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Effects of Tai Chi on the Metabolism of Breath and Energy of the Senior Citizen

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Keywords : Tai Chi; energy metabolism ; breath frequency.

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EFFECTS OF TAI CHI ON THE METABOLISM OF BREATH AND ENERGY OF THE SENIOR CITIZEN

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Abstract - The purpose of this article is to find out the different of index of metabolism of breath and energy between the senior citizen who has often trained 24 style Tai Chi for a long time and the new learner when they just finished 24 style Tai Chi, and the results tell us that the index of testing of the senior citizen who has often trained 24 style Tai Chi is much better than the new learner, so the results indicate Tai Chi can improve the function of metabolism of breath and energy of the senior citizen which as a science proof of the senior citizen who trains the Tai Chi.

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INTRODUCTION

ai Chi is a main major division of Chinese martial art, which has the characteristics of slow, soft and ethereal. The movement required to be such as spinning, to go as a cat, round-trip must be folded, advance and retreat will transform into each other, and there are rules of dynamic and quiescent, equality and connect style by style. Styles should be round, no bump, quiet, no distracting thoughts, not intended to bump, quiet, no distracting thoughts, not intended to push and so on. Tai Chi can improve the ability of, breathe and sport systems, also has some medical prevention and treatment of insomnia and neurasthenia, improving anxiety and tension. [1] The senior citizen belongs to the special community, whose cardiovascular system is very fragile, and the abilities of breath and sport are begin to decline. This article compares the data of senior citizen who training Tai Chi for a long time and the beginners, which can provide a scientific basis for Tai Chi exercise science.

II. OBJECT AND METHOD

a) Object

Ten Tai Chi trainer from Tai Chi Association of Inner Mongolia Autonomous Region as the experimental group, whose Tai Chi average training time is 8 years. Ten Tai Chi fancier as the control group, whose Tai Chi average training time is less than 3 months.

Table 1 : Basic Information of Research Object.

groups	age/year	height/cm		weight/kg	training time/year
The experimental group	69.56 ± 7.85	171±6.8	67.4	12.4±	8.5±2.7
the control group	72.16 ± 8.12	166±4.6		67.2±6.8	

b) Methods

i. Literature summary method

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Refer to reports, journal and outstanding master's and doctor degree paper as the material of this article.

ii. Interview method

After interviewing coaches of Tai Chi and exports of sports Physiology, we take the advices and instructions as the base of this article.

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iii. Experimentation

We used Germany CORTEX-3B sports heartlung function testing machine to remote test the gas metabolism of our subjects during Tai Chi, input the data to computer, dealing with SPSS software.

Experimentation process :

 Subjects are tested in laboratory where the temperature is 23°C, obtaining data at the same time. We divide 24 style Tai Chi into four phases based on the tips of Tai Chi: Phase 1: Commencing form~Play Pipa; Phase 2: Repulse Monkey~Single Whip; Phase 3: Wave Hands Like Clouds~Strike Opponent's Ears with Both Fists; Phase 4: Turn and Kick with Left Heel~Closing Form. The whole Tai Chi takes 5min45s. Testing index: quiet state before exercise; exercise; after exercise. [2]

2. Heart-lung function test: 3min before exercise is the quiet state; process of playing Tai Chi is the experiment state; 5min after playing Tai Chi is the recovery state. The annals start from the quiet state to the recovery state.

III. RESULTS AND ANALYSIS

a) Analysis of the changes of energy metabolism of senior citizen during Tai Chi exercise. Table 2 : changes of energy metabolism of quiet state, in exercise, and after exercise.

state	The experimental group	The control group
quiet state	1.25 ± 0.18	1.09 ± 0.33
Phase 1	3.26 ± 1.52	2.02 ± 1.28
Phase 2	3.78±1.57*	3.10 ± 2.44
Phase 3	$3.71 \pm 2.55*$	3.43 ± 2.01
Phase 4	1.79 ± 0.40	1.20 ± 0.49
1min after exercise	1.57 ± 0.31	1.08 ± 0.39
2min after exercise	1.37 ± 0.20	1.17 ± 0.27
3min after exercise	1.42 ± 0.38	1.13 ± 0.37
4min after exercise	1.37 ± 0.37	1.15 ± 0.38
5min after exercise	1.47 ± 0.22	1.12 ± 0.38

(marked with * when P<0.05 compared with control group)

Data from Table 2, Metabolic Equivalent of experimental group is 1.25 ± 0.18 MET, and the control group is 1.09 ± 0.33 MET, there is no significant differences. From the Commencing form, Metabolic Equivalent trends to raise, in the Phase 3 Strike Opponent's Ears with Both Fists, Metabolic Equivalent compared to be lower. There is significant difference of Metabolic Equivalent between Phase 2 and Phase 3. 5min after exercise recover to quiet state, two groups' Metabolic Equivalent are 1.47 ± 0.22 MET and 1.12 ± 0.38 MET. From Table 2 we can see the energy expenditure of experimental group is higher than control group, so the load of experimental group when they playing Tai Chi is much higher than control, the quality of Tai Chi motions of control group is lower than the experimental group. If you insist on playing Tai Chi for a long time can achieve the purpose of losing fat. [3]

