



## EFFECT OF CYCLIC MEDITATION ON PHYSICAL AND MENTAL STRESS IN HIGH SCHOOL ATHLETES- PRE-POST CONTROLLED STUDY

Shunosuke Hiraoka Ms. Padmasri Gudapti, &Dr. Rajesh S.K.

### Affiliations:

- 1 Student (M.Sc.) Yoga Therapy, University: Swami Vivekananda Yoga Anusandhana Samsthana Bengaluru (Karnataka).
- 2 M.Sc. Coordinator, Professor. University: Swami Vivekananda Yoga Anusandhana Samsthana Bengaluru (Karnataka).
- 3 Assistant Professor. University: Swami Vivekananda Yoga Anusandhana Samsthana Bengaluru (Karnataka).

### ABSTRACT

The aim of present study was to find the effect of cyclic meditation on high school athletes. A total of forty six students (male=26, female=20) who belongs to Track and Field team were enrolled for the study and completed the pre, mid and post parameters, and answered questionnaire before and after study, and twenty three yoga group students out of total students have done 35 days Cyclic Meditation (CM) program. Immediately effect of CM on 35<sup>th</sup> day showed many (following detail) significant changes and larger difference between both groups than 14<sup>th</sup> day. Yoga group Salivary Amylase (SA) was decreased significantly by 12.1 point (-44%, 0.04, 2-tail), Blood Oxygen Level (BOL) was increased significantly by 0.5 point (1%, 0.04, 2-tail) and Pulse Rate (PR) was decreased significantly by 15.1 point (-18%, 0.00, 2-tail) as against Control group SA was increased significantly by 8.2 point (14%, 0.04, 2-tail), BOL was increased by 0.6 point and PR was decreased significantly by 10.8 point (-15%, 0.00, 2-tail). Decreased SA and PR, and increased BOL indicate improvement in terms of reduced stress levels after CA because of practice of CM. In addition, Yoga group Tension-Anxiety, Depression-Dejection and Confusion were decreased significantly, and rest of negative emotions were also decreased after 35 days due to continuous CM practice. Control group showed only decrease in Confusion but this decrease was less than Yoga group. Moreover, the positive emotion namely6 Vigor, was increased in Yoga group, more than Control group. All Yoga group scores ware superior to Control group in psychological part. This result indicates that Yoga can statistically reduce physical and mental stress which means Yoga helps to thin out stresses, and proved why ancient Yogi Patañjali has used the term thinning .Present author suggest that Yoga, especially CM, is suitable relaxation technique for high school athletes.

**Keywords:** sports, athletes, yoga, high school student, physical stress, mental stress, relaxation technique, cyclic meditation

## 1. INTRODUCTION

Japanese high school athletes' ability is regarded as the high level in the world class match. This evaluation shows that how hard training they do in the high school and on the one hand some of them get good result, and on the other hand some of them are exhausted by hard training. The problem seems to lie in the fact that physical fatigue can affect mental condition such as you may have experienced in your past. The same with the converse, mental condition can affect physical.

There has been a great discussion about the stress in (senior) high school especially in Japan because Japanese minors<sup>1</sup> who decides to die by one's own hand are not rare<sup>2</sup>. This case is eccentric aspect of a serious social problem, of course, actually there many causes related refusal to attend school or mental diseases. Junior and senior high school student are always surrounded by many factors which are like study, examination, teachers, friends and club activities etc. Although these factor help forming their character, these can be negative stressors at the same time. One of Japanese city's survey which object is senior high school and high school student has revealed that students "feel stress all of the time"(12.6%), "feel stress some of the time"(50.2%), total 62.8% of them feel the stress in daily life, and they answered that its cause is "about study"(66.7%), "about school"(52.0%). In addition, proportion of students who has "satisfying sleep" was limited 21.3%. ([www.city.chofu.tokyo.jp](http://www.city.chofu.tokyo.jp))

At this period of students are considered to be susceptible and adolescence, furthermore they usually start caring about a distinction between others, a one's of identity, cooperation with co-students and one's evaluation from surrounding others.

