

Qi Gong and Heart Rate Variability: A Systematic Review

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How to cite this paper: Ramos, C.C., de França, E., Nobre, T.L., Santana, J.O., Madureira, D., Zocoler, C.A.S., Rodrigues, B., Santos, R.V.T., Sanches, I.C. and Caperuto, E. (2017) Qi Gong and Heart Rate Variability: A Systematic Review. *Journal of Biosciences and Medicines*, 5, 120-127.
<https://doi.org/10.4236/jbm.2017.53013>

Received: October 15, 2016

Accepted: March 24, 2017

Published: March 27, 2017

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Abstract

Qi Gong is a type of exercise that involves meditation and is used for health. With a background from the martial arts, it is known also as an auto healing exercise with three main elements according to Traditional Chinese Medicine (TCM): body focus (posture and movement), breathing and mind focus (meditative elements). Heart rate variability is a tool that allows us to measure the autonomic system velocity to detect and respond to unexpected stimuli. So our goal was to build a systematic review of Qi Gong and Heart rate variability. PUBMED, EBSCO and Science Direct data bases were searched. Key terms (MeSH) were Heart Rate Variability and Ch'i Kung OR Qi Gong with a 10-year filter. Four independent reviewers analyzed all articles and excluded duplicated articles, articles in Chinese and articles with no adherence to the subject. The end result was 5 studies selected. Our results showed no significant improvements in HRV with the practice of Qi Gong, probably because of data heterogeneity. We found 5 types of Qi Gong, 3 different instruments and different time intervals to measure HRV and 2 different age groups in the studies. We can conclude that there is evidence that Qi Gong can improve HRV but studies that would use the same parameters are needed to further confirm that.

Keywords

Qi Gong, Heart Rate Variability, Meditation Exercises, Exercise Physiology

1. Introduction

Ancient China knowledge is deeply present in its Medicine. Some of its pillars are adequate nutrition, phytotherapy, acupuncture, massage and regular physical

exercise. One of these pillars is Qì Gōng.

Qì Gōng is a physical exercise that involves meditation and is widely used for health. With a background from the martial arts, it is known also as an auto healing exercise with three main elements according to Traditional Chinese Medicine (TCM): body focus (posture and movement), breathing and mind focus (meditative elements).

Qì Gōng means “vital energy work”, where Qì is everything that controls our body, our vital energy and Gōng is work, the work that might improve and cultivate this energy. It’s understood as a traditional biofeedback therapy and the Qi activation can be reached by breathing control and the achievement of a special mental state [1]. Wang *et al.*, (2014) divided Qì Gōng in some categories: static, dynamic, internal (*nei qì*) and external (*wei qì*) and states that it can be practiced in several ways, for example, standing or seated [2].

The autonomic nervous system is divided in 2 parts that act in a balanced way, the sympathetic nervous system and the parasympathetic nervous system. The balance of these systems results in homeostasis [3].

As Qì Gōng is an active meditative strategy, it helps to balance the autonomic nervous system and all the structures controlled by it. For example, the autonomic nervous system influences the cardiovascular system in two ways, tonic and reflexively and there are some elements that might interfere positively in this control such as Qì Gōng or negatively as daily stress, posture changes and involuntary breathing control [4].

Heart Rate Variability (HRV) assessment helps to understand how the cardiovascular system adapts to the changes caused by the environment, and to measure the autonomic system velocity to detect and respond to unexpected stimuli [5].

Autonomic control assessment by HRV in Qì Gōng practice has been made in some studies. But because of different variables considered, different age groups and different measuring techniques, there are several aspects of this phenomenon that need to be further investigated.

2. Objective

The objective of this study is to further understand the effects of Qì Gōng on autonomic control, especially on its sympathetic and parasympathetic system branches, through a systematic literature review.

3. Methods

We searched PUBMED, EBSCO and Science Direct.

In all databases we used the following key terms (MeSH): 1) “Heart Rate Variability”; 2) “Ch'i Kung” OR “Qi Gong” and 3) “Heart Rate Variability” plus “Ch'i Kung” OR “Qi Gong”, all searches were did with a 10 years filter (2006-2016).

Two independent reviewers read all articles titles and abstracts and as excluding criteria we used duplicated articles, articles that were only in Chinese (most common language on the topic), because we understand that Chinese is an im-

portant, but local language or articles that didn't have any relationship of HRV and Qi gong although the keywords were in the title or abstract. The end result was 7 studies that were initially selected.

After a more detailed investigation, 2 more articles were excluded. The first one mentioned HRV, but didn't have any results about it and the second one used only HR and not HRV as an assessment tool. **Figure 1** below shows the articles search and selection fluxogram.

