



P-ISSN: 2394-1685  
E-ISSN: 2394-1693  
Impact Factor (ISRA): 5.38  
IJPESH 2018; 5(5): 100-107  
© 2018 IJPESH  
www.kheljournal.com  
Received: 19-07-2018  
Accepted: 20-08-2018

**Martin Ebenezer Chellappan**  
Lecturer, Faculty of Medicine  
and Health Sciences,  
Department of Physiotherapy,  
Universiti Tunku Abdul  
Rahman, Malaysia

**Jemeela S**  
Ph.D. Scholar, Vinayaka  
Missions Annapoorana College of  
Nursing, Salem, Tamil Nadu,  
India

**Ngo Jia Sheng**  
Student, Faculty of Medicine and  
Health Sciences, Department of  
Physiotherapy, Universiti Tunku  
Abdul Rahman, Malaysia

#### Correspondence

**Jemeela S**  
Ph.D. Scholar, Vinayaka  
Missions Annapoorana College of  
Nursing, Salem, Tamil Nadu,  
India

# International Journal of Physical Education, Sports and Health

## Cardiovascular responses among individuals who practice either Tai Chi Chuan or yoga during six minute walk test

**Martin Ebenezer Chellappan, Jemeela S and Ngo Jia Sheng**

### Abstract

Tai Chi Chuan, a Chinese traditional conditioning exercise, has shown to improve the quality of life in elderly people. It decreases the risk of multiple falls but also improve the cardiorespiratory fitness in elderly people. Whereas yoga, a physical, mental, and spiritual practice that originated from India, uses different posture in promoting physical fitness.

**Objective:** To determine the effect of six minute walk test on the cardiovascular responses among individuals who practice Tai Chi Chuan and yoga.

**Procedure:** 16 participants were recruited each in TCC and yoga group. The BP and HR taken before and after the test were compared in groups. The mean differences in BP and HR before and after the test were compared among the group.

**Result:** Comparison of HR and BP before and after the test in the groups were done and was found to have significant difference ( $p < 0.001$ ) in both groups. An independent T test was used to analyse the mean difference in SBP (mean=0.062, sd=1.22) and HR (mean=6.875, sd=5.53) among yoga and TCC group. Result show no significant difference among both groups ( $p > 0.05$ ).

**Conclusion:** Null hypothesis was accepted. There was no significant difference found in individual who practices either TCC or yoga.

**Keywords:** Tai Chi Chuan, Yoga, cardiovascular responses, 6 minute walk test

### 1. Introduction

Tai Chi Chuan (TCC), is an ancient Chinese traditional form of exercise, had been used for centuries in many places. It includes a series of movements performed in a focused and slow manner, accompanied by deep breathing. It was developed from a type of martial arts in China and slowly being modified in to an exercise program with the purpose of promoting health in a variety of age, particularly the elderly<sup>[1]</sup>.

In Tai Chi Chuan, the movements performed are linked together in a continuous manner that seems to flow smoothly from one movement to another which ensure the body to be in constant motion. This will be accompanied by deep breathing and mental concentration in order to achieve harmony and balance between the body and mind<sup>1</sup>. Thus, it can be used to train mental control other than just physical fitness<sup>[2]</sup>.

There are 4 major types of Tai Chi Chuan styles that exist till now. They are the Chen, Yang, Wu, and Hao styles. There is also another style which combines a group of style which is called the combination styles. The combination of different elements from different Tai Chi Chua styles may also include several movements taken from other martial arts forms. Each style contained movements which are slightly different than the others<sup>[3]</sup>.

Other than just stretching out each poses, yoga can actually create balance in the body through developing and balancing both strength and flexibility. Similar to Tai Chi Chuan, it is also considered to be a low impact and low to moderate intensity type of exercises<sup>[4]</sup>. Thus will not put much stress on the involved anatomical structures. There also a research on the effect of yoga in young healthy individual's cardiovascular system. The finding shows that it has a positive effect on the individual cardiovascular system thus proving that it is beneficial to those who practice it<sup>[5]</sup>.

The word 'yoga' comes from the Sanskrit word for root, yuj, which in this context means 'to join', 'to yoke', or 'to unite' – the union in this case being between the mind, body, and soul. This union is achieved through the physical and spiritual practices of yoga, which include yoga postures, meditation, and pranayama. Chakras are believed to be the energy centers in the subtle body, lying within the spinal cord and corresponding to the main nerve centers in the body. There are seven main chakras and it is believed that by balancing the chakra system, which can lead to a healthier and happier lives. The seven chakras are: Muladhara, Svadhisthana, Manipura, Anahata, Vissudha, Ajna, Sahasrara [6].

Each chakra is located along the spine, starting at the base and running upwards, to the crown of the head. Each radiates a specific colour and spiritual quality, and together they make up the psychological, physical, and emotional states necessary for the development of the whole person. The three chakras residing below the heart are mainly concerned with the physical body and physical needs; the chakras above the heart are of a more spiritual nature [6].

