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## Effect of Kalaripayattu on physical fitness variables among college students

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### Abstract

**Objectives:** To assess the characteristic effects of Tai Chi Chuan (TCC) exercise on metabolism and cardio respiratory response, and to measure its effect on cardio respiratory function, mental control, immune capacity, and the prevention of falls in elderly people.

**Design:** A review of controlled experimental studies and clinical trials designed with one of two aims: either to assess physiological responses during the performance of TCC or to assess the impact of this exercise on general health and fitness. **MAIN OUTCOME MEASURES:** Metabolic rate, heart rate, blood pressure, ventilation, maximal oxygen uptake (VO(2)MAX), immune capacity, falls, and fall related factors.

**Subjects:** A total of 2216 men and women.

**Results:** Under review were 31 original studies, published in Chinese or English journals, that met the criteria for inclusion. Most of the papers written in Chinese had not been introduced into the Western literature. Nine of these studies showed that TCC can be classified as moderate exercise, as its does not demand more than 55% of maximal oxygen intake. When this form of exercise and others conducted at equal intensity were compared, TCC showed a significantly lower ventilatory equivalent (VE/VO(2)MAX). Evidence provided by cross sectional and longitudinal studies suggests that TCC exercise has beneficial effects on cardiorespiratory and musculoskeletal function, posture control capacity, and the reduction of falls experienced by the elderly.

**Conclusions:** TCC is a moderate intensity exercise that is beneficial to cardiorespiratory function, immune capacity, mental control, flexibility, and balance control; it improves muscle strength and reduces the risk of falls in the elderly.

Caldwell K, Harrison M, Adams M, Triplett NT. *et al*; conducted a study on Effect of Pilates and taiji quan training on self-efficacy, sleep quality, mood, and physical performance of collegestudents. Abstract: Methods of exercise such as Pilates and taiji quan, which have been shown to have beneficial effects on physical and mental characteristics, have been studied more often in samples of older participants. The purpose of this investigation was to examine the effects of a semester of either Pilates or taiji quan training on perceived self-efficacy, sleep quality and mood, as well as strength and balance in college-age individuals. Self-efficacy was found to be improved in the Pilates and taiji quan groups and there was a trend towards improvement in sleep quality. Mood was found to be improved significantly in the Pilates group while the taiji group showed a trend towards improvement. There were no changes or group differences in the strength or balance measures. Pilates and taiji quan are effective exercise modes to improve mental parameters in college-age individuals.

**Keywords:** Kalaripayattu, physical fitness variables, college students, maximal oxygen uptake

### Introduction

Exercise is physical activity done regularly to improve, maintain, or slow the loss of fitness. Physical fitness is the capacity to perform physical activities with vigor and alertness and without undue fatigue. Fit people have more energy to pursue leisure activities. Fitness is also the degree to which people can withstand stress and persevere under difficult or emergency circumstances. Regular exercise is one of the best things that people can do to help prevent illness, preserve health and longevity, and enhance quality of life. Exercise comes in many forms and can vary in intensity of effort. With so many ways to exercise, almost everyone can participate in some way.

Physical fitness is defined as the body's ability to function efficiently and effectively in work and leisure activities, to be healthy, to resist hypokinetic diseases and to meet emergency

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situations. (by Brian D. Johnston) Physical fitness is the capacity to carry out reasonably well various forms of physical activities without being unduly tired and includes qualities important to the individual's health and well being. (by Werner W. K). Physical fitness has always been one of the foremost goals of physical education.

### **Kalaripayattu**

'Kalari' means place of training and 'Payattu' means training of martial arts. As the training of martial arts is done from Kalari, this is called Kalaripayattu.

Kalaripayattu from Kerala is probably the oldest martial art form in the world. It is said that Bodhi Dharma took this art form to China, which it is claimed to have evolved into Kung Fu and other forms of Chinese martial arts. It is not only a martial art but also a school of exercise which develops the physical and mental behavior of the students. While practicing, the students develop right virtues as well as power of healing on his body. It is not only a physical fitness exercise but is also helps to dominate one's fear. Although it uses different types of weapons, it demands an extremely precise knowledge of the body and even of all living beings, as many of the movements follow the pattern of different animals' behaviors of attacks as well as of defense. Kalaripayattu demonstration includes physical exercises and mock duels – armed and unarmed combat. (The Complete Guide to Kerala's Ancient Martial art by Chirakkal T Sreedharan Nair)

