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Title:

The effect of Tai Chi on health related quality of life in people with elevated blood glucose or diabetes: A randomized controlled trial

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Abstract

Purpose: The aim was to assess the effects of a Tai Chi based program on health related quality of life (HR-QOL) in people with elevated blood glucose or diabetes who were not on medication for glucose control.

Method: 41 participants were randomly allocated to either a Tai Chi intervention group (N = 20) or a usual medical care control group (N = 21). The Tai Chi group involved 3 x 1.5 hour supervised and group-based training sessions per week for 12 weeks. Indicators of HR-QOL were assessed by self-report survey immediately prior to and after the intervention.

Results: There were significant improvements in favour of the Tai Chi group for the SF36 subscales of physical functioning (mean difference = 5.46, 95% CI = 1.35-9.57, $P < 0.05$), role physical (mean difference = 18.60, 95% CI = 2.16-35.05, $P < 0.05$), bodily pain (mean difference = 9.88, 95% CI = 2.06-17.69, $P < 0.05$) and vitality (mean difference = 9.96, 95% CI = 0.77-19.15, $P < 0.05$).

Conclusions: The findings show that this Tai Chi program improved indicators of HR-QOL including physical functioning, role physical, bodily pain and vitality in people with elevated blood glucose or diabetes who were not on diabetes medication.

Keywords Tai Chi · Exercise · Quality of Life · Elevated Blood Glucose · Diabetes

Abbreviations

HR-QOL Health related quality of life

PA Physical activity

Introduction

There is growing evidence to suggest that Tai Chi may improve glucose control as well as health related quality of life (HR-QOL) in people with type 2 diabetes [1-2]. However, the effects of Tai Chi on HR-QOL in people with elevated blood glucose or people with diabetes who are not on medication for glucose control have not been assessed. The aim of the study was therefore to evaluate the effects of a Tai Chi based program on HR-QOL in this group.

Method

Study design, participants and intervention

This was a randomized controlled trial. The study sample size was based on the findings from a feasibility study and/or clinically significant differences, with a power of 80% and a two-sided significance level of 5%, resulting in 20 participants per group [2]. Our pilot study showed that this sample size would provide sufficient power to detect meaningful changes in SF36 subscales (with between group difference = 10 units), body weight (3 kg), waist circumference (2.8 cm), HbA1c (0.5%), and insulin resistance (0.5 mmol/L·μU/mL) [2-4]. Participants were recruited via general practitioners and local media. Of 132 people who expressed interest in the study, 41 with elevated blood glucose (defined as having fasting blood glucose ≥ 5.6 mmol/L to < 7.0 mmol/L [5] and/or 2 hours post-glucose load ≥ 7.8 mmol/L to < 11.1 mmol/L) or type 2 diabetes (fasting blood glucose ≥ 7.0 mmol/L and/or 2 hours post-glucose load ≥ 11.1 mmol/L) who were not on diabetes medication were recruited and randomized to a Tai Chi intervention group (N = 20) or usual medical care control group (N = 21), by an independent research assistant (using a computer-generated randomization schedule). The sample was not stratified by having diabetes or elevated blood glucose before randomization. The Tai Chi Intervention was a supervised group based program with 3 x 1.5 hour training sessions per week for 12 weeks, and has been described in more detail elsewhere [2]. All participants signed a consent form prior to baseline assessment and continued to receive usual medical care from their general practitioners during the study. Ethical approval for the study was obtained from The University of Queensland Human Research Ethics Committee.

Measures

Each participant completed a self-report survey at baseline and 12-week post intervention.

HR-QOL was assessed using the Medical Outcomes Study (MOS) SF36 Survey [6]. The items assess eight dimensions: general health, physical functioning, role-physical, role-emotional, social functioning, bodily pain, mental health, and vitality. Two aggregate physical and mental component summary scores were also calculated based on Australian population norms [7]. Scores ranged from 0 to 100, with higher scores representing better HR-QOL. The MOS SF36 has been shown to be reliable and valid for Australian adults [8-9].

Physical activity in the past week including frequency and duration of time spent in walking (“for recreation or exercise” and “to get to and from places”), moderate and vigorous physical activity (PA) (not including gardening and yard work) was also assessed at baseline and 12 weeks, using self-report items from the Active Australia Survey [10]. Total PA time was calculated by adding the time spent in walking and moderate activity and twice the time spent in vigorous activity (to allow for its greater intensity). Short reporting periods such as one week are considered less prone to recall bias than one to twelve month periods [11]. Self-report PA measures in the Active Australia survey provide acceptable levels of test-retest reliability for assessing PA levels, and moderate reliability for assessing total minutes of activity [12].

