Tai Chi's Effects on Health-Related Fitness of Low-Income Older Adults*

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RÉSUMÉ

On a démontré que le Tai Chi peut influer positivement sur la condition physique liée à la santé (CLPS) des participants âgés, en leur offrant un moyen d'accoître la force musculo-squelettique. L'objectif de cette étude était d'examiner les effets de l'intervention de Tai Chi sur la forme physique, et de découvrir si ethnies culturellement étrangères au Tai Chi constituaient un obstacle à la participation à un programme communautaire pour les aînés à faible revenu. Soixante-dix-huit aînés d'origine mixte (55 ans et plus), qui n'étaient pas culturellement affiliés au Tai Chi, ont été recrutés pour cette étude. Les mesures de la condition liée à la santé ont été prises avant et après un programme de Tai Chi d'une durée de 16 semaines, avec sept séances par semaine. Des améliorations significatives en résultaient dans l'aptitude supérieur et inférieur musculo-squelettique ainsi que dans la flexion partielle parmi ceux qui pratiquaient le Tai Chi. Ces résultats suggèrent que le Tai Chi peut être efficace pour améliorer la CLPS, et que les ethnies non pas liées culturellement au Tai Chi n'éprouviaient pas un obstacle à la participation d'un échantillon de population âgée à un niveau socio-économique faible.

ABSTRACT

Tai chi (TC) has been shown to positively influence health-related fitness (HRF) of elderly participants by affording them a means to increase musculoskeletal strength. The objective of this study was to examine TC intervention effects on HRF and whether ethnic groups not culturally related to TC experienced a barrier to participation in a community-based program for low-income older adults. Seventy-eight older mixed-ethnicity adults (age 55 and older) who were not culturally affiliated with TC were recruited for this study. HRF measures were taken before and after a 16-week TC program that offered seven sessions per week. Significant improvements were found in upper and lower musculoskeletal fitness and partial curl-ups, with TC being embraced by the participants. These results suggest that TC can be effective for improving HRF and that non-TC culturally related ethnic groups did not experience a barrier to participation in an older low-socioeconomic population sample.

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Aging is influenced by a complex interaction of physiological and psychological factors. As the aging population grows globally it is important to improve our understanding of the aging process and how this process can be enhanced by evidence-based health-related fitness (HRF) interventions. *HRF* refers to various health outcomes that are affected by habitual physical activity and include such things as cardiorespiratory fitness,

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motor function, musculoskeletal fitness, morphologic influences, and metabolic factors (Gledhill, 1990). Not only is the aging population expanding, but that population's life expectancy is increasing. In Japan, for example, average life expectancy has reached 86 years, the highest of all the world's major countries, followed closely by Australia, Canada, Sweden, and Switzerland (Kinsella & Phillips, 2003). In Canada, it is estimated that adults aged 65 and over will represent approximately 25 per cent of the population by 2036 and up to 28 per cent by 2061, compared with 14 per cent in 2009 (Statistics Canada, 2010). Within this aging adult population, there are segments whose inactivity levels put them at increased risk for early morbidity and mortality (Sui et al., 2007). The relationship between high-risk inactivity levels and health status is further complicated by a biomedical approach to disease management in which inappropriate pharmacological treatment typically supersedes physical activity treatment, often compounding negative health effects (Upshur & Tracy, 2008).

Research has demonstrated the value of community HRF programs, separate from the health care network, to help an aging population stay vital and self-actualized. Accumulated regular exercise activity can improve muscle strength, aerobic capacity, and balance (Keysor & Jette, 2001), thereby reducing physical frailty and delaying institutionalized physical dependence. However, research is still needed to investigate the effects of exercise training on performance of activities of daily living (ADLs) (2001). This research includes efforts related to the most optimal type, frequency, duration, and intensity of exercise to both perform ADLs and prevent frailty (Marijke et al., 2008). Lower socioeconomic status (SES) populations as well as racial/ethnic minority older adults, moreover, can experience increased challenges because they are more likely to live in neighborhoods with poorer social environments (Fong & Gulia, 1999). An additional challenge is that recreational resources in North America are not readily accessible by low SES and ethnic minority groups, highlighting the need to target these specific groups with activities and health initiatives in an effort to offset such social inequities (Moore, Diez Roux, Evenson, McGinn, & Brines, 2008).