### **Types of Kalaripayattu**

There are different styles of Kalaripayattu called Vadakkan – Northern style, Thekkan – Southern style, and Madhya Kerala – Central style of Kerala. All use the same weapons but methods and styles were strongly influenced by different regional masters. The Vadakkan style is more traditional, it demands that the whole body be covered with oil and implies a precise explanation during the training itself. Southern style is more silent, and uses all

movements that can be later found in the different martial art like Judo, Karate, Kungfu, Tai chi, Wrestling and Gymnastics. These types of movements like various types of kicking, punching, diving and all defensive and offensive movements. (Kalaripayattu by Balakrishnan P)

Physical and mental development, physical flexibility, neural strength, art of self defense, eye control, sharp reflexes, patience regularization of difficulties due to arthritis, bronchitis diseases, discipline, obedience, strengthening of the protection from disease, skill to handle weapons, overcoming fear of weapon and leaderships are the benefits of Kalaripayattu.

**Cardiovascular Endurance:** Cardiovascular endurance, or aerobic fitness, is the ability to exercise continuously for extended periods without tiring. A person's aerobic fitness level is dependent upon the amount of oxygen which can be transported by the body to the working muscles, and the efficiency of the muscles to use that oxygen

**Balance:** is the ability to stay upright or stay in control of body movement

**Explosive Strength:** refers to an individual's ability to exert a maximal amount of force in the shortest possible time interval.

**Agility:** is the ability to change the direction of the body in an efficient and effective manner

## **Chapter II**

### **Reviews of Literature**

Chandran CK, *et al* conducted a study on Respiratory functions in Kalaripayattu practitioners. Kalaripayattu, an ancient traditional martial art form of Kerala, is considered as the basis for all martial arts viz. Karate, Kungfu, etc. physiological studies are more concentrated on Karate, Kungfu and other martial arts due to their global acceptance. Considering the limited knowledge available regarding the physiological profiles of Kalaripayattu practitioners, the present study was taken up for filling the lacunae in the field. Lung function tests were carried out in ten Kalari practitioners. Residual volume was measured by indirect method. Higher lung volumes and flow rates were achieved in Kalari practitioners compared to age and height-matched controls. Better mechanical factors and lower airway resistance influenced during Kalari practice might have benefited in improving Lung volumes and flow rates.

Wang YT, Taylor L, Pearl M, Chang LS. *et al*; conducted a study on Effects of Tai Chi exercise on physical and mental health of college students Abstract: The purpose of this pilot study is to examine the effects of Tai Chi Quan, a body-mind harmony exercise, on college students' perceptions of their physical and mental health. A three-month intervention of Tai Chi exercise was administered to college students, and multidimensional physical (PHD) and mental (MHD) health scores were assessed using the SF-36v2 health survey questionnaire before and after the intervention. Thirty college students participated in a 1-hour-long Tai Chi exercise intervention twice a week for 3 months. Each practice session included 10 minutes of breathing and stretching exercises followed by 50 minutes of Tai Chi Quan 24-form practice. PHD including physical function (PF), role physical (RP), bodily pain (BP), general health (GH), and MHD including social function (SF), role mental/emotion function (RE), vitality (VT), perceptions of mental health (MH) were assessed. The normalized scores of each variable and the combined PHD or MHD scores before and after the Tai Chi intervention were examined by paired t-test ( $p < 0.05$ ). Physical measures of BP and GH, and mental measures of RE, VT and MH were significantly improved after Tai Chi exercise intervention. When the overall PHD or MHD scores were evaluated, the MHD had increased significantly. In conclusion, Tai Chi exercise had positive effects on the self-assessed physical and mental health of college students. Scores on the mental health dimension appeared to be particularly sensitive to change. Colleges/universities might consider offering Tai Chi as a component of their ongoing physical activity programs available to students.

Chang JY, Tsai PF, Beck C, Hagen JL, Huff DC, Anand KJ, Roberson PK, Rosengren KS, Beuscher L. *et al*; conducted a study on The effect of tai chi on cognition in elders with cognitive impairment. Abstract: This one-arm pilot study investigated the effect of tai chi on cognition in elders with cognitive impairment. Although no significant difference existed between pre- and post-test performance on all cognition measures, a dose-response relationship was demonstrated between attendance and some cognition measures.