Statistical analysis

The primary analyses used intention-to-treat methods whereby missing data at any follow-up assessment, were replaced with values from the previous assessment. This conservative method of data analysis assumes that participants who did not complete the follow-up assessments did not change from the previous assessment, thus reducing the bias that can be introduced when participants lost to follow-up are excluded from analysis. The flow of participants through the study has been reported previously [13]. In brief, of the 41 participants who commenced the program, 95% of the intervention group and 81% of the control group provided data at all time points.

All statistical tests were two-sided with significance level $P < 0.05$. Change values are reported as mean change scores with 95% confidence intervals. General linear regression models were used to detect between-group differences in mean change scores in measures of HR-QOL and PA after the 12-week intervention (controlling for baseline values). Homogeneity of variance between-groups was examined by box plots and Levene’s test. All analyses were conducted with SPSS Version 15.

Results

Participants' baseline characteristics have been reported previously [13]. In brief, they were aged 41 to 71 years (mean 59 ± 8 years). Nearly two thirds were women and more than three quarters reported a history of diabetes. At baseline, 17% of participants had elevated blood glucose levels and 83% had type 2 diabetes glucose levels. More than half reported baseline PA at a level consistent with national recommendations (i.e. ≥ 150 minutes moderate intensity PA/week) [10]. Fisher's Exact Probability Test showed no between-group differences at baseline in blood glucose level (among participants with elevated blood glucose or diabetes), age, gender, marital status, education level, employment status, main education, English spoken at home, physical activity level, or family history of diabetes. There were significant between-group differences in favour of the Tai Chi group in two of the eight SF36 subscales, including role physical ($P < 0.05$) and bodily pain ($P < 0.05$) at baseline.

The mean between-group differences for the SF36 sub scales after the 12-week intervention are summarized in Figure 1. There were statistically significant between-group differences in favour of the Tai Chi group in four of the SF36 subscale measures including physical functioning, role physical, bodily pain and vitality ($P < 0.05$), with the mean difference ranging from 5.5 for physical functioning to 18.6 for role physical, after controlling for baseline values. In addition, there was a significant improvement in PA in the Tai Chi intervention group, relative to the control group (mean difference=385.94 minutes/week, 95% CI=150.29-621.60, $P < 0.01$), over the 12-weeks intervention period.

Discussion

This was the first study to evaluate the effects of a Tai Chi program on HR-QOL in people with elevated blood glucose or diabetes who were not on medication for glucose control. At baseline, participants in the intervention group had lower than national normative scores [7] on five SF36 subscales: physical functioning, general health, vitality, mental health and role emotional. Similarly, participants in the control group had lower than national norms on five subscale scores (including physical functioning, role physical, bodily pain, general health and vitality). This reflects the poorer overall health status of this clinical group than the general population, and is consistent with previous research [14].

In our study, there were significant improvements in three of the four SF36 physical subscale scores, including physical functioning, role physical and bodily pain, in the

intervention group, relative to the control group, after the 12-week intervention. These improvements were also described anecdotally by intervention group participants when they were asked about perceived benefits. This is consistent with the work by Atlantis who also found improvements in physical functioning, bodily pain and general health after a 24-week combined aerobic and behavior modification intervention [15].

There was also a significant improvement in the SF36 vitality score in the intervention group, relative to the control group, after the 12-week intervention. This is consistent with the findings reported in previous Tai Chi studies with people with diabetes [1-2]. Vitality may be especially important for people with elevated blood glucose and diabetes, who often report feelings of tiredness and lack of energy which may act as barriers to exercise. As there was a statistically significant improvement in PA in the current study, the Tai Chi exercise may have had a role in helping people to become more energetic and more physically active. As Tai Chi is a gentle exercise, it has potential to be offered as an alternative to other more vigorous forms of exercise to achieve these improvements.

The main strength of this study is the randomised controlled design. We acknowledge that the small sample size is a limitation of this study, and that this may mean that, because of the wide variation in general health, social functioning, mental health and role emotional scores, we did not have the power to detect changes in these subscales. Other limitations include the short study duration with data collected only twice, and the lack of comparative group contact in the control group. Other researchers have noted that using the SF-36 scoring approach can be somewhat problematic, particularly when there is substantial improvement in physical health relative to mental health, and that the RAND-36 scoring approach may offer advantages over the standard SF-36 scoring approach, in terms of performance of the physical and mental summary scores [16].

In conclusion, the findings from this study suggest that this Tai Chi exercise may improve indicators of HR-QOL including physical functioning, role physical, bodily pain and vitality for people with elevated blood glucose or diabetes who are not on diabetes medication. Larger controlled trials are required to further confirm the findings.

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Figure 1: Mean between-group differences (asterisks on the vertical lines) and 95% confidence intervals (edges of the vertical lines) of the SF36 sub-scales in the Tai Chi group, relative to the control group, during the 12-week intervention. NS=No statistically significant difference. PF=Physical functioning. RP=Role physical. BP=Bodily pain.

GH=General health. SF=Social functioning. VT=Vitality. MH=Mental health. RE=Role emotional.