigate ways to reduce or negotiate constraints in order to determine how best to help adults improve their health through regular participation in physical activity.

A potential approach to negotiating physical activity constraints is through exercise that taps into the mind-body connection. The mind-body connection is being widely examined for its potential to address many of the health-related issues plaguing society today (10). The mind has been described as a "healer and slayer, because what we think, feel, and perceive have profound implications for health and longevity" (10, p. 5). The mind and body provide information to each other through complex mechanisms in the nervous, endocrine, and immune systems. The mind-body response was first documented by Walter B. Cannon, a Harvard physiologist who described and provided evidence about a theory known today as the fight or flight response (11). The fight or flight response explains that when humans experience fear, rage, or anger (the mind response), the body responds with reduced digestion, increased blood pressure and heart rate, dilation of the pupils, and clammy skin, among others.

While numerous researchers have spent time better understanding the physiological reactions to events in the mind, few studies have identified the specific activities that have a direct influence on the mind. LaForge (12) theorized that the internal focus on breath work and control in mind-body exercise may facilitate greater feelings of control over self as compared with exercise where the focus is on external cuing. One activity that may facilitate the mind-body connection is Hatha yoga.

Hatha yoga is an ancient Indian tradition that uses gentle physiological movements (i.e., postures or *asanas*, as well as breathing or *pranayamas*), in conjunction with psychological activity (i.e., meditation or *dhāranā*) to increase physical, mental, cognitive, and spiritual health. Hatha yoga focuses on stretching and strengthening core muscle groups, with a

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concentration on breath work and internal application. Hatha yoga is gentle, adaptable for all people, and can be modified to be performed in seated, supine, prone, or standing positions (13, 14). While the evidence on the health-related benefits of Hatha yoga is moderate and growing (e.g., 15–19), a few studies have suggested that the mind-body component may provide greater benefit than traditional exercise (20).

Conceptual framework

In order to conceptualize how Hatha yoga may influence physical activity constraint negotiation, the International Classification of Functioning, Disability, and Health (ICF) (21) provided the framework with which to study these mechanisms (Figure 1). The ICF is a framework put forth by the World Health Organization to describe "all aspects of human health and some health-relevant components of well-being …" (21, p. 7). The ICF has two parts: functioning and disability, consisting of (a) body structure and function and (b) activity and participation; and contextual factors, consisting of (a) environmental factors and (b) personal factors. The dually directed arrows in the model indicate that the constructs are dynamic and any construct may be influenced by another. This is an important distinction of the ICF, as both activities and participation (which include performances by the body) may influence body functions and structures (which include performances by the mind) as well as other concepts within the framework. The ICF uses the following terminology:

- *Body functions* are the physiological functions of body systems (including psychological functions).
- *Body structures* are the anatomical parts of the body such as organs, limbs, and their components.
- *Activity* is the execution of a task by an individual.
- *Participation* is involvement in a life situation.
- *Environmental factors* make up the physical, social, and attitudinal environment in which people conduct their lives.
- *Personal factors* are the internal influences on functioning and disability (21, p. 10–11).

Each section in the ICF model is coded using a system that assigns it a letter, and then these letters are followed by qualifiers to further define the section. This coding schema allows researchers and clinicians from a variety of disciplines to ensure consistent terminology to study the same factors. The ICF has been suggested as a framework to describe the research and practice of the therapeutic application of activity (such as yoga) to improve function and well-being (22, 23).

Purpose of the study

Framed by the ICF, the purpose of this study was to explore Hatha yoga as a modality to improve the negotiation of physical activity constraints. The research questions for the study were:

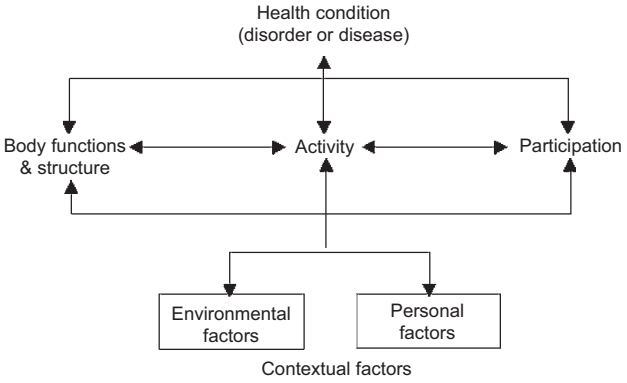

Figure 1 ICF model.
(From: World Health Organization. International Classification of Functioning, Disability, and Health. Geneva: WHO, 2001:18. © 2001 World Health Organization.) Permission to reprint applied for.