Apart from these, teenager athletes show natural tendency toward insistence on competition result and they are often expected to win. This kind of tendency can be good motivation, but at the same time it easily can change into impatience or pressure which makes them train too hard or feel anxiety. They are considered to be in circumstance where they are liable to feel physical stress or mental stress or both compared with normal students.

Burnout syndrome is grasped as result of miss-adaptation to athletic stress of athletes (Smith, 1986) and unsuitable approaches or challenging of sport's activities links to an eating disorder, a depression and an overuse syndrome (Nagashima, 2002). Aoki (2003), Aoki and Matsumoto (1997), Asakura and Mori (2004) have pointed out that the ability of adapt to club activity is profound related mental stress for teenager athletes. Study of Kogayashi, Idemura, and etc. (2005) showed significant relation between "Club Activity", "Schoolwork" and "Fatigue (indicated by scales of Difficult mconcentration, Laziness, Decrease in vigor, Decrease in motivation and Physical strange feeling)" in high school students by questionnaire; SFS-Y (Subjective Fatigue Scale for the Young adults). Researchers have proved relationship between mental stress and school environment and discussed connection between high school students and their environment. Therefore what should we do next is to find effective manner of coping with mental stress for them.

The present author agree with Bethany's (2015) in that school-based yoga may be advantageous for stress management and behavior. I believe that yoga, especially yoga-

---

<sup>1</sup> under 20 years old

<sup>2</sup> 538 minors died by one's own hand in 2014. (Sause: The breakdown of suicide in 2014. Cabinet Office Government of Japan, 2014)

based relaxation technique, can good influence teenagers. For example, the following show strong possibility of it.

Rabindra, Pradhan and Nagendra (2014) have conducted study of stress management following yoga based SMET (Self-Management of Excessive Tension) program. It has revealed that the negative moods sub-scale of Profile of Mood States (POMS) was significantly reduced by SMET program. In mental disorders field, Hiramoto, Yoshihara and Kubo (2009) have revealed that Cyclic Meditation (CM) can effectively reduce stress-related symptoms of 20~50-year-old women and that these effects could maintain for 12 weeks. Furthermore they have suggested that CM can be a countermeasure of mental health and improve tolerance to stress.

CM's effect is not limited in improvement of mental health. Practicing cyclic meditation twice a day has appeared to improve the objective and subjective quality of sleep on the following night (Snjib and Shirley, 2009), and it reduces physiological arousal, simultaneously improving performance on tasks requiring attention (Balaram and Nagendra, 2010). In addition, Pailoor and Shirley (2009) have advocated that cyclic meditation improved memory scores immediately after practice and decreased state anxiety more than rest in a classical yoga relaxation posture<sup>3</sup>.

As above-mentioned, CM is regarded as suitable manner of coping with mental stress for high school athletes. Little attention has been given to effect of CM on physical aspect. Hence the present study will be undertaken in order to prove an effectiveness of CM on mental stress and recovery of physical fatigue in high school athletes. It was also hypothesised that the cyclic meditation may effect physical and mental stress in high school athletes.

## **2. METHODOLOGY**

### **2.1 Sample size:**

46 high school students (male=26, female=20, average age 16.1±0.9 years) who belongs to Track and Field team.

### **2.2 Design:**

This study was used for two group pre-post controlled study.

### **2.3 Methods:**

They were classified male and female group at first. After that, they classified again randomly into experimental group and control group.

*Experimental group* received instruction of cyclic meditation after their club activities when author could go to their school, and did self-practice of cyclic meditation after their daily works before having dinner every day.

*Control group* students' environment was same as experimental group except what they did not learn cyclic meditation technique.

### **2.4 Operational Definitions:**

#### **2.4.1 Physical stress**

Physical stress is defined by increase of Salivary Amylase or Pulse Rate, decrease of Blood Oxygen Level due to Club Activity, sports training, in this study.