4. Results

Of the 5 remaining studies, we found a total number of 334 participants. From the 5 studies, one had only one experimental group of Qi Gong while the others had two groups, one is experimental and other control group. The 5 studies can be seen in **Table 1**.

5. Discussion

All studies used Internal Qi Gong. Amongits many types we found the following: Qi Gong: BaDuànJīn (8 Pieces of Brocade), Dharma Drum (Dharma drum),

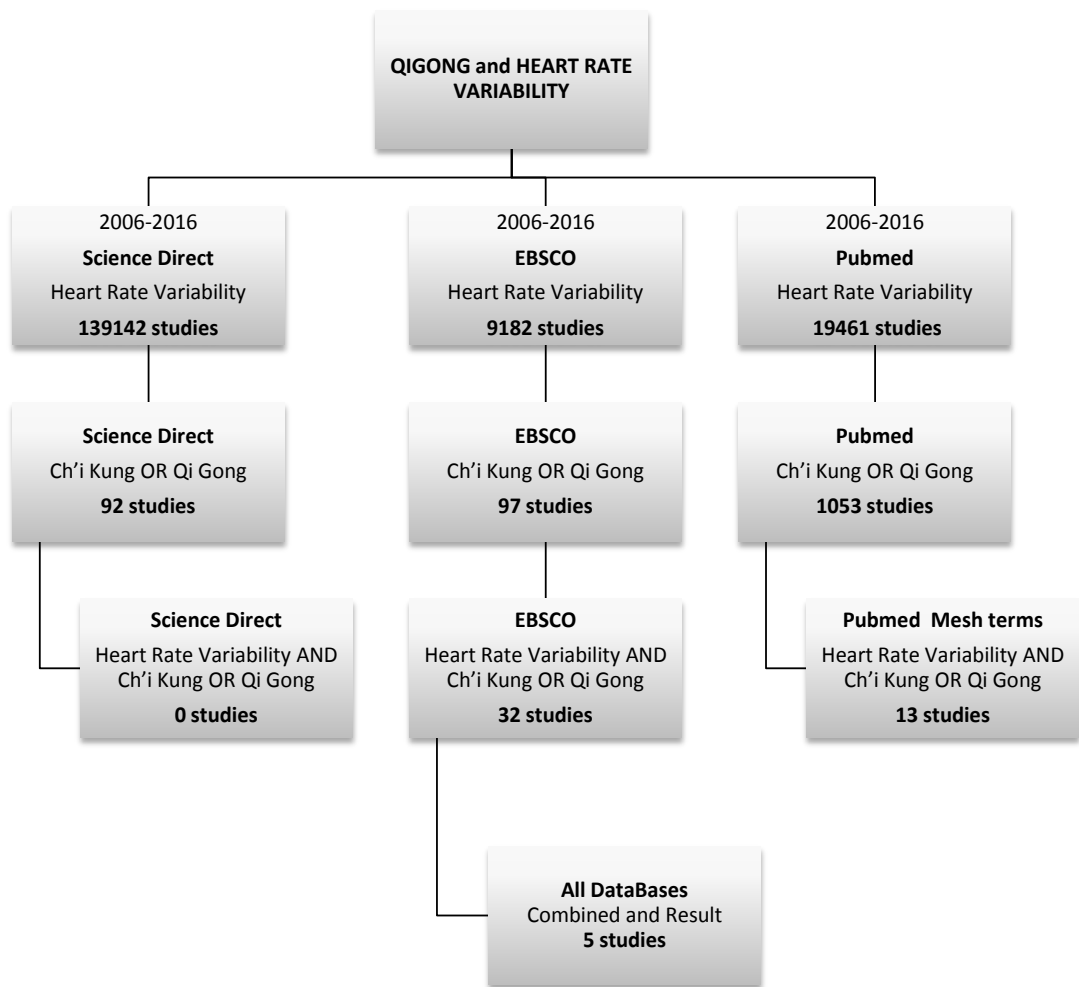


Figure 1. Article search and selection in all database.

Table 1. Articles selected to compose the systematic review. (↑ = increase; ↓ = decrease)