Tai chi offers a potentially useful adjunct to community HRF programs. In particular, Yang-style tai chi (TC) has been shown to be a powerful intervention for HRF and has been used with health challenges such as falls, cardiovascular health ailments, arthritis, and dynapenic changes, and with improved psychosocial behavior (Barbat-Artigas, Filion, Dupontgand, Karelis, & Aubertin-Leheudre, 2011; Han et al., 2009; Low, Wei, Sern, & Kai, 2009; Taylor-Piliae & Froelicher,). In performing Yang-style TC, the body is naturally extended and relaxed, the mind is focused on the moment, and body movements are slow, smooth, and well-coordinated (Hong & Xian, 2007). TC is a low-speed, low-impact exercise that focuses on diaphragmatic breathing coordinated with graceful motions to achieve mind tranquility (Lan, Lai, & Chen, 2002). TC is often performed in combination with Qigong, a practice that focuses on sensing, cultivating, and working with a person's vital life force to improve health and harmonize mind, body, and spirit with nature and the universe (Davis, 2008). Yang-style TC is the form most often used in research interventions and is the form most practiced worldwide with elderly subjects (Jimenez, Melendez, & Albers, 2012). The intensity of TC is moderate, approximately equivalent to 50–58 per cent of heart rate reserve in participants aged 25 to 80 (Lan, Chen, & Lai, 2004).

Despite the apparent appropriateness of this form of physical activity for older populations, few studies have examined the effectiveness of a TC intervention in a public, community-based program (Li, Hong, & Chan, 2001; Qin et al., 2005). Although researchers have studied community programs centered on stroke recovery, public health initiatives, fall prevention, and concerns of the aging population (Docker, 2006; Hart et al., 2004.; Jones, Dean, & Scudds, 2005; Li et al., 2008), limited research has been carried out on the unique needs of an aging community's older adults who live independently with limited resources.

The central objective of the study this article describes was to examine TC intervention effects on HRF and whether ethnicities not culturally related to TC experienced a barrier to participation in a community-based program offering TC for low-income older adults.

Methods

Study Design

The target population for this study was male and female residents from the Jane-Finch community. The Jane and Finch neighborhood is located in the northwestern area of Toronto, Ontario, Canada. It is commonly referred to as the most ethnically diverse of all of Toronto's communities, with 120 nationalities and ethnic populations and more than 100 languages spoken (Jane Finch Neighbourhood Action Plan Report, 2005). "The Jane-Finch community has one of the largest proportions of youth, sole-support families, refugees and immigrants, low-income earners, and public housing tenants of any community in Toronto" (Jane Finch Neighbourhood Action Plan Report, 2005).

The inclusion criteria for the study targeted individuals who were (a) age 55 or older (male and female), (b) of mixed ethnicity not culturally affiliated with tai chi, (c) ambulatory without assistive devices, and (d) had the medical capability to be involved in a physical

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activity intervention. This capability was assessed using the Physical Activity Readiness Questionnaire (PAR-Q) and the Physical Activity Readiness Medical Examination (PAR-Med-X) (Canadian Society for Exercise Physiology, 2002).

Participants were initially recruited through two focus groups (male and female) conducted to identify barriers and promoters to participation in a community-based tai chi program. The focus group participants were found through several connection points within the Jane-Finch community. Initially, recruitment was conducted at a large shopping mall in the area; from these contacts, more focus group members were found from a mixed-ethnic female exercise class. Information attained from these focus groups facilitated poster placement in strategic areas in the Jane-Finch neighborhood, and specific buildings were targeted to actively recruit participants. The study was approved by the ethics review committee of York University.

