J. Phys. Ther. Sci.
26: 881–884, 2014

Original Article

The Influence of "wuqinxi" exercises on the Lumbosacral Multifidus

Feng Zhang, MD[1, 2], Yu-Hua Bai, MD[1, 2], Jing Zhang, MD[1, 2]*

[1] *Department of Rehabilitation Medicine, The Third Hospital of Hebei Medical University: Ziqiang Road 139, Shijiazhuang 050051, China*
[2] *Hebei Provincial Orthopedic Biomechanics Key Laboratory, China*

Abstract. [Purpose] To investigate the effect of the five animals (*wuqinxi*) exercises on the lumbosacral multifidus. [Subjects and Methods] This study enrolled two groups of volunteers, 15 volunteers who did the five animals exercises, the experimental group, and 15 volunteers who did aerobic exercise (walking), the control group. Both before and after the 1 year exercise intervention, the average surface electromyography (ASEMG) of the two groups in the process of flexion and extension was recorded and analyzed using DASYLab10.0 software, and the flexion extension ratio (FER) was calculated. [Results] The ASEMG in the process of flexion was lower than the ASEMG in the process of extension both before and after the 1 year exercise intervention on both sides of all volunteers. There was no significant difference in FER between the experimental group and control group before the 1 year exercise intervention; however, the FER of experimental group was lower than that of the control group after the 1 year exercise intervention. There was no significant difference between the two sides in any individual both before and after the 1 year exercise intervention in both groups. [Conclusion] The "*wuqinxi*" exercises improved the function of the lumbosacral multifidus, and might be an alternative method of reducing low back pain.
Key words: *Wuqinxi* exercises, Flexion extension ratio (FER), Low back pain

(This article was submitted Nov. 21, 2013, and was accepted Jan. 7, 2014)

INTRODUCTION

Low back pain (LBP) is a very common disease in both developed and developing countries[1–4], and it easily develops into a chronic disease[5]. Most low back pain patients do not need to receive surgery to alleviate the pain. The application of complementary and alternative medicine in our society has increased[6]. *Qigong* (pron. "chee-gong") is a method of complementary and alternative medicine. It is practiced to regulate breathing, movement, and awareness while doing exercise[7]. Typically, such practice includes rhythmic breathing, stylized fluid movement and a peaceful state[8].

Based on a series of recent reports, approximately 5% of China's population practice some kind of *qigong*[9–11]. The history of practicing *qigong* to cure and prevent diseases is more than 2000 years old. There are nearly 3,000 kinds of *qigong* and most of them are adaptations of ancient styles. The five animals exercises (*WuQinXi* in Chinese) were created by Hua Tuo, a very famous doctor in the history of China, and they are one of the most popular kinds of *qigong* exercise. The practitioners of *wuqinxi* exercises imitate the specific movements and breathing patterns of the five animals: the tiger, bear, crane, monkey, and deer. The practitioner attempts to integrate and harmonize breath posture and movement[12]. A series of studies have indicated that exercise of the lumbosacral multifidus could be beneficial for spinal control and alleviate LBP[13–15]. However, a relationship between the *wuqinxi* exercises and the lumbosacral multifidus has not been reported.

In this study, we designed a prospective study to determine whether *wuqinxi* exercises improve the function of the lumbosacral multifidus and reduce low back pain.

SUBJECTS AND METHODS

The subjects of this study have given their written informed consent to the publication of their case details. Informed consent was obtained from all volunteers, and all procedures were approved by the Ethnic Committee of Hebei Medical University.

Subjects

This study enrolled thirty male volunteers (aged from 40 to 50 years, average age 41.3±3.5 years; height range of 165 to 180 centimeters, average 170.4±4.1 centimeters; and a weight range of 60 to 75 kilograms, average 68.9±5.2 kilograms). Fifteen volunteers performed the five animals exercises, the experimental group, and 15 volunteers performed aerobic exercise (walking), the control group, from May 1, 2011 to May 1, 2012. On the basis of the age, height and

*Corresponding author. Jing Zhang (E-mail: doctorzhangjing1@126.com)

body weight, each volunteer in the experimental group was matched with a person in the control group. The exercise protocol was as follows: the experimental group/ subjects did the entire five animals exercises 5 times per week, for 1 year; the control group/ the subjects did 30 min aerobic exercise, 5 times per week, for 1 year.

The practitioners of *wuqinxi* exercises imitate the specific movements and respiration patterns of 5 animals: the tiger, bear, crane, monkey, and deer. The monkey imitation exercise is given as an example. Stand with the arms hanging at the sides and the feet slightly apart. With bated breath, like a monkey, raise the left hand up to head level as if embracing a pillar and place the right hand on the abdomen as if holding an apple. The left foot is lifted up to knee level with the toes pointing downward while keeping the right leg slightly bent. Breath in deeply and direct *qi* (air) down to the abdomen. Keep this position, inhale and direct *qi* down to abdomen again and again until beads of sweat start running down the face. Return to the start position and repeat the whole process with "left" and "right" reversed.