Author/year	Objective	Intervention	Method	Variables	Results
Li, R. <i>et al.</i> /2014	Effects of 16 weeks of Qigong Baduanjin to fitness and health	Ba DuanJin Qi gong	GC-55 sedentary subjects; GE-55 trained individuals-(learned Qigong 2 weeks before the start); 34.2 years 16 weeks of Qi gong Ba DuanJin 3x/week 30 to 60 minutes	Total cholesterol (TC); Serum Triglycerides, LDL, HDL, SDS (depression scale) Body fat percentage; Flexibility; BMI and circumferences; Blood pressure; HRV, Vital capacity, O2 consumption, Max HR, Max Ventilation; sit and reach.	Flexibility improvement (improves coordination, muscle Power, speed and physical skills); improves body mind coordination; no significant difference in the SDS (self rating depression scale), significant decrease in the body fat percentage; no significant variation on blood pressure, HRV, vital capacity, max O ₂ consumption and max ventilation.
Chang, M-Y/2014	Effects of 12 weeks of qi gong (8 moves) on HRV and perypheral vaso-motor response.	8 moves Dharma Drum's-Qi gong	Pre and Post test 77 subjects 47-EQG (experimental qi gong) ± 62.98 years 30 CG (control group) ± 65.07 years 12 weeks 30' qi gong-3x week	HRV-SDNN, low frequency, high frequency and total Power. PVR (peripheral vasomotor response)	↑ sdnn ↑ low frequency ↑ high frequency ↑ total power
Chang, C; Tsai, G & Hsieh, C-J/2013	Laughing Qigong effects on psychological, immunological and physiological systems and to make LQP a standard method to simulate laughing interventions.	Laughing Qi Gong Program (LQP) and Facial Scale before and after each session of LQP	Quantitative and qualitative study Control and experimental groups (CG and EG), 67 teenagers = 34 (EG) (16 male and 18 female) and 33 (CG) (18 male and 15 female) 2 months, 8 sessions of 45 minutes (LQP) and 15 min (data collection) CG (reading or doing homework for 1 hour)	Roseberg's scale for self steem (RSE), chinese humor scale (CHS), subscales from CHS (HC humor creativity), (HT humor trend), facial scale (FS); Blood pressure (BP), Heart rate variability (HRV); Salivar cortisol analysis	EG showed significant improvement in CHS ↑, specifically for HC ↑; Humor state improved in the FS; cortisol ↓, HRV showed significant difference when compared to CG.
Goshvarpour, A. e Goshvarpour, A./2012	To analyze and compare the contribution of the quadratic phase of HRV during 2 different meditation models.	Chinese Qi gong and Kundalini Yoga	Qi gong Group (5 male and 3 female ± 29 years) Kundalini Yoga Group (2 male and 2 female ± 33 years) Qi gong (1 - 3 months of practice before data collection)-1 hour of Qi gong meditation. Kundalini Yoga (meditation advanced training level)-1 hour of Kundalini meditation	Heart rate signals-Holter monitor-HOS-higher order spectra QG-holter 10 hours during DLA, 5 hours of recording from the 1 hour practices. KY-holter-1:30 hr and 15 min of easy breathing before 1 hour of meditation. For both the sample rate was 360 Hz.	Different forms of meditation could change specific components of HRV signals and the can have specific health benefits.

Continued

Kuan, S-C, <i>et al.</i> /2012	To test the effects of 12 weeks of a Qigong exercise program n psychological and physiological health in wheelchair older adults.	Qigong Ho-gong	72 older subjects, Wheel chair users of similar problems-65 years or more with cognitive integrity; CG-38 subjects without qigong, yoga or tai chi chuan for at least 3 months); EG-34 subjects for Qigong Ho-gong classes. 12 weeks-Qi gong Ho-gong practice (adapted to Wheel chairs) 5x/week-35 minutes	Blood pressure (BP), Heart Rate Variability (HRV); distant skin temperature (DST) and Brief Symptom Rating Scale (BSRS-5)	Systolic and diastolic pressures, distant skin temperature small increase (DST), no changes in the HRV, significant improvement in the psychological health;
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Laughing Qi Gong Program (Smile Qi Gong), Chinese Qi Gong (there was no style specification, but it was reported that it was a practice of Qi Gong in the sitting position) and the Ho-gong (a type created for wheelchair users and elderly people). This type is a combination of some methods such as yi-ging-xi-sueyong (column adjustment method), yang shu sheng (method to nourish vital energy), dao yin shu (method of guidance and leadership) and Tu-na (breathing control method), and this combination of methods was intended to frail people to be practiced in any place and time with the objective of strengthening the Vital Energy, as well as all the other methods, types and/or styles of Qi Gong [6].

The practice time ranged from 4 to 16 weeks, although we found 3 studies with 12 weeks of practice [6] [8] [9] used 16 weeks of practice between 30 and 60 minutes. In [8] there was an acute data collection after 1 hour of meditation, but the required practice time (participant experience) of Qi Gong to engage in the experiment was around 4 to 12 weeks.

The Qi Gong sessions had at least 30 minutes and a maximum of 60 minutes of duration, with two studies of 30 minutes [9] [10]. In [9] this time ranged from 30 to 60 minutes, meanwhile Chang, Tsai and Hsieh (2013) presented a variable time amount: 45 minutes to the group sessions and 60 minutes for the sessions done at home.