Intervention

The present study followed participants through a Yang-style TC program offering seven possible class times throughout the week. Participants were advised by research assistants to attend two classes per week for 16 consecutive weeks during the months of August through December 2009. A TC master facilitated the classes that took place at a Toronto Community Housing Building located directly at Jane-Finch. Each class was 60 minutes long and consisted of 15 minutes of Qigong followed by 45 minutes of Yang-style TC. Each participant received a name tag that they wore each time they took a class, and each class was monitored by a research assistant so that exact attendance could be recorded.

Study Variables

Demographic and health characteristics were collected from all participants at baseline. The information addressed gender, age, ethnicity, education, smoking, alcohol intake, marital status, income, chronic health conditions, and current physical activity plus fitness parameters. Physical activity information was collected using the Healthy Physical Activity Participation Questionnaire from the Canadian Physical Activity Fitness and Lifestyle Approach (2004) prior to starting. Fitness testing, conducted by CSEP-certified exercise physiologists, was assessed pre- and post-TC-program, and participants were invited to specific testing times. The HRF tests included cardiovascular measures (resting heart rate, resting blood pressure), anthropometric measures (body mass index [BMI], waist circumference) and musculoskeletal upper body measures, (including grip strength, and an arm curl test in 30 seconds), musculoskeletal lower body measures (chair stand test in 30 seconds, timed 8-foot up and go test), abdominal endurance (partial curl-ups), and lower back flexibility measures (sit and reach).

Statistical Analysis

A chi-square test was used to examine comparisons between those who completed the study and those who were lost or withdrew from it as well as comparisons between low attenders and mid-to-high attenders. A non-parametric Mann-Whitney U test for independent samples t-test was done on baseline measures for attenders, for lost/withdrew participants, and for both low and mid-to-high attenders. *Low attenders* were those who attended 25 per cent or less of the recommended TC classes (equal to or less than eight sessions in 16 weeks) whereas *mid-to-high attenders* were those who attended more than 25 per cent of the recommended TC classes (nine or more sessions in 16 weeks). Paired-sample t-tests were performed to compare HRF measures for the pre- versus post-TC-program values. Means and standard deviations of the tests were reported. A non-parametric Wilcoxon test was used to assess significant difference for pre- versus post-tests. An alpha of .05 was considered for the non-parametric Wilcoxon test, the chi-square tests, and the non-parametric Mann-Whitney U test.

Results

Of the original 78 participants, 22 were lost or withdrew from the study (12 left for health reasons, 2 left the country to visit family, 1 had surgery, and 7 left for unknown reasons). Of the 56 who completed the study, all completed the questionnaires and the health-related fitness measures. Attendance varied with a larger percentage coming once, rather than twice, a week for the duration of the TC program; participants' reported that their attendance was influenced by seasonal weather changes and H1N1 virus concerns. Eight of the participants who completed the study were identified as low attenders (fewer than 8 sessions in 16 weeks), and 48 were identified as mid-to-high attenders (nine or more sessions in 16 weeks).

Table 1 summarizes the gender, age, and ethnicity of the study participants. The majority (85.9%) were 65 years of age or older (minimum age: 55), were female (78.2%), and were of Guyanese, Trinidadian, and West Indian descent (55.5%). In addition, most had lower levels of education (literate/primary education: 52.6%) and were living alone (widowed/divorced: 67.9%). Most of the participants had incomes of less than $14,000 per year (77.0%) and had at least one or more chronic health conditions such as hypertension (67.9%), arthritis (49.3%), and type 1 or 2 diabetes mellitus (37.8%).

