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EFFECT OF "TAI CHI" EXERCISE ON ANTIOXIDANT ENZYMES ACTIVITIES AND IMMUNITY FUNCTION IN MIDDLE-AGED PARTICIPANTS

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Abstract

Background: "Tai Chi" is a useful exercise that increases physical strength and relax the mind.
Materials and Methods: The study investigates effect of "tai chi" exercise on antioxidant enzymes activities and immunity function in participants. These participants were randomly divided into two groups: "tai chi" exercise group (n=25) and control group (n=25). The participants in the "tai chi" group performed "tai chi" exercise for 1 h every day. The participants in the control group didn't perform "tai chi". The exercise lasts for half a year.
Results: "tai chi" exercise increased antioxidant enzymes activities and improve immunity function in participants.
Conclusion: "tai chi" exercise is useful for health-keep of participants.

Key words: "tai chi", Antioxidant, immunity

Introduction

"Tai Chi" is an exercise system that may increase physical strength and relax the mind (Tsang et al., 2008), and so may be useful for alleviating stress. It is known that the practice of "tai chi" dates back to 13th century and has been exercised by the Chinese for the promotion and maintenance of health and longevity (Zhuo, 1982 and Koh, 1981). Many reviews have attempted to explore the useful effects of "tai chi" on some health dimensions (Adams, 2004 and Kuramoto, 2006), including decreased blood pressure (Yeh et al., 2008), aerobic capacity (Lee et al., 2009), psychosocial wellbeing (Wang et al., 2009), and psychological wellbeing (Wang et al., 2010).

Oxidative stress indicates an imbalance between oxidation and antioxidation, resulting in neutrophil inflammatory infiltration, increasing protease secretion, causing in a large number of oxidized intermediate products. This adverse condition may lead to damage of all cellular components, including proteins, lipids, carbohydrates, and nucleic acids (Valko et al, 2007).

In the study, we evaluate effect of "tai chi" exercise on oxidative stress and immunity function in middle aged people.

Participants and Methods

Interventions

In March 2014, 50 participants (27 men, 23 women, age between 40-45 years old) were recruited in shengzhen city, china. They were asked to give up all bad habits, e.g. smoking, drinking. These participants were randomly divided into two groups: "tai chi" exercise group (n=25) and control group (n=25). The participants in the "tai chi" group (2-5) performed "tai chi" exercise for 1 h every day. The "tai chi" program was developed by two "tai chi" experts. The participants in the control group (1) didn't perform "tai chi". The exercise lasts for half a year.

In October 2014, blood was taken from all participants. Plasma was aliquoted, frozen, stored at −70 °C and freshly thawed prior to use.

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Biochemical Analysis

MDA, GSH, SOD, CAT, GSH-Px in blood were analysed using commercially available kits (GBCBIO company, Guangzhou, China). The concentration of the cytokines such as TNF-α and IL-2 were measured using commercial ELISA kits from BD Biosciences, USA

Concentration of total IgM, IgA and IgG in plasma was measured nephelometrically using the analyzers IMMAGE 800 (Beckman, Brea, CA, USA) and BNII (Dade Behring, Marburg, Germany). The results are stated in g/l.

Statistical Analysis

Values are represented as mean ± standard error (SE). Entire analysis was conducted using SPSS 15 software. The p value of ⩽0.05 was considered significant.

Results

The antioxidant indexes, blood MDA, GSH, SOD, CAT and GSH-Px levels, were assayed. Results showed that blood MDA levels were significantly decreased ($P < 0.05$, $P < 0.01$) in "tai chi" exercise group compared to the control group (Table 1 and 2). GSH, SOD, CAT, GSH-Px activities in blood of "tai chi" exercise group significantly higher increased ($P < 0.05$, $P < 0.01$) compared to the control group (Table 1 and 2). This effect is displayed in a time-dependent manner.

Table 1: Effect of "tai chi" exercise on blood MDA and GSH levels in participants

group		MDA	GSH
control		4.25±0.35	121.53±9.56
"tai chi"	2 months	4.01±0.29	136.26±8.35*
	4 months	3.48±0.22*	144.92±10.25**
	6 months	2.94±0.19**	152.97±11.42**

*$P<0.05$, **$P<0.01$, compared with control.