Sbriccoli P, Camomilla V, Di Mario A, Quinzi F, Figura F, Felici F. *et al*; conducted a study on Neuromuscular control adaptations in elite athletes: the case of top level

karateka. Abstract: This paper aimed at investigating the neuromuscular response of knee flexor and extensor muscles in elite karateka and karate amateurs (Amateurs) during isokinetic knee flexion/extensions and during the execution of a front kick (FK). Surface electromyograms (sEMG) were recorded from the right vastus lateralis (VL) and biceps femoris (BF) muscles with a four-array electrode during maximal isometric knee flexion and extension (maximal voluntary contraction), during isokinetic contractions (30 degrees, 90 degrees, 180 degrees, 270 degrees, 340 degrees, 400 degrees /s), and during the FK. The level of VL and BF agonist (ago) and antagonist (ant) activation during the isokinetic and FK protocols was quantified through normalized sEMG root mean square value (%RMS(ago/ant-ISOK/FK)). VL and BF average muscle fiber conduction velocity (CV) was computed for isokinetic and FK. Isokinetic flexion and extension torques and knee angular velocity during FK were also assessed. Analysis of variance was used to test the effect of group, angular velocity, and task on the assessed variables ( $P < 0.05$ ). Elite karateka showed higher isokinetic knee flexion torque when compared with Amateurs. For all angular velocities, VL and BF %RMS (ant-isokinetic) were lower in elite karateka, while their BF-CV (isokinetic) BF-CV(front kick) and BF %RMS (ant-front kick) values were higher. For VL and BF, %RMS (ago-front kick) was lower than %RMS (ago-isokinetic) in both groups. Elite karateka demonstrated a typical neuromuscular activation strategy that seems task and skill level dependent. Knee flexion torque and CV results suggest the presence of an improved ability of elite karateka to recruit fast MUs as a part of training induced neuromuscular adaptation.

West J, Otte C, *et al*; conducted a study on Effect of Hatha yoga and African dances on perceived stress, affect and salivary cortisol. Dance and yoga have been shown to produce improvements in psychological well-being. The aim of this study was to examine some of the psychological and neuroendocrine response to these activities. Sixty-nine healthy college students participated in one of three 90-min classes: African dance ( $n = 21$ ), Hatha yoga ( $n = 18$ ), or a biology lecture as a control session ( $n = 30$ ). Before and after each condition participants completed the Perceived Stress Scale (PSS), completed the Positive Affect and Negative Affect Schedule, and provided a saliva sample for cortisol.

### Results

There were significant reductions in PSS and negative affect ( $ps < .0001$ ) and Time x Treatment interactions ( $ps < .0001$ ) such that African dance and Hatha yoga showed significant declines, whereas there was no significant change in biology lecture. There was no significant main effect for positive affect ( $p = .53$ ), however there was a significant interaction effect ( $p < .001$ ) such that positive affect increased in African dance, decreased in biology lecture, and did not change significantly in Hatha yoga. There was a significant main effect for salivary cortisol ( $p < .05$ ) and a significant interaction effect ( $p < .0001$ ) such that cortisol increased in African dance, decreased in Hatha yoga, and did not change in biology. Changes in cortisol were not significantly related to changes in psychological variables across treatments. There was 1 significant interaction effect ( $p = .04$ ) such that change in positive affect and change in cortisol were negatively correlated in Hatha yoga but positively correlated in Africa dance and biology. CONCLUSIONS: Both African dance and Hatha yoga reduced perceived stress and negative affect. Cortisol increased in African dance and decreased in Hatha

yoga. Therefore, even when these interventions produce similar positive psychological effects, the effects may be very different on physiological stress processes. One factor that may have particular salience is that amount of physiological arousal produced by the intervention.

Li JX, Hong Y, Chan KM. *et al*; conducted a study on Tai chi: physiological characteristics and beneficial effects on health.