1. Does participation in Hatha yoga reduce perceptions of physical activity constraints?
2. If so, what are the potential mechanisms for this negotiation?

Methods

The secondary data utilized for this study were derived from two previous studies that used Hatha yoga as an intervention (both studies were conducted by the first author). The research team was interested in exploring the physical activity constraint data collected in each study in greater detail to determine whether any preliminary findings would shed light on the potential mechanism responsible for this increase in general activity following participation in a Hatha yoga intervention. Study A utilized Hatha yoga with breast cancer survivors with the intent to study the effects of yoga on quality of life. Survivors were at least 9 months post-treatment. The intervention was 8 weeks in duration, and classes were offered twice per week for 1.25 h each session. Eighteen individuals in the yoga group completed this study.

Study B utilized Hatha yoga with older adults with the intent to reduce fear of falling. Fourteen participants who endorsed a fear of falling completed this 12 week study. Classes were offered twice weekly for 1.25 h each. Thus, data for the present analyses were extracted from a combined data set of 32 individuals who completed a demographics and physical activity constraint questionnaire. Owing to some subjects' incomplete data on the physical activity constraints scale, only 25 participants were included in the analyses.

Instrumentation and analysis

Demographics The demographic information collected on a self-report questionnaire included age, ethnicity, education, marital status, and self-rated health. The mean age of the participants was 67.52±14.50 years, with the ages ranging from 43 to 90 years (see Table 1 for demographic information for this study).

Physical activity constraints A 20-item physical activity constraints questionnaire was used to measure perceived constraints related to participation in physical activity (4, 5, 9). Participants were asked to rate how each constraint limited their engagement in

Table 1 Demographic information.

Characteristic	Breast cancer survivors (n=11)	Older adults (n=14)	All participants (n=25)
Age[a]	53.72 (5.65)	77.26 (9.42)	67.52 (14.50)
Race			
White	11	14	25
Education			
High-school diploma	3	1	4
Some college	2	4	6
Technical school	1	0	1
Bachelor's degree	3	5	8
Graduate degree	2	4	6
Marital status			
Single	1	0	1
Married	7	8	15
Divorced	1	0	1
Widowed	2	6	8
Health			
Excellent	3	2	5
Very good	5	5	10
Good	2	5	7
Fair	1	2	3
Gender			
Male	0	3	3
Female	11	11	22

Data are shown as frequency or [a]mean (SD).

Table 2 International Classification of Functioning, Disability, and Health (ICF) codes applied to each physical activity constraints question.

Physical activity constraint	ICF code[a]
1. I don't have time	b1802
2. I'm afraid of getting hurt	b1522
3. It's not important for me to be physically active	d5701
4. My friends and family members would look down on me if I started to be physically active	e410; e429
5. I'm already physically active at work, I don't need to exercise	d5702
6. Weather is often bad around here	e2258
7. It's not safe to exercise in this area	e235
8. I'm afraid of unattended dogs	b1522
9. I'm too self-conscious about the way I look	b1801
10. My health is not good enough	d5701
11. I don't know where I could participate	e1400
12. I'm not skilled enough	b1644
13. I have problems with transportation	e1200
14. I have nobody to participate with	d7504
15. There are no facilities in my neighborhood	e1400
16. I participated in the past and I didn't like it	b1264
17. I don't like to participate in physical activity in public places	b1522
18. I am too self-conscious to exercise with others	b1266
19. I don't know anyone who exercises regularly	d7504
20. The local fitness facilities do not offer what I want	e1400

[a]b, body functions level one classification; d, activities and participation level one classification; e, environmental factors level one classification. The first number in the numeric sequence represents the chapter within the level one classification. The next two numbers in the sequence identify the specific function classification within the chapter. The final number further identifies the specific function within the function classification.

physical activity (each item was scored using a five-point Likert-type scale, where 1=strongly agree and 5=strongly disagree). The total score for the scale ranged from 1 to 100, with higher scores indicating less perceived constraint. Examples of the constraints included: "I'm too tired after work", "I don't have time", "it's not safe to exercise in this area", and "my health is not good enough." In both studies, participants completed the constraints questionnaire both pre- and post-intervention. Cronbach's α for the breast cancer study was α=0.74, for the older adult study was α=0.93, and for this combined analysis was α=0.88.