These two exercises have been providing a better cardiovascular fitness to the individual who practice any one of the exercises. However, there's only a negligible studies that compare the two exercises on which is better in providing a greater benefit to the cardiovascular system. Thus in this study, a comparison will be done between Tai Chi Chuan and yoga exercises on which is better in providing a better cardiovascular fitness on young healthy individual who practiced either one of them [6].

## 2. Material and Methods

### 2.1 Study Design

A Cross sectional design was carried out for a period of four weeks. The study population involves young female individuals around the age of 19 to 23 who practices Tai Chi Chuan and yoga for more than 1 year. Samples will be taken out from those populations.

### 2.2 Sample Size

Sixteen participants for Tai Chi Chuan group and sixteen participants for yoga group were selected using convenient sampling method. The inclusion criteria for the study were female, age between 19 to 23, practices either Tai Chi Chuan or Yoga exercises at least once a week for more than 1 year, moderately inactive to moderately active participants, height: 150 cm to 170 cm, body mass index: normal to overweight. The exclusion criteria for the study were with any cardiovascular and respiratory medical condition, musculoskeletal problems, unhealthy individuals, athletes, hypertensive individuals (resting systolic blood pressure >160 mmhg, resting diastolic blood pressure >110mmhg)

### 2.3 Data collection Procedure

Before the research, a General Practice Physical Activity Questionnaire with the consent form was given to the entire members of yoga club and Tai Chi Chuan club. Individuals with the General Practice Physical Activity Questionnaire with the score of moderately inactive to moderately active were chosen. Around 19 of them in Tai Chi Chuan club and 23 of them in yoga club. The body mass index of those individuals was taken to ensure that they matched the inclusion criteria. At the end, 16 of them in Tai Chi Chuan club and 20 of them in yoga club were found to be suitable for this study. To stratify the number of participants, 16 participants from yoga club were identified to match the number of participant's in Tai Chi Chuan club. Before the test

was conducted, participants were informed to dress comfortably, and wore shoes or footwear that was appropriate. The blood pressure and heart rate were measured and both were taken before the test begins. The description and procedures were explained to the participants. The pathway that the participants need to walk was also described. During the test, a metronome was set at the beats of 130 beats per minutes. This beats were set from the reference equation of the 6 minute walk test for female participants which are distance travel in 6 minutes =  $(2.11 \times \text{height in cm}) - (2.29 \times \text{weight in kg}) - (5.78 \times \text{age}) + 667$  m. The mean height, weight, and age were calculated and inserted in to the equation. As a result the predicted distance travel, after rounding off to the nearest whole number, it is 741 meters. After determining the distance, the speed will be calculated using the equation, speed = distance/ time. As a result, the speed predicted is 2.1 m/s. From the speed, it can be calculated that the time taken to travel 1 meter was 0.007937 minutes. Frequency was calculated using the equation=  $1/\text{time}$ , which was  $1/0.007937$  or 126 hertz. Participants were informed to follow the 126 hertz while walking. Each beat will represent one step. Participants were allowed to practice for 2 minutes to get used to the beats. After that they were allowed to rest for 5 minutes before the real test begin. During the 6 minute walk test, participant were observed and instructed to follow the beats. After the test, participants were immediately being seated and the blood pressure and heart rate were measured again.

### 2.4 Statistical tool

Analysis of data was done using the SPSS system. Comparisons between variables in the group, blood pressure before and after the test in yoga group, were analyzed using the paired T test. Whereas comparison in the mean difference in variables between yoga and Tai Chi Chuan groups, mean difference in heart rate, were done using independent T test.

### 3. Data Analysis

In this study, a paired T test and an independent T test was performed. A Paired T test was used to compare the value for systolic blood pressure and heart rate in the group. While the Independent T test was used to determine whether the differences between the systolic blood pressure and heart rate among yoga and Tai Chi Chuan Group were significant or not. The following will be describing on the result found from the study.

**Table 1:** Height, weight, and body mass index of yoga club participants

Subject	Height (meter)	Weight (kg)	BMI
Y1	1.5	52	23.11
Y2	1.55	50.2	20.89
Y3	1.5	51.1	22.71
Y4	1.57	55.8	22.64
Y5	1.6	57.7	22.54
Y6	1.55	51.8	21.56
Y7	1.5	53.4	23.73
Y8	1.58	51	20.43
Y9	1.61	53.8	20.76
Y10	1.59	56.3	22.27
Y11	1.6	55.6	21.70
Y12	1.56	56	23.01
Y13	1.61	53.8	20.76
Y14	1.57	58.7	23.81
Y15	1.67	58.3	20.90
Y16	1.63	59.5	22.39
Mean	1.5744	54.6875	22.0756

Table 1 shows the total of 16 participants from the yoga club were recruited. The mean height that was calculated was 1.5744 meters (sd=0.0479), and the mean weight calculated was 54.6875 kg (sd= 2.979). The body mass index was

calculated from the equation, body mass index = weight in kg/ (height in meter)<sup>2</sup>. The mean body mass index was 22.0756 (SD=1.099), which was considered to be under the category of normal as it falls under the range of 18.5 to 24.9.