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Table 1: Socio-demographic characteristics of study participants

				Completed			
	Pre-Total *n* (%)	**Lost/Withdrew** *n* (%)	**Post Total** *n* (%)	**Low Attendance** *n* (%)	**Mid-to-high Attendance** *n* (%)	***p* value****	***p* value***
Demographics							
Totals	**78**	**22**	**56**	**8**	**48**		
Sex							
Male	17 (21.8)	6 (27.3)	11 (19.6)	5 (62.5)	6 (12.5)	.012**	.463
Female	61 (78.2)	16 (72.7)	45 (80.4)	3 (37.5)	42 (87.5)		
Age							
55–64	11 (14.1)	6 (27.2)	5 (10.9)	1 (12.5)	4 (8.3)	.071	.111
65–74	42 (53.8)	10 (45.6)	32 (57.1)	4 (50.0)	28 (58.4)		
75+	25 (32.1)	6 (27.2)	19 (34.0)	3 (37.5)	16 (33.3)		
Ethnicity							
Guyanese, Trinidadian, & West Indian	45 (57.7)	12 (54.5)	33 (58.9)	6 (75.0)	27 (56.3)	.806	.349
Hindu, East Indian, Sri Lankan, & Jamaican	17 (21.8)	2 (9.1)	15 (26.8)	1 (12.5)	14 (29.2)		
Argentinian, Ecuadorian, & Brazilian	16 (20.5)	8 (36.4)	8 (14.3)	1 (12.5)	7 (14.5)		
Education							
Illiterate/Primary	41 (52.6)	12 (54.5)	29 (51.8)	5 (62.5)	24 (50.0)	.803	.874
Junior/Senior High	28 (35.9)	8 (36.4)	20 (35.7)	2 (25.0)	18 (37.5)		
College/University	9 (11.5)	2 (9.1)	7 (12.5)	1 (12.5)	6 (12.5)		
Smoking Status: Yes	2 (2.6)	1 (1.3)	1 (1.3)	0 (0.0)	0 (0.0)	N/A	N/A
Alcohol Intake: Yes	17 (22.4)	3 (13.6)	14 (25.9)	5 (71.4)	8 (14.8)	.015**	.574
Marital Status							
Unmarried	7 (9.0)	2 (9.1)	5 (8.9)	0 (0.0)	5 (10.4)	.363	.302
Married	18 (23.1)	6 (27.3)	12 (21.4)	3 (37.5)	9 (18.8)		
Widowed/Divorced	53 (67.9)	14 (63.6)	39 (69.7)	5 (62.5)	34 (70.8)		
Income							
< $14,000 per year	60 (77.0)	19 (86.4)	41 (73.2)	5 (62.5)	36 (75.0)	.580	.424
$14,000–$30,000	14 (17.9)	2 (9.1)	12 (21.4)	2 (25.0)	10 (20.8)		
> $30,000	4 (5.1)	1 (4.5)	3 (5.4)	1 (12.5)	2 (4.2)		
§Chronic Conditions							
Hypertension	53 (67.9)	15 (65.2)	38 (67.9)	4 (50.0)	34 (70.8)	.913	.763
Arthritis	37 (49.3)	10 (47.6)	27 (50.0)	5 (62.5)	22 (45.8)	.744	.853
Diabetes mellitus	28 (37.8)	9 (42.9)	19 (35.8)	2 (25.0)	17 (35.4)	.784	.575
Sleep disturbance	20 (27.0)	7 (33.3)	13 (24.5)	3 (37.5)	10 (20.8)	.214	.442
Depression	14 (19.2)	4 (19.0)	10 (19.2)	1 (12.5)	9 (18.7)	.802	.986
Hearing impairment	9 (12.2)	2 (9.5)	7 (13.2)	2 (25.0)	5 (10.4)	.471	.662
Disorientation	9 (12.2)	3 (14.3)	6 (11.3)	4 (50.0)	2 (4.2)	.003**	.725
Heart disease	8 (10.8)	3 (14.3)	5 (9.4)	1 (12.5)	4 (8.3)	.814	.545
COPD	4 (5.4)	0 (0.0)	4 (7.5)	2 (25.0)	2 (4.2)	.481	.196
Tumour	1 (1.4)	0 (0.0)	1 (1.9)	0 (0.0)	1 (2.1)	N/A	.526
Exercise/Activity Parameters							
Physical Activity							
No	53 (67.1)	14 (69.6)	39 (69.6)	5 (62.5)	34 (70.8)	.834	.070
Yes	25 (32.9)	8 (36.4)	17 (30.4)	3 (37.5)	14 (29.2)		
Perceived Fitness							
Poor	10 (12.8)	5 (22.7)	5 (8.9)	1 (12.5)	4 (8.3)	.872	.295
Moderate	28 (35.9)	5 (22.7)	23 (41.1)	4 (50.0)	19 (39.6)		
Good	40 (51.3)	12 (54.5)	28 (50.0)	3 (37.5)	25 (52.1)		