A paired samples t-test was used to test the change between pre- and post-intervention constraints scores. The percentage difference between pre- and post-intervention scores on physical activity constraints scores was also calculated to provide greater information about the amount of change between pre- and post-intervention (19). Next, post-hoc analyses were conducted on the physical activity constraints questionnaire to further examine the relationship between the physical activity constraints questionnaire and the constructs in the ICF model. First, all of the questions in the physical activity constraints questionnaire were coded using the guide provided by the ICF (see Table 2 for each question in the physical activity constraints questionnaire and its corresponding ICF code). For example, question 1 of the physical activity constraints questionnaire reads, "I don't have time." This question was coded b1802. The "b" identifies the body functions level one classification of the ICF, the "1" identifies chapter 1 within the body functions level, "mental functions", "80" refers to "experience of self and time functions", and the "2" refers to "the experience of time." Thus, b1802 refers to the "specific mental functions of the subjective experiences related to the length and passage of time" (21) such as not perceiving one's self as having enough time to participate in physical activity as presented in question 1 of the questionnaire. Two researchers independently coded the questionnaire and discrepancies were discussed until consensus was reached.

Once ICF codes had been applied to each of the questions, the researchers divided the questions into subscales based on their level one classification within the ICF. Level one classifications within the ICF are made up by the overarching sections of the ICF (body structures, body functions, activity and participation, environmental factors, and personal factors). Dividing the questions in the physical activity constraint questionnaire based on ICF level one classifications yielded three subscales: body functions subscale (eight questions), activities and participation subscale (five questions), and environmental factors subscale (seven questions).

After the physical activity constraints questionnaire had been divided into the ICF-based subscales, pre- and post-test scores were tallied for each and paired sample t-tests were run. The ICF-based subscales and total physical activity constraints questionnaire scores were then correlated using a Pearson's product – moment correlation in order to understand the strength and direction of the relationship between each subscale and total physical activity constraint questionnaire scores. Finally, a linear regression analysis was run to explore the relationship between the subscales and total score for physical activity constraints.

Results

There was a 5.99% total decrease in perceived physical activity constraints from pre-intervention (M=84.78) to post-intervention (M=89.86) (higher scores indicate lower perceived constraint). This finding was statistically significant (t=–2.835, p=0.009).

Once a statistically significant difference was established between pre- and post-intervention constraint scores, paired t-tests were conducted and percent change scores were calculated using the ICF subscales (Table 3). There was no significant change from pre- to post-intervention for the activities and participation subscale. This may indicate that change or constraints negotiation did not occur related to the actual completion of activities. A small, but statistically significant, change occurred in the environmental factors subscale (3.7% increase, t=–2.076, p<0.05), indicating that some negotiation of the environmental factors occurred and reduced the perception of environmentally related constraints. The strongest change occurred in the body functions subscale (t=–3.988, p=0.001) indicating a 10.762% decrease in constraints related to body functions.

Because there was no statistically significant change in the activities and participation subscale, it was omitted from the remainder of the analyses. Both the environmental factors and the body functions subscales were significantly correlated to the total physical activity constraints questionnaire (r=0.760, r=0.928, respectively). This indicated that the higher a participant scored on the environmental and body functions subscales, the higher his or her total score on the physical activity constraints questionnaire.