**Table 2:** Heart rate before and after the test of yoga club member

Subject	Resting HR (bpm)	HR after test (bpm)
Y1	85	95
Y2	82	120
Y3	80	100
Y4	78	98
Y5	85	105
Y6	81	111
Y7	90	121
Y8	83	98
Y9	77	97
Y10	81	105
Y11	76	80
Y12	80	88
Y13	74	87
Y14	77	93
Y15	83	113
Y16	71	98
Mean	80.1875	100.5625

Table 2 shows the Heart rate before and after the test of yoga club member. The mean resting heart rate before the test was 80.1875 beats per minutes. After the test was conducted, the heart rate increased around 20 beats per minute. The mean heart rate after the test was 100.5625 beats per minute. Although there was a difference in 20 beats per minute when subtracting the mean resting heart rate with the heart rate after

the test, a paired T test was used to further compare the variables to ensure that it is statistically significant among the variables.

The Paired T test was used to determine if there is any significant difference in heart rate before and after the test in yoga group. The result was showed in the table below.

**Table 3:** Significant difference in heart rate among yoga member

	Paired sample mean (s.d)	Mean Difference (s.d.)	95% CI	T	p value
HR after test	100.56 (11.50)	20.38 (9.30)	15.42_ 25.33	8.76*	< 0.001
Resting HR	80.19 (4.68)				

\*Paired- sample t test is performed, Level of significant at  $p < 0.05$ , CI = Confidence Interval

Table 3 results showed that the mean heart rate after test which was 100.56, with the standard deviation of 11.50, when compared to the resting heart rate with the mean of 80.19, standard deviation of 4.68, the mean difference was 20.38

with the standard deviation of 9.3. Since the p value was less than 0.001, as shown in the table 3, the result was statistically significant, thus showing that there was a significant difference in heart rate before and after the test.

**Table 4:** Blood pressure before and after the test of yoga club member

Subject	Initial SBP (mmHg)	Initial DBP (mmHg)	SBP after test (mmHg)	DBP after test (mmHg)
Y1	110	70	120	70
Y2	130	75	150	75
Y3	100	60	120	60
Y4	115	70	130	70
Y5	110	65	130	65
Y6	105	60	120	60
Y7	110	70	135	70
Y8	100	65	125	65
Y9	115	70	130	70
Y10	110	65	120	65
Y11	111	62	115	62
Y12	110	60	120	60
Y13	110	70	125	70
Y14	120	85	135	85
Y15	105	60	120	60
Y16	100	70	115	70
Mean	110.0625	67.3125	125.625	67.3125

Table 4 shows the blood pressure before and after the test of yoga club member. The mean systolic blood pressure before the test, the initial systolic blood pressure, is 110.0625 mmHg, while the diastolic blood pressure is 67.3125 mmHg. After the test, the systolic blood pressure increased around 15mmHg but no difference was found in diastolic blood pressure. The mean systolic blood pressure after the test was

125.625 mmHg while the diastolic blood pressure remains the same. The difference was only seen in the systolic blood pressure, which is around 15 mmHg, therefore a paired T test was done only for the systolic blood pressure and not the diastolic blood pressure to determine whether the difference was statistically significant or not. The result was shown in the table below:

**Table 5:** Significant difference in systolic blood pressure among yoga member

	Paired sample mean (s.d)	Mean Difference (s.d.)	95% CI	T	p value
SBP after test	125.63 (9.11)	15.56 (5.57)	12.59_ 18.53	11.17*	< 0.001
Initial SBP	110.06 (7.75)				

\*Paired- sample t test is performed, Level of significant at  $p < 0.05$ , CI = Confidence Interval

Table 5 the results shows that the mean blood pressure after the test which was 125.63 mmHg, with the standard deviation of 9.11, when compared to the initial systolic blood pressure with the mean of 110.06 mmHg, standard deviation of 7.75, the mean difference was 15.56 mmHg with the standard deviation of 5.57. Since the p value was also less than 0.001, as shown in the table 5, the result was statistically significant, thus showing that there was a significant difference in the systolic blood pressure before and after the test.

(height in meter) [2]. The mean body mass index was 22.101 (sd= 1.858), which was also fallen under the category of normal as the range for normal body mass index was from 18.5 to 24.9.

### 3.1 Participants of the Tai Chi Chuan group

**Table 6:** Height, weight, and body mass index of Tai Chi Chuan club participants

Subject	Height (meter)	Weight (kg)	BMI
T1	1.66	56.5	20.50
T2	1.54	51.4	21.67
T3	1.54	58.8	24.79
T4	1.54	54.1	22.81
T5	1.57	67.4	27.34
T6	1.58	50.3	20.15
T7	1.61	53.4	20.60
T8	1.56	52.0	21.37
T9	1.62	54.7	20.84
T10	1.68	58.9	20.87
T11	1.53	51.4	21.96
T12	1.56	57.8	23.75
T13	1.63	58.1	21.87
T14	1.55	50.3	20.94
T15	1.57	54.4	22.07
T16	1.53	51.7	22.09
Mean	1.579	55.075	22.101