### Objectives

- To find out the effect of Kalaripayattu on physical fitness variables
- To study Kalaripayattu is more effective to improve the physical fitness

### Hypotheses

It is hypothesized that the practice of Kalaripayattu will significantly improve the physical fitness of college students in relation to cardiovascular fitness, Explosive Strength, Balance and Agility

### Significance of the study

- The finding of the study will add to the quantum of knowledge in physical education, especially in the area of physical fitness in college students
- The study will enlighten the importance of practicing Kalaripayattu on healthy livings
- Through this study people will become more aware of the importance of practice of Kalaripayattu in order to keep their physical fitness
- This study is try to investigate the impact and effectiveness of Kalaripayattu training
- This study may helpful for the better awareness of health
- This study will bring the sense of awareness about the Practice of Kalaripayattu
- A lot of researches has been done already in this field
- Research regarding the effect of Kalaripayattu on this particular group of college students have not yet been conducted

### Limitations

The following are the limitations of this study:

1. The hereditary, culture and environmental factors, which will influence the criterion variables are recognized as limitation
2. Previous Practice of sports or other physical fitness activities are not taken into consideration
3. The subjects living conditions, diet, lifestyle, climatic condition, personnel habits, emotional status, psychological imbalance, family problems and motivational factors were not taken into consideration for this study.

### Delimitation

The study is delimited to the following aspects:

1. The study restricted to 20 randomly selected adults from Degree Programme, MES College Marampally, Aluva, Ernakulam District, Kerala
2. The physical fitness variables is restricted to Cardiovascular fitness, Explosive Power, Balance and Agility
3. The age of the subjects range from 19 – 21 (nineteen to twenty one) years
4. Selected Southern style of Kalaripayattu is administrated in the selected subjects

- The Kalaripayattu practice is administrated in the evening for a maximum period of 1 ½ hours for a total of 8 weeks.

### Chapter III Methodology

The subjects for the study were selected from different Under graduates of MES College Marampally, Aluva, Ernakulam District, Kerala State. Fifty (20) adults in the age group of 17 – 21 are selected randomly and divide into two groups,

- Control group
- Experimental group.

Kalaripayattu training is given to experimental group. Control group is not given any special training. The criterion measures were tested before and after the 8 weeks of experimental period hence initial and final scores of the two groups are obtain. The obtain data is analyzed with statistical tools 't' test.

#### Selection of variables

##### I) Physical Fitness Variable

- Cardio vascular endurance
- Balance
- Explosive Strength
- Agility

- Cardio vascular endurance will be measured by using Harvard step test
- Balance will be measured by using stork stand test
- Explosive power of arm is measured by using seated medicine ball throw
- Agility is measured by using Illinios agility test

#### Harvard Step test (Cardiovascular Endurance)

- The Harvard Step test** is a test of aerobic fitness; it is a kind of cardiovascular endurance test. The test computes the capability to exercise continuously for extended intervals of time without tiring. This test is developed by Brouha *et al.* (1943) in the Harvard Fatigue Laboratories during WWII. The features of this test are that it is simple to conduct and requires minimal equipment.
- Equipment required:** step or platform 20 inches / 50.8 cm high, stopwatch, metronome or cadence tape.
- Procedure:** The athlete steps up and down on the platform at a rate of 30 steps per minute (every two seconds) for 5 minutes or until exhaustion. Exhaustion is defined as when the athlete cannot maintain the stepping rate for 15 seconds. The athlete immediately sits down on completion of the test, and the total number of heart beats are counted between 1 to 1.5 minutes after finishing This is the only measure required if using the *short form* of the test. If the *long form* of the test is being conducted, there is an additional heart rate measures at between 2 to 2.5 minutes, and between 3 to 3.5 minutes.
- Scoring:** the Fitness Index score is determined by the following equations. For example, if the total test time was 300 seconds (if completed the whole 5 minutes), and the number of heart beats between 1-1.5 minutes was 90, between 2-2.5 it was 80 and between 3-3.5 it was 70, then the long form Fitness Index score would be: (100 x

300) / (240 x 2) = 62.5. Note: you are using the total number of heart beats in the 30 second period, not the rate (beats per minute) during that time.

- Fitness Index** (short form) = (100 x test duration in seconds) divided by (5.5 x pulse count between 1 and 1.5 minutes).
- Fitness Index** (long form) = (100 x test duration in seconds) divided by (2 x sum of heart beats in the recovery periods).
- Validity:** correlation to VO<sub>2max</sub> has been reported as between 0.6 to 0.8 in numerous studies.