To further explore the relationships between the environmental factors and body functions subscales with the total physical activity constraints, a stepwise multiple linear regression was calculated using environmental factors and body functions subscales as the predictor variables. Model 1 (Table 4), with only the body functions subscale, was significant (F=142.42, p=0.000, R^2=0.86). With both subscales in the regression model (Model 2), the model was significant, with 87% of the total variance explained (adjusted R^2=0.87, F=75.162, p=0.000). While the body factors subscale was a significant predictor of physical activity constraints (β=0.823, p=0.000), the environmental factors subscale was not a significant predictor (β=0.150, p=0.18). This indicates that the changes in the body functions subscale accounted for a majority of the change in overall physical activity constraints.

Table 4 Stepwise linear regression model (n=25).

Model	R^2	df	F	p-Value	β	p-Value
1. Body functions	0.861	24	142.420	0.000	0.928	0.000
2. Body functions	0.872	24	75.162	0.000	0.823	0.000
Environmental factors					0.150	0.175

Discussion

This study explored the use of Hatha yoga as a means to negotiate physical activity constraints for middle-aged and older adults. The first research question, regarding determining whether Hatha yoga would significantly decrease physical activity constraints, can be answered with preliminary support that, indeed, constraints were reduced in this merged sample. The second research question was developed to try to understand the mechanism for this negotiation. It appears that the greatest negotiation occurred in the body functions subscale of the physical activity constraints questionnaire. In this subscale, questions focused on cognitive processing and awareness of psychological events that would prohibit activity participation (see Table 5 for the specific constraints that were coded in the body functions subscale). Specifically, two questions addressed one's experience of self and time, three questions addressed emotional functioning, one question addressed higher level cognitive functioning, and two questions addressed temperament and personality functions.

This present analysis may indicate that, indeed, modifying the perception of psychological constraints (the specific mental functions mentioned previously) following the yoga intervention may have been the mechanism for the reduction in overall physical activity constraints. This finding may be explained by the Broaden and Build Theory of Positive Emotions proposed by Fredrickson (24). The Broaden and Build Theory of Positive Emotions posits that positive emotions expand an individual's mindset, and that in turn this expanded mindset allows or even encourages new activities. More specifically:

> *by broadening an individual's momentary thought–action repertoire – whether through play, exploration or similar activities – positive emotions promote discovery of novel and creative actions, ideas and social bonds, which in turn build that individual's personal resources; ranging from physical and intellectual resources, to social and psychological resources* (24, p. 1367).

Table 3 Comparison of pre- and post-yoga intervention physical activity constraint subscale scores (n=25).

Variable	Pre-intervention	Post-intervention	t	p-Value	% Change[a]
Physical activity constraints body functions subscale	31.8840	35.3152	–3.988	0.001[b]	10.762%
Physical activity constraints environmental subscale	31.3200	32.4800	–2.076	0.049[b]	3.704%
Physical activity constraints activities and participation subscale	21.7600	22.3472	–0.891	0.382	2.699%

[a]T_1-T_2/T_1×100; [b]significant at the 0.05 level (two-tailed).

Table 5 Body Functions Subscale questions and International Classification of Functioning, Disability, and Health (ICF) codes.

Physical activity constraint question	ICF code
1. I don't have time	b1802
2. I'm afraid of getting hurt	b1522
8. I'm afraid of unattended dogs	b1522
9. I'm too self-conscious about the way I look	b1801
12. I'm not skilled enough	b1644
16. I participated in the past and I didn't like it	b1264
17. I don't like to participate in physical activity in public places	b1522
18. I am too self-conscious to exercise with others	b1266

Thus, by participating in yoga, an activity that is known to promote positive emotions (e.g., 15, 19, 25), personal resources were built and constraints to physical activity were negotiated. It is possible that as these mental body function constraints were negotiated, environmental constraints were also negotiated through broadened awareness of options.

As with any study, there are limitations. The sample size for this analysis was small, which is suitable for introductory, exploratory analyses, but not for making larger generalizations. The physical activity constraints questionnaire should be implemented in larger Hatha yoga intervention studies with more diverse populations to gather sufficient data. This would allow more definitive claims to be made about the properties and mechanisms of the constraint negotiation. Future research in this area should also include qualitative interviews with the participants to provide greater understanding of the negotiation that occurs. Overall, these data provide an interesting and novel insight into the mechanisms of how Hatha yoga may influence physical activity constraint negotiation.

Conflict of interest statement

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