---

<sup>3</sup> classical yoga relaxation posture: Shavasana

### 2.4.2 Mental stress

Mental stress in this study is defined by increase of stressed score which is indicated by Profile of Mood States questions and answered by high school athlete who joined this study.

### 2.5 Intervention

#### *Cyclic Meditation*

Steps of Cyclic Meditation	Duration (min)	Rounds
1: STRTING PRAYER	1	1
2: INSTANT RELAXATION TECHNIQUE (IRT)	2-3	1
3: CENTERING	5	1
4: STANDING ASANAS <sup>4</sup>		
i ) ARDHAKATI CAKRASANA – RIGHT SIDE	3	1
ii ) ARDHAKATI CAKRASANA – LEFT SIDE	3	1
5: QUICK RELAXATION TECHNIQUE (QRT)	5-7	1
6: SITTING ASANAS		1
i ) VAJRASANA	1	
ii ) SASANKASANA	1	
iii) USTRASANA	1	
7: DEEP RELAXATION TECHNIQUE (DRT)	10-15	1
8: CLOSING PRAYER	1	1
Total	33-41	8

*Total duration of a session – 33min to 41min.*

*Total times of sessions – 28 sessions.*

*Frequency of session – 1 time in a day. 7 times in a week.*

### 2.6. Primary outcome measurement

#### 2.6.1 Salivary Amylase (SA)

Salivary Amylase (SA) is reflection of mental stress and physical stress because it reflects sympathetic nerve activity. It is secreted by direct nerve action and *norepinephrine's control* of a sympathetic nerve, and concentration of amylase in saliva is increased by stress. Since its reaction time of super-secretion by direct nerve action is within few minutes, it is considered that its response is earlier than cortisol. Nakano and Suzuki (2009) revealed that concentration of Salivary Amylase is increased statistically by fatigue condition or subjective symptoms of fatigue.

*Salivary Amylase Monitor* – To collect saliva with a test-strip (small paper chip) and its amylase will be measured by Salivary Amylase Monitor©. It can collect data immediately and non-invasive. Yamaguchi and etc.<sup>5</sup> (2001) have revealed that the change of salivary amylase activity was confirmed as being originated from stress. Hence results suggest that the monitoring of salivary amylase could be used as a non-invasive indicator of stress reaction. In addition, Nakano and Yamaguchi (2011) have advocated that it was considered that the score of SAA<sup>6</sup> between before and after the stressor might be useful to distinguish the eustress and the distress. Additionally, it was suggested that the SAA is a better index of acute stress. The SAA biosensor realizes to analyze the human stress in real time and noninvasive, making multiple sampling easy and stress free.

#### 2.6.2 Profile of Mood States (POMS)

<sup>4</sup> ASANA: Yoga posture

<sup>5</sup> Masaki Yamaguchi, Takahiro Kanemori, Masashi Kanemaru, Hirofumi Mizuno and Hiroshi Yoshida. Salivary α-amylase activity

Profile of Mood States (POMS) is a standard validated psychological test formulated by McNair et al. (1971). The questionnaire contains 65 words/statements (fatigued, tense, miserable, confused, active and relaxed, etc.) that describe feelings people have. Analysis of the result is by comparing it with the results of previous tests. It is expected that, with appropriate training between each test, the analysis would indicate an improvement. Rabindra, Pradhan and Nagendra (2014) have conducted yoga based stress management study with POMS and the result has showed that profile of mood in manages was enhanced by yoga based SMET (Self-Management of Excessive Tension).

## **2.7 Secondary outcome measurement**

### **2.7.1 Blood Oxygen Level (BOL/SpO<sub>2</sub>)**

Biologically active substance like oxygen or vitamin B1 are needed as energy for physical and mental activity. The cause of occurrence of harmful fatigue substance is consumption of energy source. When enough oxygen level is supplied, aerobic energy production occur and fatigue substance is converted into carbon dioxide and water.