Table 6 shows the total of 16 participants from the Tai Chi Chuan club were taken. The mean height that was calculated was 1.579 meters (sd= 0.047), and the mean weight calculated was 55.075 kg (sd= 4.448). The body mass index was calculated from the equation, body mass index = weight in kg/

**Table 7:** Heart rate before and after the test of Tai Chi Chuan club member

Subject	Resting HR (bpm)	HR after test (bpm)
T1	99	116
T2	88	108
T3	89	92
T4	78	80
T5	78	104
T6	100	120
T7	89	101
T8	81	100
T9	85	110
T10	83	125
T11	73	115
T12	85	131
T13	83	125
T14	85	131
T15	89	124
T16	81	120
Mean	85.375	112.625

Table 7 shows the heart rate before and after the test of Tai Chi Chuan club member. The mean heart rate before the test, resting heart rate, is 85.375 beats per minutes. After the test was conducted, the heart rate increased around 27 beats per minute. The mean heart rate after the test was 112.625 beats per minute.

The Paired T test was used to determine if there is any significant difference in heart rate before and after the test. The result was showed in the table below.

**Table 8:** Significant difference in heart rate among Tai Chi Chuan member

	Paired sample mean (s.d)	Mean Difference (s.d.)	95% CI	T	p value
HR after test	112.62 (14.43)	27.25 (14.83)	19.35_ 35.15	7.35*	< 0.001
Resting HR	85.38 (7.11)				

\*Paired- sample t test is performed, Level of significant at  $p < 0.05$ , CI = Confidence Interval

Table 8 shows the mean heart rate after test which was 112.62, with the standard deviation of 14.43, when compared to the resting heart rate with the mean of 85.38, standard deviation of 7.11; the mean difference was 27.25 with the

standard deviation of 14.83. Since the p value was also less than 0.001, as shown in the table 3, the result was statistically significant, thus showing that there was a significant difference in heart rate before and after the test.

**Table 9:** Blood pressure before and after the test among Tai Chi Chuan member

Subject	Initial SBP (mmHg)	Initial DBP (mmHg)	SBP after test (mmHg)	DBP after test (mmHg)
T1	110	70	120	70
T2	100	60	120	60
T3	100	70	125	70
T4	110	60	120	60
T5	122	70	140	70
T6	118	80	125	80
T7	110	70	120	70
T8	115	75	125	75
T9	110	65	130	65
T10	120	85	135	85
T11	115	70	125	70
T12	100	60	120	60
T13	110	75	130	75
T14	120	60	125	60
T15	100	70	125	70
T16	110	60	135	60
Mean	110.625	68.75	126.25	68.75

Table 9 shows the blood pressure before and after the test among Tai Chi Chuan member. The mean systolic blood pressure before the test, the initial systolic blood pressure, is 110.625 mmHg, while the diastolic blood pressure is 68.75 mmHg. After the test was conducted, the systolic blood

pressure increased around 16 mmHg but no difference was found in diastolic blood pressure. The mean systolic blood pressure after the test was 126.25 mmHg while the diastolic blood pressure remains the same.

**Table 10:** Significant difference in systolic blood pressure among yoga member

	Paired sample mean (s.d)	Mean Difference (s.d.)	95% CI	T	p value
SBP after test	126.25 (6.19)	15.63 (6.79)	12.01_ 19.24	9.20*	< 0.001
Initial SBP	110.63 (7.54)				

\*Paired- sample t test is performed, Level of significant at  $p < 0.05$ , CI = Confidence Interval

Table 10 shows the mean blood pressure after the test which was 126.25 mmHg, with the standard deviation of 6.19, when compared to the initial systolic blood pressure with the mean of 110.63 mmHg, standard deviation of 7.54; the mean difference was 15.63 mmHg with the standard deviation of

6.79. Since the p value was also less than 0.001, as shown in the table 5, the result was statistically significant, thus showing that there was a significant difference in the systolic blood pressure before and after the test.

**Table 11:** Association in heart rate between yoga and Tai Chi Chuan group

	Paired sample mean (s.d)	Mean Difference (s.d.)	95% CI	T	p value
Tai Chi Chuan	27.250 (14.83)	6.875 (5.53)	-2.0609_ 15.8824	1.571*	< 0.066
Yoga	20.375 (9.30)				

\*Independent- sample t test is performed, Level of significant at  $p < 0.05$ , CI = Confidence Interval

Table 11 shows the association in heart rate between yoga and Tai Chi Chuan group and the mean difference in heart rate in Tai Chi Chuan group was 27.25, with the standard deviation of 14.83, when compared with that in yoga group which has the mean difference of 20.375 and a standard deviation of 9.3, the difference among the group is 6.875 with the standard

deviation of 5.53. However the difference is not statistically significant as the p value is 0.066. Other than that, the confidence interval which was from -2.0609 to 15.8824 was more than 1. Thus showing that the difference is not statistically significant and the null hypothesis is accepted.