Table 2: Effect of "tai chi" exercise on blood SOD, CAT and GSH-Px activities in participants

group		SOD (U/ml)	CAT (U/ml)	GSH-Px (U/ml)
control		215.46±20.83	38.57±2.64	47.37±2.46
"tai chi"	2 months	228.69±24.88**	47.36±2.95**	55.37±3.31*
	4 months	241.14±31.07**	56.13±4.13**	64.85±4.27**
	6 months	249.63±33.11**	61.49±4.82**	72.25±5.07**

*$P<0.05$, **$P<0.01$, compared with group 1.

Blood TNF-α and IL-2 levels in participants were shown in Table 2. The blood TNF-α and IL-2 levels did not varied significantly between "tai chi" exercise group and control group.

Table 3: Effect of "tai chi" exercise on blood TNF-α and IL-2 levels in participants

group		TNF-α (pg/ml)	IL-2 (pg/ml)
control		20.58±3.06	894.15±96.15
"tai chi"	2 months	23.14±2.95	890.68±105.28
	4 months	22.53±2.75	899.45±89.58
	6 months	21.63±2.93	902.52±121.65

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Blood immunoglobulin (IgA, IgG and IgM) levels in participants were shown in Table 3. The Blood IgA, IgG and IgM levels varied significantly between tai chi exercise group and control group. It can be observed that blood IgA, IgG and IgM levels increased significantly in tai chi exercise group with increasing exercise time.

Table 4: Effect of "tai chi" exercise on blood IgA, IgM and IgG levels in participants

group		IgA	IgG	IgM
control		3.27±0.13	11.49±0.95	1.17±0.09
"tai chi"	2 months	4.16±0.18*	13.25±0.78	1.83±0.08*
	4 months	4.42±0.21**	14.83±0.88*	2.41±0.14**
	6 months	4.85±0.25**	15.49±1.27**	2.96±0.18**

*P<0.05, **P<0.01, compared with control.

Discussion

The results showed that the participants who performed the "tai chi" exercise program had less oxidative stress as measured 2, 4 and 6 months after starting the "tai chi" program. In addition, antioxidant enzymes activities in participants who performed tai chi exercise continuously increased with prolonged exercise time. The intensity of "tai chi" is closely related to its training style, posture, and duration (Lan et al., 2013). Catastrophe theory of muscular fatigue shows that the fatigue can happen in any links from the cerebral cortex excitement to the contractile proteins of the skeletal muscle (Nguyen et al, 2016).

As the body does exercise, about 2% O_2 of the body intake is transform into the superoxide anion FR in the way of one-electron reduction, and the oxidative stress is increased (Simmons, 1984).

Our results showed that the participants doing light-intensity exercise could keep their physical function and reduce oxidative stress during exercise. This finding is in agreement with previous studies (Mendoza-Núñez et al, 2014).

TNF-α is a cytokine that can directly kill tumor cells without obvious toxicity to normal cells. It is one of the most important biological active factors to directly kill the tumor (Tanaka et al, 2016).

Interleukin-2 (IL-2), a cytokine, with wide range of biological activities, is mainly produced by activated CD4+Th1 cells and can promote the proliferation of Th0 and CTL. It also involves into antibody response, hematopoiesis and tumor surveillance (Leventhal et al, 2016).

In our current study, we found no significant differences in the blood TNF-α and IL-2 between the control and "tai chi" groups in our study. This result implies that six months of "tai chi" exercise could not decrease blood TNF-α and IL-2 levels in the human body.

Serum immunoglobulins levels are determined routinely in clinical practice because they provide key information on the humoral immune status. Immunoglobulins production is prototypical function of B cells, and immunoglobulins has important roles in multiple inflammatory diseases including lupus, rheumatoid arthritis and atherosclerosis (Zhang et al, 2015; Tsiantoulas et al, 2014; Feist & Steiner, 2014), and now T2D is also considered as an inflammatory disease (Donath & Shoelson, 2011).

In our current study, tai chi exercise significantly enhanced blood immunoglobulin (IgA, IgG and IgM) levels in participants. Moreover, the effect became better with prolonged exercise time. This indicates that tai chi exercise can improve immunity function in participants.

In conclusion, tai chi exercise can enhance blood antioxidant enzymes activities, and improve immunity function in participants.