A surface EMG system (BioVision®Inc., Germany) was used in this study. The analysis software was DASYLab10.0 (Measurement Computing Corp., MA, USA). To capture the EMG signals, all procedures were performed in accordance with a previous study[16]. The reference electrode was positioned over the olecranon of the elbow, as recommended by Hermens et al.[16] The EMG signals were recorded from the multifidus muscle at the L-5 level on the two sides. The subjects are asked to perform full flexion for 3 seconds then return to the start position. The process was repeated 3 times. The action was guided by a video displayed by a computer so as to guarantee the consistency of different actions between different practitioners. The averages of surface electromyography (ASEMG) in the processes of flexion and extension were recorded and analyzed using DASYLab10.0 software. All the parameters were measured both before and after the 1 year exercise intervention.

Statistical analyses were performed using SPSS 13.0 for Windows (SPSS Inc, Chicago, III). Two-way analysis of variance was used for the analysis of ASEMG in flexion, ASEMG in extension, and FER. The t-test was used to evaluate the FER of multifidus between the experimental group and control group, the ASEMG in the process of flexion and extension on both sides, and FER between the two sides all individuals. All statistical analyses used a significant level of 0.05.

RESULTS

There were no significant differences in the subjects, characteristics (age, height, weight) between the two groups. ($p>0.05$)

The ASEMG in the process of flexion was lower than the ASEMG in the process of extension on both sides of all volunteers ($p<0.05$). There was no significant difference of FER between the experimental group and the control group ($p>0.05$). There was no significant difference of FER between the two sides in any individual ($p>0.05$). The results are presented in Tables 1 and 2.

The ASEMG in the process of flexion was lower than the ASEMG in the process of extension on both sides of all volunteers ($p<0.05$). The FER of experimental group was lower than that of the control group ($p<0.05$). There was no significant difference in FER between the two sides in any individual ($p>0.05$). The results are presented in Tables 3 and 4.

DISCUSSION

Qigong is a mental and physical exercise originating from traditional Chinese medicine and aims to improve health[17]. In earlier studies, *qigong* was found to reduce stress[18, 19], anxiety[20], and depression[21] as well as to improve physical activity and balance[22]. Twelve months of *wuqinxi* exercise was reported to be beneficial for obese old people, promoting blood antioxidant enzymes activities, enhancing lipid peroxidation and increasing intestinal bacteria count[23].

A previous study reported that 64 healthy older people had practiced *wuqinxi* exercise for 30 days, blood lipids levels and oxidative injury decreased, indicating that the exercise was beneficial for the health of old people[24]. That study indicated that thirty days of *wuqinxi* exercise significantly lowered the serum levels of total cholesterol (TC), triacylglycerol (TG), malondialdehyde (LDL-C) and malondialdehyde (MDA), while promoting the activity of SOD[24]. MDA is a key oxidation product of peroxidized polyunsaturated fatty acids, and the MDA level is a crucial indicator of lipid peroxidation[25]. Superoxide dismutase (SOD) is an important intracellular antioxidant enzyme of aerobic cells, and it may exert antitoxic effects against superoxide radicals[26]. Therefore, practicing *wuqinxi* exercise may alleviate the oxidative damage exerting a positive effect on the human body.

Exercise programmes to promote the "stability" of the lumbar spine are widely used in the management of LBP patients[27, 28]. Previous studies have demonstrated they alleviate stress on injured osseoligamentous structures, reducing pain and enhancing function[28–31]. Specific isometric exercises for the lumbar multifidus of low load and tonic manner have been proved to be beneficial for spinal control[13–15]. Furthermore, exercise of the deep segmental fibers of the lumbar multifidus (DM) has been indicated to reduce the recurrence of acute LBP[29], alleviate pain, and reduce disability in chronic LBP patients[28].

SEMG is a simple and non-invasive parameter of muscle activity, which is an objective marker of LBP[32]. The flexion-extension ratio (FER) is a good parameter of trunk muscle balance. A 5-year prospective study indicated that an imbalance in trunk muscle strength, i.e., higher flexor muscle strength than extensor muscle strength, might be one risk factor of low back pain[33]. Furthermore, FER of the lumbar erector muscle might be practically applied as an objective indicator in the diagnosis of non-specific chronic low back pain in surface EMG[34].