**Table 12:** Association in systolic blood pressure between yoga and Tai Chi Chuan group

	Paired sample mean (s.d)	Mean Difference (s.d.)	95% CI	T	p value
Tai Chi Chuan	15.625 (6.79)	0.062 (1.22)	-4.42 _ 4.55	0.028*	< 0.099
Yoga	15.563 (5.57)				

\*Independent- sample t test is performed, Level of significant at  $p < 0.05$ , CI = Confidence Interval

Table 12 shows the association in systolic blood pressure between yoga and Tai Chi Chuan group and the mean difference in systolic blood pressure in Tai Chi Chuan group was 15.625, with the standard deviation of 6.79, when compared with that in yoga group which has the mean difference of 15.563 and a standard deviation of 5.57, the difference among the group is 0.062 with the standard deviation of 1.22. However the difference is not statistically

significant as the p value is 0.099. Other than that, the confidence interval which was from -4.42 to 4.55 was more than 1. Thus showing that the difference is not statistically significant and the null hypothesis is accepted.

#### 4. Discussions

In this study, the cardiovascular responses of Tai Chi Chuan club members and yoga club members were compared using

the six minute walk test. It was hypothesized that there will be difference in cardiovascular responses in both groups when an exercise testing was done. However, result showed no significant difference in the cardiovascular responses when both groups were compared. This shows that both of the exercises have a similar effect on the cardiovascular system of individuals who practices it.

The effect of both Tai Chi Chuan and yoga exercises on the cardiovascular fitness of an individual who practices it regularly can be found when a rough comparison was done between two studies to identify the effect of the exercise of interest on hypertensive individuals. In the study about the effect of yoga on hypertensive individuals, the objective is to determine the effectiveness of one hour yoga sessions, two times a week consistently for six weeks. The yoga regime includes relaxation technique, breathing control, and meditation. Thirty four hypertensive individual were recruited where ninety four percent of them were under anti-hypertensive drug. Individuals were followed up for 12 months. Result showed that there was a significant reduction in the systolic blood pressure and diastolic blood pressure [8]. Whereas in the study about the effect of Tai Chi Chuan exercise on hypertensive individuals also showed the reduction in the systolic and diastolic blood pressure of those individuals. The objective was to identify the effect of Tai Chi Chuan exercise on blood pressure and hypertensive individual. Follow up were done for 8 weeks. Significant reduction in blood pressure was found as a result. This shows that Tai Chi Chuan exercises also have the ability to regulate blood pressure similar to that in yoga [9].

Similar effect in Tai Chi Chuan and yoga exercises were not limited to only the cardiovascular system. There were also a few studies that showed the effect of Tai Chi Chuan exercises and also yoga exercises as an intervention to counter age related cognition decline. One of the studies had shown the effect of Tai Chi Chuan, meditation, aerobic exercises on the executive function. A cross-sectional field study that measured the executive function of individuals who practiced Tai Chi Chuan, meditation, or aerobic exercise in relation to sedentary individuals. It was hypothesized that individuals who practices Tai Chi Chuan and meditation with exercises for a long period would produce greater benefits to executive function than aerobic exercise. Individuals were required to train in their own specific exercise field for at least thirty sessions a day, 3 times a week, consistently for more than five years. Sedentary individuals were also recruited to act as a control. As expected, individuals who are from the Tai Chi Chuan and meditation group showed better executive function than the control group. However there was no significant different in the executive function in aerobic group when compared with the control group. This showed that other than the similarities that were found in the effect of Tai Chi Chuan and yoga exercises in the cardiovascular system, there were also other similarities found in the effect of those exercises toward other body function, such as the neurological system. Six minute walk test was used instead of other exercise testing such as three minutes step test was due to the accessibility towards the required item to conduct the test. In six minute walk test, materials and apparatus can be obtained easily from the research site unlike three minute step test which requires a box with specific height for different genders. Other than that, despite knowing that six minute walk test does not exert much stress on the cardiovascular and respiratory system, the research only need an exercise testing that was able to make a changes in the cardiovascular system. In addition, although

this type of exercise testing does not place much stress on the cardiovascular system especially in normal individual, but for individuals who were inactive or moderately inactive, this test was considered fair enough to elicit a response in their cardiovascular system. If a three minute step test were used on such individuals, the possibility for participants to drop out was high, thus leading to a decrease in accuracy of the data collected. A study was done on administering 3 minutes step test in individuals who were from a clinical setting. The design of this study was a cohort survey and an epidemiological study. Study took place in Cleveland Ohio and Chicago Illinois where individuals from either 3 community clinics or 2 academic medical practices were chosen. A total of one thousand two hundred and thirty individuals with the age 45 to 64 were recruited as sample. While administering the modified Queens College Step test, the response of the participants was observed to look for any contraindications of the test. Participants were informed to stop the test when they complete the three minutes test, when their heart rates were eighty percent greater than the predicted maximal heart rate, when they feel dizzy, nausea, or in pain, and also when they asked to terminate the test. The results showed that twenty eight percent of the participants were able to complete the test, and thirty six percent of them drop out from the test, and the remaining refuse to perform the test. In conclusion, the dropout rates of this exercise testing were higher than that in those who completed it. More studies should be done on modifying this exercise test and to focus more on the ability of an individual to complete the test so that more individuals will be able to complete [10]. This showed that the dropout rate in three minutes step test was higher, thus if it was taken as an exercise testing for this research study, the possibility for a participants to dropout will be high leading to a decrease in accuracy of the result. Participants who matched the inclusive criteria were already limited thus further dropout of participants during the study was not encouraged.