*** comparing participants who were lost / withdrew to those who were followed**

**** comparing low attendance to mid-to-high attendance**

§ percentages do not total 100 because multiple chronic conditions could apply to a single participant

COPD = chronic obstructive pulmonary disease

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The majority of the participants (67.1%) had limited activity in their daily lives; however, more than half (51.3%) of the participants perceived their fitness as good.

At baseline, there was a significant association between mid-to-high and low attenders and gender ($p < .05$) with a higher percentage of females in the mid-to-high attendance category. Alcohol intake also had a significant association ($p < .05$) with a higher percentage of drinkers in the lowest attendance category. A further significant association was found with disorientation ($p < .05$), with a higher percentage in the lowest attendance category. Table 2 shows baseline differences with respect to HRF. Significant differences were evident between those who attended, versus those who were lost/withdrew from the study, in resting heart rate only ($p <.05$). In addition, low versus mid-to-high attenders differed in systolic blood pressure, BMI and waist circumference, 30-second chair sit, and partial curl-ups ($p < .05$).

Table 3 summarizes comparisons of the pre- and post-HRF measures. Overall participation attendance in a 16-week TC intervention was significantly associated with increased hand grip strength (left and right combined), increased arm curl test in 30 seconds, increased chair stand test in 30 seconds, and increased partial curl-ups ($p < .01$). No significant changes were identified in BMI and waist circumference or in resting blood pressure, sit and reach, or the timed 8-foot up and go test. When dividing attendance into low and mid-to-high categories, group differences persisted in hand grip (left and right combined) and the chair stand test in 30 seconds ($p < .05$) but not in any of the other measures.

Discussion

Our study assessed the effect of a 16-week TC intervention on health-related fitness in a community-based program with low-income older adults from ethnic groups not culturally affiliated with TC. This study is one of only a few TC studies to look at a community-based TC program with participants not culturally related to TC. Results showed that a 16-week program aimed at twice weekly participation was effective at improving HRF through upper and lower musculoskeletal strength. These benefits may be particularly valuable given that many participants were unable to consistently attend two times a week yet still showed select HRF improvements.

Researchers Wayne and Kaptchuk (2008) have defined TC as a complex, multicomponent intervention that integrates numerous physical, cognitive, and ritualistic components. One of that study's aims was to implement a physical activity intervention in the form of TC in a community of low-income older adults. TC has the potential to be a low-cost group activity that can influence health-related fitness through "active ingredients".