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References

1. Adams, K.P.J. (2004). Comprehensive therapeutic benefits of Taiji. Am. J. Phys. Med. Rehabil., 83: 735–745
2. Donath, M.Y., Shoelson, S.E. (2011). Type 2 diabetes as an inflammatory disease. Nat Rev Immunol., 11: 98–107
3. Feist, E., Steiner, G. (2014). Rheumatoid arthritis: an antigenic chameleon. Ann Rheum Dis., 73: 1753–1754
4. Koh, T.C. (1981). Tai Chi Chuan. Am. J. Chin. Med., 9: 15–22
5. Kuramoto, A.M. (2006). Therapeutic benefits of Tai Chi exercise: research review. Wis. Med. J., 105: 42–46
6. Lan, C., Chen, S.Y., Lai, J.S., Wong, A.M. (2013). Tai chi chuan in medicine and health promotion. Evidence-Based Complement. Altern. Med., 2013: 502131
7. Lee, M.S., Lee, E.-N., Ernst, E. (2009). Is tai chi beneficial for improving aerobic capacity? A systematic review. Br. J. Sports Med., 43: 569–573
8. Leventhal, J.S., Odell, I.D., Imaeda, S., Maverakis, E., King, B.A. (2016). Treatment of melanoma in-transit metastases with combination intralesional interleukin-2, topical imiquimod, and tretinoin 0.1% cream. JAAD Case Rep. 2(2):114-116.
9. Mendoza-Núñez, V.M., Hernández-Monjaraz, B., Santiago-Osorio, E., Betancourt-Rule, J.M., Ruiz-Ramos, M. (2014). Tai Chi exercise increases SOD activity and total antioxidant status in saliva and is linked to an improvement of periodontal disease in the elderly. Oxid Med Cell Longev. 2014:603853.
10. Nguyen, A., Duquette, N., Mamarbachi, M., Thorin, E. (2016). Epigenetic Regulatory Effect of Exercise on Glutathione Peroxidase 1 Expression in the Skeletal Muscle of Severely Dyslipidemic Mice. PLoS One. 11(3):e0151526.
11. Simmons, K.J. (1984). Defence against free radicals has therapeutic implications. Am Med Assoc, 251: 2187–2192
12. Tanaka, Y., Ito, S., Isobe, K.I. (2016). Vancomycin-sensitive bacteria trigger development of colitis-associated colon cancer by attracting neutrophils. Sci Rep. 6:23920.
13. Tsang, H.W.H., Chan, E.P., and Cheung, W.M. (2008). Effects of mindful and non-mindful exercises on people with depression: a systematic review. Br. J. Clin. Psychol., 47: 303–322
14. Tsiantoulas, D., Diehl, C.J., Witztum, J.L., Binder, C.J. (2014). B cells and humoral immunity in atherosclerosis. Circ Res., 114: 1743–1756
15. Valko, M., Leibfritz, D., Moncol, J., Cronin, M.T., Mazur, M., Telser, J. (2007). Free radicals and antioxidants in normal physiological functions and human disease. Int J Biochem Cell Biol, 39: 44–84
16. Wang, C., Bannuru, R., Ramel, J., Kupelnick, B., Scott, T., Schmid, C.H. (2010). Tai Chi on psychological well-being: systematic review and meta-analysis. BMC Complement. Altern. Med., 10: 23
17. Wang, W.C., Zhang, A.L., Rasmussen, B., Lin, L.W., Dunning, T., Kang, S.W., Park, B.J., Lo, S.K. (2009). The effect of Tai Chi on psychosocial well-being: a systematic review of randomized controlled trials. J. Acupunct. Meridian Stud., 2: 171–181
18. Yeh, G.Y., Wang, C., Wayne, P.M., Phillips, R.S. (2008). The effect of Tai Chi exercise on blood pressure: a systematic review. Prev. Cardiol., 11: 82–89
19. Zhang, H., Li, P., Wu, D., Xu, D., Hou, Y., Wang, Q., Li, M., Li, Y., Zeng, X., Zhang, F., Shi Q. (2015). Serum IgG subclasses in autoimmune diseases. Medicine (Baltimore). 94: e387
20. Zhuo, D.-H. (1982). Preventive geriatrics: an overview from traditional Chinese medicine. Am. J. Chin. Med., 10: 32–39