## 5. Conclusions

From the outcome of the study, it was concluded that, there were no significant different found in the cardiovascular response of both yoga and Tai Chi Chuan group. Several research supported that there was an improvement shown when individuals who practiced either yoga or Tai Chi Chuan for a long period of time. Thus the differences in cardiovascular response among individual who practices either yoga or Tai Chi Chuan was not significant as both the exercises were able to produce similar effect on the cardiovascular system as stated in several studies. However the significant in difference among the two exercises was still not specific yet. There were many limitations and problems faced during the research process which were able to affect the accuracy of the result obtained. Therefore more studies should be conducted to further confirm the difference between the cardiovascular effect in individuals who practices Tai Chi Chuan and yoga. Different exercise testing can be used while conducting similar research design to determine the reliability of this study. Other than that, sample size can also be increased to increase the accuracy of the result.

## 6. Research Limitations

During the research process, there were several problems faced. Part of it was the limited time given to complete the study. Due to the restriction in time, participants were only limited to the yoga and Tai Chi Chuan club in only one

centre. Sample size must be increased to retrieve more accurate data would be obtained. Most participants from other studies had given time to practice their respective exercises, either yoga or Tai Chi Chuan, a least for 12 month, 3 times a week and one hour per session. This is because a longitudinal study provides more specific and greater data on the changes occur before and after the exercises were done. This will allow us to understand more about the comparison between these two exercises. In addition, due to the limited time, the researchers will need to undergo countless sleepless night in order to finish the task in hand. This will have an impact on the data that were collected. As one of the articles stated the effect done by sleep deprivation, one of it was a decreased in concentration, reasoning skill, and problem solving skill <sup>[11]</sup>. Thus when conducting a research which requires the researcher's skill to measure certain parameter, such as taking blood pressure or heart rate manually, it will affect the outcome of those measure.

The accessibility towards the materials and apparatus were limited. The space available to conduct the six minute walk test, although it was sufficient, but due to the reason that the space was one of the corridor or walkway in the research site, distraction occurred when there were other people walking around that corridor. Even though the corridor was cleared prior to six minute walk test, participants reported that they feel awkward having other people watching them walking to and forth in the corridor for six minutes. This might leave an impact on the data collected. There was an article which correlates the different state of mind on the performance done daily. It was stated that people who feel calm, happy, and energetic were able to give out better result than that in those who were anxious, frustrated, and stress <sup>[12]</sup>. There was a research done on the relationship between anxiety and performance. It showed that anxiety was able to cause a considerable amount of impact on performance done. Managing and care for the environment was important as it can be used as a conventional treatment for many individuals with anxiety disorders <sup>[13]</sup>. This showed the impact of difference in environment will lead difference in attitude and behaviour thus providing an absolute different performance or outcome of the chores given. It is important to conduct the six minute walk test in a suitable environment as different environment will lead to different study result. If an empty room with larger space was available, the data collected could be more accurate.

In addition, there were also a limited number of participants in each club who were suitable for the study. Before the research, it was planned that male participants were taken in to consideration. However, due to the limited number of male participants, 5 in Tai Chi Chuan and 3 in yoga, male was excluded from the study. If more time were given to conduct the research, other yoga club and Tai Chi Chuan club members from other area can be recruited. This will increase the sample size which can also increase the accuracy of the study.

## 7. Research Recommendations

The recommendation for future researches, sample size can be increased by recruiting members from other yoga and Tai Chi Chuan club in different areas. By increasing the sample size the accuracy of data collected can be increased. As mentioned previously, individual's state of mind is important while conducting an exercise testing. Difference in the state of mind will lead to different result thus the validity and reliability of the data collected is compromised. With a more conducive

environment, a control on the participant's state of mind will be easier. With similar state of mind, the consistency in obtaining a valid and reliable data will increased. Recruit participants who have greater experience in their own field of exercise: Participants with greater experience will give greater difference when compared to a controlled group. The difference will be more statistically significant and obvious. When compared among participants in Tai Chi Chuan group and yoga group, result may be more accurate and a more significant analysis can be done