Table 2: Baseline differences

	Attended vs Lost/Withdrew			Low vs Mid-to-High Attendance		
	Attended Mean (*SD*)	Lost/Withdrew Mean (*SD*)	*p* value*	Low Mean (*SD*)	High Mean (*SD*)	*p* value*
Cardiovascular Measures						
Heart rate (BPM)	71.7 (10.4)	65.7 (9.2)	.032*	73.1 (14.8)	71.3 (9.2)	.439
Systolic BP (mmHg)	126.0 (10.2)	125.5 (16.1)	.615	124.8 (12.5)	126.3 (9.7)	.041*
Diastolic BP (mmHg)	74.9 (6.8)	76.4 (5.4)	.330	76.9 (5.5)	74.4 (7.0)	.144
Anthropometrics						
BMI (kg/m^2)	27.2 (8.1)	26.4 (7.2)	.488	24.9 (5.1)	27.5 (8.5)	.050*
Waist circumference (cm)	99.9 (12.1)	96.3 (7.4)	.193	94.7 (10.9)	101.0 (12.1)	.011*
Musculoskeletal Upper Body						
Overall grip (kg)	46.1 (14.5)	50.5 (20.0)	.367	48.6 (16.6)	45.5 (14.1)	.817
Arm curl test in 30 secs (#)	12.0 (4.2)	12.2 (3.5)	.870	11.4 (4.0)	12.2 (4.1)	.299
Musculoskeletal Lower Body						
Chair stand test in 30 secs (#)	10.2 (2.8)	8.8 (2.6)	.102	8.8 (2.7)	10.4 (2.7)	.028*
Timed 8-foot up and go test (secs)	8.7 (4.5)	8.4 (3.6)	.640	10.1 (8.4)	8.4 (3.1)	.643
Core and Flexibility						
Partial curl-ups (#)	3.9 (6.7)	5.4 (7.2)	.104	2.6 (4.3)	3.3 (6.5)	.031*
Sit and reach (cm)	25.1(8.8)	20.5 (11.5)	.172	22.5 (11.1)	26.2 (7.3)	.122

*Independent samples t-test

BMI = body mass index
BP = blood pressure
BPM = beats per minute
***SD* = standard deviation**

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Table 3: Pre- and post-health-related fitness (HRF) measures

	Low Attendance			Mid-to-High Attendance			Total Attendance		
	Pre-HRF Mean (*SD*)	Post-HRF Mean (*SD*)	*p* value	Pre-HRF Mean (*SD*)	Post-HRF Mean (*SD*)	*p* value	Pre-HRF Mean (*SD*)	Post-HRF Mean (*SD*)	*p* value
Cardiovascular Measures									
Heart rate (BPM)	73.1 (14.8)	73.0 (13.2)	.383	71.3 (9.2)	73.1 (7.1)	.212	71.7 (10.4)	73.1 (8.5)	.301
Systolic BP (mmHg)	124.8 (12.5)	124.6 (10.69)	.975	126.3 (9.7)	126.6 (8.9)	.801	126.0 (10.2)	126.2 (6.8)	.878
Diastolic BP (mmHg)	76.9 (5.5)	76.0 (3.0)	.524	74.4 (7.0)	76.5 (6.5)	.115	74.9 (6.8)	75.0 (7.3)	.929
Anthropometrics									
BMI (kg/m^2)	24.9 (5.1)	25.2 (5.2)	.612	27.5 (8.5)	27.9 (7.5)	.342	27.2 (8.1)	26.5 (8.8)	.476
Waist circumference (cm)	94.7 (10.9)	101.8 (22.7)	.286	101.0 (12.1)	100.0 (11.0)	.420	99.9 (12.1)	100.4 (13.9)	.766
Musculoskeletal Upper Body									
Overall grip (kg)	48.6 (16.6)	57.6 (13.5)	.012*	45.5 (14.1)	49.6 (14.4)	.003*	46.1 (14.5)	51.1 (14.5)	.000*
Arm curl test in 30 secs (#)	11.4 (4.5)	12.7 (6.9)	.357	12.2 (4.1)	15.8 (3.8)	.000*	12.0 (4.2)	15.2 (4.6)	.000*
Musculoskeletal Lower Body									
Chair stand test in 30 secs (#)	8.8 (2.7)	11.3 (2.7)	.049*	10.4 (2.7)	12.7 (3.5)	.000*	10.2 (2.8)	12.4 (3.4)	.000*
Timed 8-foot up and go test (secs)	10.1 (8.4)	8.2 (3.4)	.386	8.4 (3.1)	8.1 (2.6)	.242	8.7 (4.5)	8.2 (2.8)	.134
Core and Flexibility									
Partial curl-ups (#)	2.6 (4.3)	7.7 (9.8)	.310	4.1 (7.1)	10.0 (14.1)	.003*	3.9 (6.7)	9.3 (13.4)	.001*
Sit and reach (cm)	22.5 (11.1)	25.4 (8.7)	.553	26.2 (7.3)	26.7 (5.8)	.623	25.1(8.8)	26.5 (6.2)	.178