Weekly frequency ranged from 3× a week (2 studies) [7] [9]; 1 time [10], 5 times [6] and an acute collection [8].

The participants of the studies were heterogeneous regarding their ages. There were studies with teenagers (age not defined) [10]; adults (29 to 34.2 years) [8] [9]; elderly (62.98 or more) [6] in one study (with elderly people), the main feature was to be in a wheelchair.

When we analyze the HRV results, one study [9] (using a heart rate monitor, Polar RS 800CX, Polar Finland) with adults (~34.2 years) found no significant difference. They analyzed the RR interval, the very low frequency (VLF), low frequency (LF), high frequency (HF) and Total Power.

In the study of Goshvarpour and Goshvarpour (2013) [8], used bispectrum magnitude analysis, estimated through three techniques, tendencious, parame-

tric and direct (FFT). They found variations of different components of HRV in young adults (~29 years) with a significant decrease in the magnitude of the heart rate bispectrum. This type of analysis generates extra data that gives more information than the traditional power spectrum analysis.

That study was reinforced by another research with a meditation technique called Vipassana. The author analyzed LF and HF from adults (~43.8 years) after 10 days of an intensive course of the technique. Normalized HF data was significantly different and the authors believed that happened due to a decrease in LF values instead of an increase of HF itself [11].

According to these authors, normalized data represents an advantage because it presents the measurement of the vagal output, not presented by other spectral analysis. These oscillating data (LF increase, HF increase or HF increase due to LF decrease) happens because meditation techniques have a slow breathing pattern that influences HRV components, as described in another study published by Leher (1992) [4]. Therefore, a careful analysis is needed when pure data is compared to normalized data in situations where the respiratory frequency might change the results [11].

HF, LF and the low frequency/high frequency (LF/HF) ratio were analyzed in the teenager group doing the Smile Qi Gong. Although the authors didn't specify the tool used to analyze this variable, there was a significant difference in the control group, with different results when compared to some other studies from the literature. That probably happened because the control group was submitted to stress relief activities such as reading and writing. Besides, the experimental group suffered cross contamination, they did not comply with the rules of pre-determined rest for the proper measurement of the variable, probably because of inadequate behavior related to their age.

The above results are in opposition with those obtained by [12] and [13], they found gains in the parasympathetic nervous system modulation reflecting in a better HRV in teenagers. In the first study Sharma *et al.* (2015) [12], the better HRV was associated to a larger estrogen concentration. This hormone, according to this study [12], increases the parasympathetic system modulation, when female teenagers are compared to their counterparts (male teenagers). In the second study [13] when teenage athletes from both genders were compared, the difference found was not related to the gender, but to a better parasympathetic modulation imposed by physical training. In another gender and ethnic differences study, HRV was improved in black teenagers, especially those who did moderate cardiovascular activities [13].

One of the studies analyzed HRV (BFM 5000 plus) with spectral analysis in the elderly, they analyzed SDNN, total power, HF, LF and the LF/HF ratio. They found an increase of SDNN, total power, HF, LF and no significant difference in the LF/HF ratio. These results are in opposition to the findings of another study with Qi Gong and HRV (presented below).

Elderly individuals that were wheelchair users were also submitted to an adapted form of Qi Gong, so they could perform the movements. Their HRV

was measured by a portable equipment manufactured by DailyCare. No significant differences were found for HRV [6].

Lopes *et al.*, (2007) [14] found in their study that strength training can improve HRV, especially in young people, but that was not seen in the elderly, since variability declines with the physiological process of aging because of depletion of the vagal tonus, increase in the sympathetic activity and the presence of diseases such as hypertension or heart failure.

Jandackova *et al.* (2016) [15] corroborates the notion that aging impairs HRV. They show that individuals present a decrease in autonomic control with a considerable reduction of heart rate variability. Therefore, the absence of results with the Qi Gong intervention in HRV is expected since different studies used different strategies with varied magnitudes.

We believe that meditative activities such as Qi Gong promote changes in the autonomic nervous system (ANS), depending on the level of concentration of the participant and that is improved when it is synchronized to a slow breathing rhythm.

However, because this practice has several types with different forms of Qi Gong presented in the studies used in this review, HRV analysis can be performed with different equipment, and finally the age differences of the experimental groups in the studies, studies with similar methods are needed to assure the Qi Gong positive effects in HRV pointed in this review.

6. Conclusions

We concluded that Qi Gong promotes improvement in some of the Heart rate variability parameters, but there is no evidence to further detail this improvement.

Therefore, we suggest that further studies regarding both, longer time of practice and equal time interval and instruments used to analyze HRV are necessary to confirm such benefits.

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