## 8. References

1. Mayoclinic.org. Tai chi: A gentle way to fight stress - Mayo Clinic, 2015. Retrieved 29 October 2015, from <http://www.mayoclinic.org/healthy-lifestyle/stress-management/in-depth/tai-chi/art-20045184>.
2. Kutner N, Barnhart H, Wolf S, McNeely E, Xu T. Self-Report Benefits of Tai Chi Practice by Older Adults. The Journals of Gerontology Series B: Psychological Sciences and Social Sciences. 1997; 52B(5):P242-P246. <http://dx.doi.org/10.1093/geronb/52b.5.p242>.
3. Beginnerstaichi.com. Tai Chi Styles for Beginners: An Overview, 2015. Retrieved 9 December 2015, from <http://www.beginnerstaichi.com/tai-chi-styles-for-beginners.html>.
4. Bwysoutheast.org.uk. About Yoga: A short introduction, 2015. Retrieved 29 October 2015, from <http://www.bwysoutheast.org.uk/about-yoga.htm>.
5. Priya S, Manjunath T. Effect of Shavasana Training On Cardiovascular Response To Exercise In Young Healthy Volunteers. National Journal of Basic Medic Al Sciences, 2012, 3(1). Retrieved from <http://www.njbms.com/wp-content/uploads/2012/10/7-EFFECT-OF-SHAVASANA-TRAINING.pdf>.
6. Sally Parkes. The Manual of Yoga Anatomy: Step-by-step guidance and anatomical analysis of 30 asanas. Global Book Publishing Pty Ltd, 2017.
7. Jason R, Rachel T. Rehab Measures - 6 Minute Walk Test. The Rehabilitation Measures Database, 2010. Retrieved 8 December 2015, from <http://www.rehabmeasures.org/Lists/RehabMeasures/PrintView.aspx?ID=895>.
8. Patel C, North WR. Randomised controlled trial of yoga and bio-feedback in management of hypertension. Lancet. 1975; 2(7925):93-5.34.
9. Yeh G, Wang C, Wayne P, Phillips R. Tai Chi Exercise for Patients with Cardiovascular Conditions and Risk Factors. Journal of Cardiopulmonary Rehabilitation and Prevention, 2009; 29(3):152-160. <http://dx.doi.org/10.1097/hcr.0b013e3181a33379>.
10. Sudano J, Huber G, Perzynski A, Lewis S, Murray P. Difficulties in administering and evaluating a 3-minute step test modified for a clinical population. Journal of Sport and Human Performance. 2014, 2(3). <http://dx.doi.org/10.12922/jshp.v2i3.46>.
11. Camille P. Sleep Loss: 10 Surprising Effects, 2013. WebMD. Retrieved 11 December 2015, from <http://www.webmd.com/sleep-disorders/excessive-sleepiness-10/10-results-sleep-loss>.
12. Caillet A, Hirshberg J, Petti S. How Your State of Mind Affects Your Performance. Harvard Business Review, 2014. Retrieved 12 December 2015, from <https://hbr.org/2014/12/how-your-state-of-mind-affects-your-performance>.
13. Miguel H. The Relationship between Anxiety and