#### Stork Balance Stand Test: (Balance)

- Purpose:** To assess the ability to balance on the ball of the foot. The stork balance test requires the person to stand on one leg
- Equipment required:** flat, non-slip surface, stopwatch, paper and pencil.
- Procedure:** Remove the shoes and place the hands on the hips, then position the non-supporting foot against the inside knee of the supporting leg. The subject is given one minute to practice the balance. The subject raises the heel to balance on the ball of the foot. The stopwatch is started as the heel is raised from the floor. The stopwatch is stopped if any of the follow occur:
  - the hand(s) come off the hips
  - the supporting foot swivels or moves (hops) in any direction
  - the non-supporting foot loses contact with the knee.
  - the heel of the supporting foot touches the floor.
- Scoring:** The total time in seconds is recorded. The score is the best of three attempts. The adjacent table lists general ratings for this test.

#### Seated Medicine Ball Throw: (Explosive power)

- Aim:** This test measures upper body (arm) strength and explosive power. By keeping the back in contact with the wall the strength of the arms only are tested.
- Equipment required:** 4 kg (~ 8 lb) medicine ball, wall, tape measure
- Procedure:** The athlete sits on the floor with his legs fully extended, feet 24 inches (~60 cm) apart and the back against a wall. The ball is held with the hands on the side and slightly behind the center and back against the centre of the chest. The forearms are positioned parallel to the ground. The athlete throws the medicine ball vigorously as far straight forward as he can while maintaining the back against the wall. The distance thrown is recorded.
- Scoring:** The distance from the wall to where the ball lands is recorded. The measurement is recorded to the nearest centimeter (other protocols have used the nearest 0.5 foot or 10 cm). The best result of three throws is used.

#### Illinois Agility Test (Agility)

- Agility is an important component of many team sports,

though it is not always tested, and is often difficult to interpret results. The Illinois Agility Test (Getchell, 1979) is a commonly used test of agility in sports, and as such there are many norms available.

- **Purpose:** to test running agility
- **Equipment required:** flat non-slip surface, marking cones, stopwatch, measuring tape, timing gates (optional)
- **Procedure:** The length of the course is 10 meters and the width (distance between the start and finish points) is 5 meters. Four cones are used to mark the start, finish and the two turning points. Another four cones are placed down the center an equal distance apart. Each cone in the center is spaced 3.3 meters apart. Subjects should lie on their front (head to the start line) and hands by their shoulders. On the 'Go' command the stopwatch is started, and the athlete gets up as quickly as possible and runs around the course in the direction indicated, without knocking the cones over, to the finish line, at which the timing is stopped.

**Results**

- The table below gives some rating scores for the test

**Chapter IV**

**Analysis of Data and Results of The Study**

The analysis of data pertaining to this study has been presented in this chapter. Group I served as the control group and group II served as the experimental group. The study has been examined by 't' test for each variables separately in order to determine the difference between controlled and experimental group.

Twenty subjects from MES College Marampally were taken for this study. The data was collected initially and after the training period from both the control and the experimental groups on six four physical variables (Endurance, flexibility, balance, Speed, muscular endurance)

The level of significance was fixed at 0.005 level. The data collected from the subject were statistically analyzed by using 't' test with the degree of freedom 18.

The results are presented in this chapter.

**Table I:** computation of mean, standard deviation and standard error of the mean of cardio respiratory endurance for the control and the experimental group

					Pre test
SL.NO	Name of the Group	Mean	Standard Deviation	Standard Error of the Mean	't' Ratio
1	Control	1567.50	236.848465	74.8974	0.0997
2	Experimental	1558.00	186.1478	58.8651	

Table value = 1.734  
 Insignificant at 0.05 level  
 Degrees of freedom = 18

					Post Test
SL.NO	Name of the Group	Mean	Standard Deviation	Standard Error of the Mean	't' Ratio
1	Control	1599.0000	225.5194	71.3155	2.2931*
2	Experimental	1839.000	172.8554	54.6617	

Table value = 1.734  
 Insignificant at 0.05 level  
 Degrees of freedom = 18

It is observed from table I that there is no significant difference between the two groups in the pre test but there is a significant difference in the post test, as the 't' ratio of 2.293 is higher than the table value 1.734. Hence the hypothesis was

accepted and the result of study is significant. This shows that kalaripayattu is having significant effect on improvement of cardio-respiratory endurance.