In this study, the ASEMG in the process of flexion was lower than that of the ASEMG in the process of extension both before and after the 1 year exercise intervention on both sides of all volunteers. There was no significant differ-

Table 1. The comparison of ASEMG and FER of the left side between the two groups before the exercise intervention

	ASEMG in flexion (mV)	ASEMG in extension (mV)	FER
wuqinxi exercises group	0.134±0.048*	0.223±0.124	0.600±0.073
Control group	0.131±0.035*	0.214±0.076	0.612±0.054

* indicates a statistically significant difference in ASEMG between flexion and extension
The unit of ASEMG is millivolts (mV)

Table 2. The comparison of ASEMG and FER of the right side between the two groups before the exercise intervention

	ASEMG in flexion (mV)	ASEMG in extension (mV)	FER
wuqinxi exercises group	0.149±0.053*	0.240±0.091	0.622±0.073
Control group	0.212±0.091*	0.335±0.099	0.632±0.095

* indicates a statistically significant difference in ASEMG between flexion and extension

Table 3. The comparison of ASEMG and FER of the left side between the two groups after the exercise intervention

	ASEMG in flexion (mV)	ASEMG in extension (mV)	FER
wuqinxi exercises group	0.153±0.078*	0.275±0.112	0.555±0.093**
Control group	0.174±0.046*	0.264±0.097	0.659±0.084

* indicates a statistically significant difference in ASEMG between flexion and extension
** indicates a statistically significant difference in FER between the *wuqinxi* exercise and control groups

Table 4. The comparison of ASEMG and FER of the right side between the two groups after the exercise intervention

	ASEMG in flexion (mV)	ASEMG in extension (mV)	FER
wuqinxi exercises group	0.169±0.064*	0.291±0.101	0.581±0.087**
Control group	0.270±0.101*	0.389±0.139	0.668±0.129

* indicates a statistically significant difference in ASEMG between flexion and extension
** indicates a statistically significant difference in FER between the *wuqinxi* exercise and control groups

ence in FER between the experimental group and the control group before the 1 year exercise intervention. The FER of the experimental group was lower than that of the control group after the 1 year exercise intervention. There was no significant difference between the two sides in any individual both before and after the 1 year exercise intervention. The results indicate that the *wuqinxi* exercises can improve the function of the lumbosacral multifidus, and might offer an alternative method for reducing low back pain.

Finally, limitations of this study were the small population of each group, and the outcome measures were too few. In a future study, we will enroll more practioners and select more suitable parameters.

ACKNOWLEDGEMENT

We sincerely thank all of the volunteers who took part in this study. Without their devotion, this research could not have been performed.

REFERENCES

1) Deyo RA, Mirza SK, Martin BI: Back pain prevalence and visit rates: estimates from U.S. national surveys, 2002. Spine, 2006, 31: 2724–2727. [Medline] [CrossRef]
2) Mohseni-Bandpei MA, Fakhri M, Bagheri-Nesami M, et al.: Occupational back pain in Iranian nurses: an epidemiological study. Br J Nurs, 2006, 15: 914–917. [Medline]
3) Mohseni-Bandpei MA, Fakhri M, Ahmad-Shirvani M, et al.: Low back pain in 1,100 Iranian pregnant women: prevalence and risk factors. Spine J, 2009, 9: 795–801. [Medline] [CrossRef]
4) Jin K, Sorock GS, Courtney TK: Prevalence of low back pain in three occupational groups in Shanghai, People's Republic of China. J Safety Res, 2004, 35: 23–28. [Medline] [CrossRef]
5) Nickel R, Egle UT, Eysel P, et al.: Healthy-related quality of life and somatization in patients with long-term low back pain. Spine, 2001, 344: 363–370.
6) Eisenberg DM, Davis RB, Ettner SL, et al.: Trends in alternative medicine use in the United States, 1990–1997: results of a follow-up national survey. JAMA, 1998, 280: 1569–1575. [Medline] [CrossRef]
7) von Trott P, Wiedemann AM, Lüdtke R, et al.: Qigong and exercise therapy for elderly patients with chronic neck pain (QIBANE): a randomized controlled study. J Pain, 2009, 10: 501–508. [Medline] [CrossRef]
8) Skoglund L, Josephson M, Wahlstedt K, et al.: Qigong training and effects on stress, neck-shoulder pain and life quality in a computerised office environment. Complement Ther Clin Pract, 2011, 17: 54–57. [Medline] [CrossRef]