*Pulse oximeter* – Many researchers have evaluated the muscle fatigue by expiration gas of metabolism and imaging of biological tissue, but these ways are invasive, high-priced and need large-scaled measuring device which is Expiration gas analyzers and MRS. Pulse oximeter can collect data which is indicator of physical fatigue immediately and non-invasive.

The study of relation between yoga and oxygen saturation has been researching especially in respiratory disorders field. Judith M, Jean E and Hossein N (2013) have reported that oxygen saturation remained high and vital signs stable; forced expiratory volume in 1 second values increased significantly by Viniyoga (Hatha).

### **2.7.2 Pulse Rate (PR)**

Pulse rate (PR) is commonly reported in studies of the relationship between fatigue and cardiac functioning. Rapid pulse rate often shows that physical fatigue or a sign of medical conditions. This measurement is also measured by pulse oximeter.

## **2.8 Data analysis**

The data was analyzed by the statistician using SPSS. Shapiro wilk test was used to check normality of base line data. Although the data from vital (Salivary Amylase) parameter was not normally distributed, it was regarded as characteristic of measurement. Thus independent sample t-test and paired sample t-test was used for further analyses with SPSS and Excel.

## **3. RESULTS**

Total seven times parameters in physiological part were conducted at first day before and after Club Activity (Measurement1&2), 14<sup>th</sup> day before (after CA) and after CM (Measurement3&4), last day before and after CA (Measurement5&6) and after CM (Measurement7). In this part, following outcomes has been found by various combination of each measurement depended on object; Physiological Part, in the measurement of stress level measured by the Salivary Amylase, Blood Oxygen Level and Pulse Rate (**Table6-1, 6-2**).

### Objects

*i ) Immediate effect of CM on 35th day - Measurement 6 vs 7*

*ii ) Immediate effect of CM on 14th day- Measurement 3 vs 4*

*iii) Long term effect of CM for before CA- Measurement 1 vs 5*

*iv) Long term effect of CM on effect of CA- Measurement 1-2 vs Measurement 5-6*

In addition, two times questionnaire, Profile of Mood States (POMS), were conducted before and after study; Psychological Part (table 2).

3.1 Result of Physiological Part

TABLE I  
RESULTS OF SALIVARY AMYLASE (SA), BLOOD OXYGEN LEVEL (BOL), PULSE RATE (PR) FOR OBJECTIVES.

YOGA							CONTROL						
<b>Immediate effect of CM on 35<sup>th</sup> day</b>													
	Before CM		After CM		Changes		Before CM		After CM		Changes		
		±		±		%		±		±		%	
SA	39.9	36.0	27.8	22.4	-12.1	-44*	52.1	30.3	60.3	31.6	8.2	14*	
BOL	96.7	1.0	97.2	0.8	0.5	1*	96.6	1.3	97.2	0.8	0.6	1	
PR	100.5	12.6	85.4	14.4	-15.1	-18**	84.2	17.0	73.4	12.3	-10.8	-15**	
<b>Immediate effect of CM on 14<sup>th</sup> day</b>													
	Before CM		After CM		Changes		Before CM		After CM		Changes		
		±		±		%		±		±		%	
SA	34.7	22.7	25.1	19.6	-9.6	-38	36.0	24.3	41.3	29.6	5.3	13**	
BOL	97.0	1.3	97.6	0.7	0.6	1*	96.6	1.7	97.1	1.0	0.5	1*	
PR	91.2	17.9	76.5	13.5	-14.7	-19**	76.6	18.0	69.3	10.3	-7.3	-11**	
<b>Long term effect of CM for Before CA</b>													
	1 <sup>st</sup> day Before CA		35 <sup>st</sup> day Before CA		Changes		1 <sup>st</sup> day Before CA		35 <sup>st</sup> day Before CA		Changes		
		±		±		%		±		±		%	
SA	40.5	48.9	25.7	19.9	-12.8	-46	48.8	31.0	41.3	28.4	-4.1	9	
BOL	97.3	1.0	97.7	0.5	0.4	0	97.2	1.0	97.2	0.8	0	0	
PR	73.9	8.5	71.0	6.1	-2.9	-4	68.4	12.9	67.6	8.3	-0.8	-1*	
<b>Long term effect of CM on effect of CA</b>													
	M1-2 changes		M5-6 changes		Changes		M1-2 changes		M5-6 changes		Changes		
		±		±		%		±		±		%	
SA	1.7	49.4	12.1	31.2	10.4	86	0.83	39.9	7.39	40.9	6.6	89	
BOL	0.1	1.3	0.9	1.0	0.8	86	0.13	0.6	0.57	1.5	0.4	77	
PR	26.4	16.2	29.5	11.1	3.1	11	16.9	15.9	16.6	13.3	-0.3	-2	