**Table II:** Computation Of Mean, Standard Deviation And Standard Error Of The Mean Of Balance Performance Of The Control And The Experimental Group

					Pretest
SL.NO	Name of the Group	Mean	Standard Deviation	Standard Error of the Mean	't' Ratio
1	Control	3.900	0.6701	0.2948	0.6829
2	Experimental	4.500	1.7464	0.5523	

Table value = 1.734  
 Insignificant at 0.05 level  
 Degrees of freedom = 18

					Post Test
SL.NO	Name of the Group	Mean	Standard Deviation	Standard Error of the Mean	't' Ratio
1	Control	4.2000	2.1354	0.6753	2.6496*
2	Experimental	7.2000	1.9391	0.6132	

Table value = 1.734  
 Insignificant at 0.05 level  
 Degrees of freedom = 18

It is observed from table II that there is no significant difference between the two groups in the pre test but there is a significant difference in the post test, as the 't' ratio of 2.96496 is higher than the table value 1.734. Hence the

hypothesis was accepted and the result of study is significant. This shows that kalaripayattu is having significant effect on improvement of balance.

**Table III:** Computation of mean, standard deviation and standard error of the mean of agility performance of the control and the experimental group

					Pretest
SL.NO	Name of the Group	Mean	Standard Deviation	Standard Error of the Mean	't' Ratio
1	Control	12.4800	0.7692	0.2432	0.1086
2	Experimental	12.4300	1.2354	0.3907	

Table value = 1.734  
 Insignificant at 0.05 level  
 Degrees of freedom = 18

					Post Test
SL.NO	Name of the Group	Mean	Standard Deviation	Standard Error of the Mean	't' Ratio
1	Control	12.56	0.3826	0.1210	3.0189*
2	Experimental	11.60	0.6356	0.2010	

It is observed from table III that there is no significant difference between the two groups in the pre test but there is a significant difference in the post test, as the 't' ratio of 3.0189 is higher than the table value 1.734. Hence the hypothesis was

accepted and the result of study is significant. This shows that kalaripayattu is having significant effect on improvement of agility.

**Table IV:** Computation of mean, standard deviation and standard error of the mean of explosive strength performance of the control and the experimental group

					Pretest
SL.NO	Name of the Group	Mean	Standard Deviation	Standard Error of the Mean	't' Ratio
1	Control	1.79201	0.1458	0.0461	1.7047
2	Experimental	1.6610	0.1732	0.0548	

Table value = 1.734  
 Insignificant at 0.05 level  
 Degrees of freedom = 18

					Post Test
SL.NO	Name of the Group	Mean	Standard Deviation	Standard Error of the Mean	't' Ratio
1	Control	1.8570	0.1493	0.0472	2.1586*
2	Experimental	1.6740	0.1812	0.0573	

Table value = 1.734  
 Insignificant at 0.05 level  
 Degrees of freedom = 18

It is observed from table IV that there is no significant difference between the two groups in the pre test but there is a significant difference in the post test, as the 't' ratio of 2.1586 is higher than the table value 1.734. Hence the hypothesis was accepted and the result of study is significant. This shows that kalaripayattu is having significant effect on improvement of explosive strength.

## Chapter V Summary, Conclusions and Recommendations

### Summary

The purpose of this study was to find out the effect of Kalaripayattu practice on physical fitness in College Students. The investigator selected 20 male adults as subjects. Their age ranged from 17 to 21 years old. The 20 subjects were randomly equated into two groups i.e., group I and group II. Group I served as the control group while group II served as the experimental group. To group II was assigned the practice of Kalaripayattu during 8 weeks, while group I was not allowed to participate in this practice

### Interpretation of data

The analysis of the data showed that there is a significant improvement in cardio-respiratory endurance, Explosive strength, agility and balance.

### Conclusion

The regular practice of Kalaripayattu has a significant effect in improving the physical fitness of College students. The 8 weeks practice was too short to draw a definite conclusion concerning their psychological response.

### Recommendations

On the basis of the observations and conclusions made from this study, the following recommendation can be made for educators and research scholars:

- A regular Kalaripayattu practice should be introduced as an essential element in education for the physical development of children
- It would be important to study the influence of kalaripayattu practice on adults psychological behavior over a practice period of at least six months. It is expected that this influence would be positive especially for adults.
- A similar study should be conducted on psychological behavior and physiological changes of adults.

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