Table 3 : Changes of respiratory quotient of quiet state, in exercise, and after exercise.

state	The experimental group	The control group
quiet state	0.89 ± 0.11	0.87 ± 0.05
Phase 1	0.85 ± 0.03	0.8 ± 0.06
Phase 2	0.97 ± 0.07	0.86 ± 0.03
Phase 3	1.03 ± 0.07	0.87 ± 0.03
Phase 4	1.01 ± 0.19	0.96 ± 0.22
1min after exercise	0.96 ± 0.09	0.92 ± 0.12
2min after exercise	$0.94 \pm 0.08*$	0.93 ± 0.08
3min after exercise	$0.93 \pm 0.07*$	0.87 ± 0.02
4min after exercise	0.93 ± 0.09	0.83 ± 0.01
5min after exercise	0.92 ± 0.06	0.84 ± 0.02

(marked with * when P<0.05 compared with control group)

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The respiratory quotient of every phase raises like waves during the whole exercise, and higher in Phase 4 and before recovery (Table 3).The level of oxygen consumption recovers to quiet state 5min after exercise. The average of oxygen consumption is above 0.8 during the whole exercise, the result suggests the main energy supply system is sugar and fat.

Compared with two groups, there is no significant difference during quiet state and exercise, but the respiratory quotient of the experimental group is higher than the control group during recovery, the results suggest that the level of energy supply is the same during quiet state and exercise, but the experimental group's is much lower than the control group's during recover, there is significant difference when 2min and 3min after exercise. The results suggest that the oxygen consumption of experimental group is lower than the control group, which has faster recovery. Based on the oxygen consumption ratio, people who want to consume more energy and lose fat needs to train Tai Chi again and again for a long time. [2]

b) Effects of Tai Chi on the heart function of the senior citizen.i. Effects of Tai Chi on the heart rate

state	The experimental group	The control group		
quiet state	81.27 ± 4.18	84.06±4.93		
Phase 1	96.45±5.12	103.61 ± 5.78		
Phase 2	104.54 ± 5.62	112.73 ± 5.90		
Phase 3	131.46 ± 3.98	134.55 ± 4.76		
Phase 4	150.09 ± 4.21	159.63 ± 3.86		
1min after exercise	133.21 ± 5.76	150.54 ± 4.56		
2min after exercise	120.78 ± 6.49	143.54 ± 3.74		
3min after exercise	110.67 ± 6.09	132.09 ± 3.72		
4min after exercise	$90.84 \pm 5.74*$	120.73 ± 4.67		
5min after exercise	83.43±4.53*	103.12 ± 4.84		

Table 4 : Changes of the heart rate of quiet state, in exercise, and after exercise.

The heart rate significant increases during the whole Tai Chi, and which keeps high level, the heart rate shown a clear upward trend, the max of the heart rate shows in the Phase 4(Table 4), so Tai Chi is an exercise which heart rate and intension increase gradually.

The heart rate of experimental group is lower than the control group during the whole phases, and

shows significant difference in recovery time, that suggests it can improve the function of heart if you insist on training Tai Chi. The research discovered the heart rate keeps $90 \sim 130$ BPM during Tai Chi exercise, which belongs to low to medium intensity exercise, so Tai Chi is a safe, gentle, soft sport. [4]

Table 5 : Changes of the breath frequency of quiet state, in exercise, and after exercise.

state	The experimental group	The control group
quiet state	17.91 ± 3.66	18.69 ± 6.28
Phase 1	26.61 ± 6.00	19.52 ± 2.59
Phase 2	27.48 ± 5.64	24.29 ± 5.46
Phase 3	28.03 ± 7.75	23.01 ± 3.14
Phase 4	24.52 ± 4.04	22.9 ± 3.74
1min after exercise	23.66 ± 4.47	21.26 ± 3.38
2min after exercise	20.78 ± 2.76	20.61 ± 3
3min after exercise	19.37 ± 3.37	20.04 ± 3.92
4min after exercise	18.98 ± 3.15	19.98 ± 3.37
5min after exercise	18.08 ± 2.69	19.78 ± 2.23

The breath frequency of the experimental group is 17.91 ± 3.66 times/min and which the control group is 18.69 ± 6.28 times/min in quiet state, the breath frequency begin to raise from the Commencing form, the frequency increases go with time, and relates to the load of exercise. The max breath frequency shows in the Phase 3, recovery to the quiet level 5min after exercise. And there is no significant difference between two groups.