- Performance: A Cognitive-Behavioral Perspective. *Athletic Insight*. 1999; 1(2), 1-14. Retrieved from <http://www.athleticinsight.com/Vol1Iss2/CognitivePDF.pdf>.
14. Amanda J. Burn Fat Faster with Yoga. *Women's Health*, 2009. Retrieved 9 December 2015, from <http://www.womenshealthmag.com/fitness/burn-calories>.
  15. Birdee G, Cai H, Xiang Y, Yang G, Li H, Gao Y, *et al.* Tai Chi as Exercise among Middle-Aged and Elderly Chinese in Urban China. *The Journal of Alternative and Complementary Medicine*. 2013; 19(6):550-557. <http://dx.doi.org/10.1089/acm.2012.0223>.
  16. Bodybuilding.com. An Introduction To Yoga, 2006. Retrieved 29 October 2015, from <http://www.bodybuilding.com/fun/issal17.htm>.
  17. Butland RJ, Pang J, Gross ER, Woodcock AA, Geddes DM. Two-, six-, and 12-minute walking tests in respiratory disease. *British Medical Journal Clinical Research Ed*. 1982; 284(6329):1607-8. See more at: <http://www.rheumatology.org/I-Am-A/Rheumatologist/Research/Clinician-Researchers/Six-Minute-Walk-Test-SMWT#sthash.x31vHj6t.dpuf>.
  18. Casanova C, Celli B, Barria P, Casas A, Cote C, De Torres J, *et al.* The 6-min walk distance in healthy subjects: reference standards from seven countries. *European Respiratory Journal*. 2010; 37(1):150-156. <http://dx.doi.org/10.1183/09031936.00194909>.
  19. Du H, Newton P, Salamonson Y, Carrieri-Kohlman V, Davidson P. A review of the six-minute walk test: its implication as a self-administered assessment tool. *European journal of cardiovascular nursing*. 2009; 8(1):2-8.
  20. Enright P, Sherrill D. Reference Equations for the Six-Minute Walk in Healthy Adults. *Am J Respir Crit Care Med*. 1998; 158(5):1384-1387. <http://dx.doi.org/10.1164/ajrccm.158.5.9710086>.
  21. Harada ND, Chiu V, Stewart AL. Mobility-related function in older adults: assessment with a 6-minute walk test. *Arch Phys Med Rehabil*. 1999; 80(7):837-41. See more at: <http://www.rheumatology.org/I-Am-A/Rheumatologist/Research/Clinician-Researchers/Six-Minute-Walk-Test-SMWT#sthash.x31vHj6t.dpuf>.
  22. Hong Y. Balance control, flexibility, and cardiorespiratory fitness among older Tai Chi practitioners. *British Journal of Sports Medicine*. 2000; 34(1):29-34.
  23. Jason R, Rachel T. Rehab Measures - 6 Minute Walk Test. *The Rehabilitation Measures Database*, 2010. Retrieved 8 December 2015, from <http://www.rehabmeasures.org/Lists/RehabMeasures/PrintView.aspx?ID=895>.
  24. Kimberly W. Lower Back Pain | IYNAUS | Iyengar Yoga: National Association of the United States, 2003. [iynaus.org](http://iynaus.org/research/lower-back-pain). Retrieved 9 December 2015, from <https://iynaus.org/research/lower-back-pain>.
  25. Lai J, Lan C, Wong M, Teng S. Two-Year Trends in Cardiorespiratory Function among Older Tai Chi Chuan Practitioners and Sedentary Subjects. *Journal of the American Geriatrics Society*. 1995; 43(11):1222-1227. <http://dx.doi.org/10.1111/j.1532-5415.1995.tb07397.x>.
  26. Lan C, Chen S, Lai J, Wong A. Tai Chi Chuan in Medicine and Health Promotion. *Evidence-Based Complementary and Alternative Medicine*. 2013, 1-17. <http://dx.doi.org/10.1155/2013/502131>.
  27. Lan C, Lai J, Chen S, Wong M. 12-month Tai Chi training in the elderly: its effect on health fitness. *Medicine & Science in Sports & Exercise*. 1998; 30(3):345-351. <http://dx.doi.org/10.1097/00005768-199803000-00003>.
  28. Lenssen AF, Wijnen LC, Vankin DG, Van Eck BH, Berghmans DP, Roox gm. A Six-minute walking test done in a hallway or on a treadmill: How close to the two methods agree? *Eur J Cardiovasc Prev Rehabilitation*. 2010; 17(6):713-7.
  29. Li A. The six-minute walk test in healthy children: reliability and validity. *European Respiratory Journal*. 2005; 25(6):1057-1060. <http://dx.doi.org/10.1183/09031936.05.00134904>.
  30. Morinder G, Mattsson E, Sollander C, Marcus C, Larsson U. Six-minute walk test in obese children and adolescents: Reproducibility and validity. *Physiotherapy Research International*. 2009; 14(2):91-104. <http://dx.doi.org/10.1002/pri.428>.
  31. Ng SS, Tsang WW, Cheung TH, Chung JS, To Fp, Yu PC. A Walkway length, but not turning direction, determines the six-, minute walk test distance in individuals with stroke. *Arch Phys Med Rehabil*. 2011; 92(5):806-11.
  32. Nguyen M, Kruse A. The effects of Tai Chi training on physical fitness, perceived health, and blood pressure in elderly Vietnamese. *OAJSM*, 2012, 7. <http://dx.doi.org/10.2147/oajsm.s27329>.
  33. Posadzki P, Cramer H, Kuzdzal A, Lee M, Ernst E. Yoga for hypertension: A systematic review of randomized clinical trials. *Complementary Therapies In Medicine*. 2014; 22(3):511-522. <http://dx.doi.org/10.1016/j.ctim.2014.03.009>.
  34. Sinha B, Sinha T, Pathak A, Tomer O. Comparison of cardiorespiratory responses between Surya Namaskar and bicycle exercise at similar energy expenditure level. *Indian J Physiol Pharmacol*, 2013; 57(2):169-76. Retrieved from <http://www.ncbi.nlm.nih.gov/pubmed/24617167>.
  35. Troosters T, Gosselink R, Decramer M. Six-minute walk test: a valuable test, when properly standardized. *Physical Therapy*. Authorreply 7-8, 2002; 82(8):826-7.
  36. Wang C, Collet J, Lau J. The Effect of Tai Chi on Health Outcomes in Patients with Chronic Conditions. *Arch Intern Med*. 2004; 164(5):493. <http://dx.doi.org/10.1001/archinte.164.5.493>.
  37. Wang J, Feng B, Yang X, Liu W, Teng F, Li S, Xiong X. Tai Chi for Essential Hypertension. *Evidence-Based Complementary and Alternative Medicine*, 2013, 1-10. <http://dx.doi.org/10.1155/2013/215254>.
  38. Wang J, Xiong X, Liu W. Yoga for Essential Hypertension: A Systematic Review. *Plos ONE*, 2013, 8(10):e76357. <http://dx.doi.org/10.1371/journal.pone.0076357>.
  39. Wolf S, Barnhart H, Kutner N, McNeely E, Coogler C, Xu T. Reducing Frailty and fall in Older Persons: An Investigation of Tai Chi and Computerized Balance Training. *Journal of the American Geriatrics Society*. 1996; 44(5):489-497. <http://dx.doi.org/10.1111/j.1532-5415.1996.tb01432.x>.
  40. Zheng G, Li S, Huang M, Liu F, Tao J, Chen L. The Effect of Tai Chi Training on cardiorespiratory Fitness in Healthy Adults: A Systematic Review and Meta-Analysis. *PLoS ONE*. 2015; 10(2):e0117360. doi:10.1371/journal.pone.0117360