The Influence of “wuqinxi” exercises on the Lumbosacral Multifidus

FENG ZHANG, MD1, 2, YU-HUA BAI, MD1, 2, JING ZHANG, MD1, 2*

1) Department of Rehabilitation Medicine, The Third Hospital of Hebei Medical University: Ziqiang Road 139, Shijiazhuang 050031, 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

INTRODUCTION

Low back pain (LBP) is a very common disease in both developed and developing countries1–4, and it easily develops into a chronic disease5,6. 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 increased7,8. Qigong (pron. “chee-gong”) is a method of complementary and alternative medicine. It is practiced to regulate breathing, movement, and awareness while doing exercise9. Typically, such practice includes rhythmic breathing, stylized fluid movement and a peaceful state9.

Based on a series of recent reports, approximately 5% of China’s population practice some kind of qigong9–11. 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 movement12. A series of studies have indicated that exercise of the lumbosacral multifidus could be beneficial for spinal control and alleviate LBP13–15. 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
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/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 imitating exercise is given as an example. Stand with the arms hanging at the sides and the feet slightly apart. With a deep 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. Inhale deeply and direct *qi* (air) down to the abdomen. Keep this position, inhale and direct *qi* down to abdomen again and again until the body is warm. 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. The reference electrode was positioned over the olecranon of the elbow, as recommended by Hermens et al. 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, Ill). Two-way analysis of variance was used for the analysis of ASEM in flexion, ASEM in extension, and FER. The *t*-test was used to evaluate the FER of multifidus between the experimental group and control group, the ASEM 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 ASEM in the process of flexion was lower than the ASEM 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 1 and 2.

The ASEM in the process of flexion was lower than the ASEM 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. In earlier studies, *qigong* was found to reduce stress, anxiety, and depression as well as to improve physical activity and balance. Twelve months of *wuqinxi* exercise was reported to be beneficial for obese people, promoting blood antioxidant enzymes activities, enhancing lipid peroxidation and increasing intestinal bacteria count.

A previous study reported that 64 healthy older people had practiced *wuqinxi* exercises for 30 days, blood lipids levels and oxidative injury decreased, indicating that the exercise was beneficial for the health of old people. 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. MDA is a key oxidation product of peroxidized polyunsaturated fatty acids, and the MDA level is a crucial indicator of lipid peroxidation. Superoxide dismutase (SOD) is an important intracellular antioxidant enzyme of aerobic cells, and it may exert antioxidant effects against superoxide radicals. 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. Previous studies have demonstrated they alleviate stress on injured osseoligamentous structures, reducing pain and enhancing function. Specific isometric exercises for the lumbar multifidus of low load and tonic manner have been proved to be beneficial for spinal control. Furthermore, exercise of the deep segmental fibers of the lumbar multifidus (DM) has been indicated to reduce the recurrence of acute LBP, alleviate pain, and reduce disability in chronic LBP patients.

SEMG is a simple and non-invasive parameter of muscle activity, which is an objective marker of LBP. 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. 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.

In this study, the ASEM in the process of flexion was lower than that of the ASEM 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-
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 practitioners 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 BJ: 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: 904–917. [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, Eyssel P, et al.: Healthy-related quality of life and somatization in patients with long-term low back pain. Spine, 2001, 34: 363–370.
6) Eisenberg DM, Davis RB, Etter 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 Trotta P, Wiedemann AM, Lüdtke R, et al.: Qigong and exercise therapy for elderly patients with chronic neck pain (QHANE): 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]

| Table 1. The comparison of ASEM and FER of the left side between the two groups before the exercise intervention |
|---------------------------------------------------------------|
| | ASEM in flexion (mV) | ASEM 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 ASEM between flexion and extension |

The unit of ASEM is millivolts (mV)

| Table 2. The comparison of ASEM and FER of the right side between the two groups before the exercise intervention |
|---------------------------------------------------------------|
| | ASEM in flexion (mV) | ASEM 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±0.076 | 0.632±0.095 |
| * indicates a statistically significant difference in ASEM between flexion and extension |

| Table 3. The comparison of ASEM and FER of the left side between the two groups after the exercise intervention |
|---------------------------------------------------------------|
| | ASEM in flexion (mV) | ASEM 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 ASEM between flexion and extension |
| ** indicates a statistically significant difference in FER between the wuqinxi exercise and control groups |

| Table 4. The comparison of ASEM and FER of the right side between the two groups after the exercise intervention |
|---------------------------------------------------------------|
| | ASEM in flexion (mV) | ASEM 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 ASEM between flexion and extension |
| ** indicates a statistically significant difference in FER between the wuqinxi exercise and control groups |
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) Sancier KM: Medical applications of qigong. Altern Ther Health Med, 1996, 2: 40–46. [Medline] [CrossRef]  
14) Lee S: Chinese hypnosis can cause qigong induced mental disorders. BMJ, 2000, 320: 803. [Medline]  
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, Dissinghorst-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] [CrossRef]  
18) Lee M, Ryu H, Chung H: Stress management by psychosomatic training: effects of ChunDoSunBup Qiq-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 program 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] [CrossRef]  
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. [Medline] [CrossRef]  
24) Chen Y: Effect of “WuQinXi” exercise on blood lipid levels and the antioxidant enzyme activities in aged practitioners. Afr J Microbiol Res, 2011, 5: 5733–5736. [Medline] [CrossRef]  
25) Freeman BA, Crapo JD: Hyperoxia increases oxygen radical production in rat lungs and lung mitochondria. J Biol Chem, 1981, 256: 10986–10992. [Medline] [CrossRef]  
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 spondyloysis 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. Stabilisation 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 reliability of flexion-extension ratio in surface EMG for the diagnosis of nonspecific chronic low back pain]. Zhongguo Gu Shang, 2008, 21: 411–413. [Medline]