III.	Effects of Tai Chi or	n the Relative Oxyg	en Uptake		
Table 6 : Changes of the	Relative Oxygen Up	take of quiet state,	in exercise, a	and after exercis	se.

state	The experimental group	The control group
quiet state	4.4 ± 0.60	3.74 ± 1.16
Phase 1	15.06 ± 5.48	10.24 ± 4.49
Phase 2	$18.25 \pm 5.78*$	13.95 ± 8.46
Phase 3	$21.96 \pm 8.84*$	11.6 ± 7.00
Phase 4	$14.52 \pm 0.90 *$	9.35 ± 1.6
1min after exercise	5.48 ± 1.03	3.87 ± 1.3
2min after exercise	5.06 ± 1.05	4.07 ± 1
3min after exercise	4.74 ± 1.14	3.91 ± 1.38
4min after exercise	5 ± 1.39	4.14 ± 1.32
5min after exercise	5.18 ± 0.73	3.89 ± 1.4

The relative oxygen uptake of the experimental group is 4.4 ± 0.60 and which the control group is 3.74 ± 1.16 in quiet state, and raises when begin to exercise, the relative oxygen uptake of the experimental group is much higher than the control group, which range is bigger and faster, descendent when Strike Opponent's Ears with Both Fists(Table 6). There is significant difference from Phase 2 the Phase 4.

The relative oxygen uptake of the experimental group is much higher than the control group when training Tai Chi, suggesting that Tai Chi can improve the oxygen transport system, the function of heart pump blood and the ability of muscular tissue uptakes oxygen, consequently to meet the needs of oxygen of body.[5]

iv. Effects of Tai Chi on the time of expiration

Table 7: Changes of the time of expiration of quiet state, in exercise, and after exercise.

state	The experimental group	The control group
quiet state	2.17 ± 0.59	2.92 ± 2.01
Phase 1	1.11 ± 0.24	1.33 ± 0.15
Phase 2	1.18 ± 0.36	1.64 ± 0.5
Phase 3	1.39 ± 0.58	1.99 ± 0.31
Phase 4	1.68 ± 0.27	1.94 ± 0.33
1min after exercise	1.56 ± 0.28	2.01 ± 0.42
2min after exercise	1.76 ± 0.18	1.95 ± 0.31
3min after exercise	1.76 ± 0.17	2.09 ± 0.41
4min after exercise	1.7 ± 0.19	1.81 ± 0.31
5min after exercise	1.69 ± 0.23	1.84 ± 0.19

There is no significant difference of the time of expiration between two groups during the whole testing. The time of expiration became shorter from Commencing form, begin to stabilize from Play Pipa, and raises clearly after exercise (Table 7).

state	The experimental group	The control group
quiet state	1.4 ± 0.28	2.3 ± 2.18
Phase 1	1.08 ± 0.33	1.08 ± 0.13
Phase 2	1.03 ± 0.27	1.18 ± 0.2
Phase 3	1.1 ± 0.29	1.27 ± 0.14
Phase 4	1.12 ± 0.17	1.35 ± 0.26
1 min after exercise	1.07 ± 0.17	1.37 ± 0.29
2min after exercise	1.19 ± 0.21	1.37 ± 0.27
3min after exercise	1.13 ± 0.21	1.39 ± 0.32
4min after exercise	1.2 ± 0.19	1.14 ± 0.18
5min after exercise	1.14 ± 0.22	1.19 ± 0.21

Tahle 8	Changes	of the time	of breathe in	of quiet state	in evercise	and after evercise
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Based on the data of Table 8, the time of breathe in became shorter when begin to train Tai Chi, but there is no significant difference, the time of breathe in kept a stable state during the whole 4 Phases and which increased clearly during recovery time, there in no significant difference between the experimental group and the control group. So someone who trained Tai Chi for a long time can meet the needs of oxygen of body in a shorter time, which suggests the ability of muscular tissue uptakes and utilize oxygen of experimental group is better than the control group.[6] May 2012

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state	The experimental group	The control group
quiet state	0.99 ± 0.91	0.57 ± 0.11
Phase 1	1.15 ± 0.1	0.87 ± 0.15
Phase 2	1.06 ± 0.27	0.85 ± 0.14
Phase 3	1.07 ± 0.28	0.84 ± 0.22
Phase 4	0.74 ± 0.1	0.61 ± 0.13
1min after exercise	0.66 ± 0.1	0.57 ± 0.08
2min after exercise	0.7 ± 0.08	0.6 ± 0.05
3min after exercise	0.68 ± 0.11	0.53 ± 0.03
4min after exercise	0.62 ± 0.04	0.53 ± 0.07
5min after exercise	0.61 ± 0.04	0.54 ± 0.07

The Tidal Volume of two groups increase when begin to train, and the experimental group's data is higher than the control group during the whole test (Table 9). Which suggests that the depth of breath of the experimental group is higher than the control group, under the conclusion of there is no significant difference in the breath frequency, and enhanced the ability of breathing reserve and the lung ventilation. [7] And the energy and oxygen consumption of the breathe muscle are decreased correspondingly, so the senior citizen who trained Tai Chi for a long time will use different style

IV. CONCLUSIONS

1. Insisting on training Tai Chi is good for losing body fat because the effect of consuming the body

energy of Tai Chi is obvious.

- 2. Appropriate quantity and intension of Tai Chi can improve the cardiovascular function and vital capacity, promote the function of heart-lung and energy metabolize.
- 3. Tai Chi can strengthen senior citizen's physique, promotes the health.

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