*** Based on the non-parametric Wilcoxon test**
BMI = body mass index
BP = blood pressure
BPM = beats per minute
***SD* = standard deviation**

These ingredients are (a) increased strength influenced by the different poses (Lan, Lai, Chen, & Wong, 2000), (b) efficient breathing through focused practice (Pal, Velkumary, & Madanmohan, 2004), and (c) concentration, attention, and mindfulness through consistent awareness (Kubota et al., 2001). According to Wayne and Kaptchuk (2008), TC is not well-suited for randomized, placebo-controlled research precisely because of these active ingredients, and placebo control is challenged by TC's inherent characteristics since these components are highly interdependent and some cannot be independently isolated (2008). It is for precisely this reason that Wayne and Kaptchuk's study was implemented instead as within the context of a low-income, ethnically diverse, community-based older adult population to implement these active ingredients for maximal HRF influences.

Research has shown that adults from ethnic minority groups engage in physical activity less often than do adults from the rest of the population (Caspersen, Christenson, & Pollard, 1986; Crespo, Smit, Carter-Pokras, & Andersen, 2001; Yurgalevitch et al., 1998). Despite the known benefits of physical activity and the increasing awareness of health disparities among ethnic minorities, there is a lack of information on factors that encourage these groups to be physically active (Kriska & Rexroad, 1998). Subcultural differences in language, ethnicity, education, and income present unique challenges for interventions that are targeted to increase physical activity (Brawley, Rejeski, & King, 2003). In our study, TC was embraced fully by the ethnically diverse participants as an acceptable form of physical activity.

Much of the TC literature has originated in Asia where this martial art developed and has been carried out for hundreds of years. In recent years, TC practice has expanded in Western cultures. It is important to view TC with respect to its potential physical benefits and the ways in which this form of exercise can be best integrated into cultures which are not connected historically to the practice of TC. To examine whether the physiological benefits of TC observed in experimental conditions would persist in community settings, a study of 51 Chinese subjects from a residential area of Hong Kong having a mean age of 52 undertook a TC program for 12 weeks, 3 times per week (Jones et al., 2005). This was one of the first community-based TC studies that looked at the HRF effects on inexperienced practitioners. Similar to our findings, they found increases in strength plus improvements in range of motion and

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postural control; however, an important difference is that in our study the participants consisted of those ethnicities not culturally related to TC (Jones et al., 2005).

Using ethnographic methods, researchers in England in 2006 found that older participants were drawn to TC in response to physical and emotional challenges, a desire to keep active, and to integrate gentle exercise while at the same time being part of a social group (Docker, 2006). In 2008, an evaluation of a falls prevention program based on TC was undertaken in five cities in Oregon, United States. The goal of that study was to evaluate the effectiveness of TC-based falls prevention programs rolled out in the community (Li et al., 2008). The program was targeted at senior service organizations providing community health resources and social services. The program consisted of 1-hour classes twice weekly for 12 weeks with seniors (mean age: 70). Similar to what we found, the researchers found improvements in strength (Li et al., 2008), reinforcing the real-world application of TC benefits for older adults.

Unlike a randomized controlled study, the current study design has known limitations related to internal validity of results. These limitations include uncontrolled intervention-induced changes in daily physical activities, seasonal variations in health status and mood, lifestyle factors, and self-reporting bias. However, when considering the present study's baseline analysis, we found minimal differences in HRF between attenders and those who were lost (or withdrew) from the TC classes, and between low and mid-to-high attenders of the classes.

In conclusion, the findings of our study suggest that a community-based TC program with low-income elderly participants not culturally connected to TC is beneficial in improving HRF through increased strength and without ethnicity barriers. This suggests that TC has considerable potential – as an economical, effective, and convenient physical activity program –for conferring health benefits on low-income, elderly community-dwelling adults with complex chronicity, even without prior knowledge of TC. More community-based TC research programs throughout the elderly population in Canada would provide additional methodological context within which to validate this evidence.

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