9) Lee S: Chinese hypnosis can cause qigong induced mental disorders. BMJ, 2000, 320: 803. [Medline]
10) Jiang J, Guo YJ, Niu AJ: Extraction, characterization of Angelica sinensis polysaccharides and modulatory effect of the polysaccharides and Tai Chi exercise on oxidative injury in middle-aged women subjects. Carbohydr Polym, 2009, 77: 384–388. [CrossRef]
11) Yu DH, Wu JM, Niu AJ: Health-promoting effect of LBP and healthy Qigong exercise on physiological functions in old subjects. Carbohydr Polym, 2009, 75: 312–316. [CrossRef]
12) Ng BH, Tsang HW: Psychophysiological outcomes of health qigong for chronic conditions: a systematic review. Psychophysiology, 2009, 46: 257–269. [Medline] [CrossRef]
13) Macdonald DA, Dawson AP, Hodges PW: Behavior of the lumbar multifidus during lower extremity movements in people with recurrent low back pain during symptom remission. J Orthop Sports Phys Ther, 2011, 41: 155–164.
14) Hides J, Stanton W, Mendis MD, et al.: The relationship of transversus abdominis and lumbar multifidus clinical muscle tests in patients with chronic low back pain. Man Ther, 2011, 16: 573–577. [Medline] [CrossRef]
15) Brenner AK, Gill NW, Buscema CJ, et al.: Improved activation of lumbar multifidus following spinal manipulation: a case report applying rehabilitative ultrasound imaging. J Orthop Sports Phys Ther, 2007, 37: 613–619. [Medline] [CrossRef]
16) Hermens HJ, Freriks B, Disselhorst-Klug C, et al.: Development of recommendations for SEMG sensors and sensor placement procedures. J Electromyogr Kinesiol, 2000, 10: 361–374. [Medline] [CrossRef]
17) Sancier KM: Medical applications of qigong. Altern Ther Health Med, 1996, 2: 40–46. [Medline]
18) Lee M, Ryu H, Chung H: Stress management by psychosomatic training: effects of ChunDoSunBup Qi-training on symptoms of stress: a cross-sectional study. Stress Med, 2000, 16: 161–166. [CrossRef]
19) Skoglund L, Jansson E: Qigong reduces stress in computer operators. Complement Ther Clin Pract, 2007, 13: 78–84. [Medline] [CrossRef]
20) Lee M, Kang C, Lim H, et al.: Effects of Qi-training on anxiety and plasma concentrations of cortisol, ACTH, and aldosterone: a randomized placebo-controlled pilot study. Stress Health, 2004, 20: 243–248. [CrossRef]
21) Tsang HW, Fung KM, Chan AS, et al.: Effect of a qigong exercise programme on elderly with depression. Int J Geriatr Psychiatry, 2006, 21: 890–897. [Medline] [CrossRef]
22) Stenlund T, Lindström B, Granlund M, et al.: Cardiac rehabilitation for the elderly: Qi Gong and group discussions. Eur J Cardiovasc Prev Rehabil, 2005, 12: 5–11. [Medline]
23) Sang QX: Effect of "wuqinxi" exercise on antioxidant status, intestine Bacillus acidophilus, Lactobacillus casei and Bacillus bifidus in obese old people. J Med Plants Res, 2011, 5: 2445–2447.
24) Chen Y: Effect of "WuQinXi" exercise on blood lipid levels and the antioxidant enzyme activities in aged practicers. Afr J Microbiol Res, 2011, 5: 5733–5736.
25) Freeman BA, Crapo JD: Hyperoxia increases oxygen radical production in rat lungs and lung mitochondria. J Biol Chem, 1981, 256: 10986–10992. [Medline]
26) Fridovich I: Superoxide radical and superoxide dismutases. Annu Rev Biochem, 1995, 64: 97–112. [Medline] [CrossRef]
27) McGill SM: Low back stability: from formal description to issues for performance and rehabilitation. Exerc Sport Sci Rev, 2001, 29: 26–31. [Medline] [CrossRef]
28) O'Sullivan PB, Phyty GD, Twomey LT, et al.: Evaluation of specific stabilizing exercise in the treatment of chronic low back pain with radiologic diagnosis of spondylolysis or spondylolisthesis. Spine, 1997, 22: 2959–2967. [Medline] [CrossRef]
29) Hides JA, Jull GA, Richardson CA: Long-term effects of specific stabilizing exercises for first-episode low back pain. Spine, 2001, 26: E243–E248. [Medline] [CrossRef]
30) Norris C: Spinal stabilisation.: Part 1. Active lumbar stabilisation concepts. Physiotherapy, 1995, 81: 61–64. [CrossRef]
31) Norris C: Spinal stabilisation.: Part 3. Stablisation mechanisms of the lumbar spine. Physiotherapy, 1995, 81: 72–79. [CrossRef]
32) Geisser ME, Ranavaya M, Haig AJ, et al.: A meta-analytic review of surface electromyography among persons with low back pain and normal, healthy controls. J Pain, 2005, 6: 711–726. [Medline] [CrossRef]
33) Lee JH, Hoshino Y, Nakamura K, et al.: Trunk muscle weakness as a risk factor for low back pain. A 5-year prospective study. Spine, 1999, 24: 54–57. [Medline] [CrossRef]
34) Wei J, Zhao P, Zhou W, et al.: [Study on reliablility of flexion-extension ratio in surface EMG for the diagnosis of nonspecific chronic low back pain]. Zhongguo Gu Shang, 2008, 21: 411–413. [Medline]