[CM: Cyclic Meditation, CA: Club Activity] \*p>0.05, \*\*p>0.01 T test, f=22, 2tail

3.1.1 Immediate effect of CM on 35th day-Measurement 6 vs 7 showed many significant changes and larger difference between both groups than 14<sup>th</sup> day. Yoga group Salivary Amylase (SA) was decreased significantly by 12.1 point (-44%, 0.04, 2-tail), Blood Oxygen Level (BOL) was increased significantly by 0.5 point (1%, 0.04, 2-tail) and Pulse Rate (PR) was decreased significantly by 15.1 point (-18%, 0.00, 2-tail) as against Control group SA was increased significantly by 8.2 point (14%, 0.04, 2-tail), BOL was increased by 0.6 point and PR was decreased significantly by 10.8 point (-15%, 0.00, 2-tail). Decreased SA and PR, and increased BOL indicate improvement in terms of reduced stress levels after CA because of practice of CM.

3.1.2 Immediate effect of CM on 14th day-Measurement 3 vs 4 showed that Yoga group SA was decreased by 9.6 point (-38%), BOL was increased by 0.6 (1%) and PR was decreased significantly by 14.7 point (-19%, 0.01, 2-tail) indicating increased reduction of stress levels due to practice of CM as against Control group SA was increased significantly by 5.3

point (13%. 0.01, 2-tail), BOL was increased significantly by 0.5 point (1%, 0.09, 2-tail) and PR was decreased significantly by 7.3 point (-11%, 0.00, 2-tail).

**3.1.3** Long term effect of CM for before CA- In measurement 1 vs 5, Yoga group SA was decreased by 12.8 point (-46%), BOL was increased by 0.4 point (0%) and PR was decreased by 2.9 point (-4%) compared with Control group SA was decreased by 12.8 point (-46%), BOL was increased by 0.4 point (0%) and PR was decreased by 2.9 point (-4%). Although there was no significant change in Yoga group, decreased SA and PR in Yoga group were larger than Control group and its result indicate that continuous CM practice has reduced stress levels before CA, it also mean that student became to show the less stress scores after schoolwork through 5weeks CM practice.

**3.1.4** Long term effect of CM on effect of CA- Measurement 1-2 vs Measurement 5-6 showed no significant changes but Yoga group showed decrease in PR as against Control group PR was increased. Yoga group SA change was increased by 6.6 point, BOL change was decreased by 0.5 point and PR change was decreased by 0.4 point compared to Control group SA change was increased by 10.4 point, BOL change was decreased by 0.5 point and PR change was increased by 3.1 point. This indicates that both Yoga and Control groups show almost same immediate effect for Club Activity (sports training), although Cyclic Meditation (CM) practice can reduce increase in PR by effect of CA.

**3.2 Result of Psychological Part**

**TABLE- II  
RESULTS OF PROFILE OF MOOD STATES (POMS).**

Psychological Part												
	YOGA						CONTROL					
	Pre		Post		Changes		Pre		Post		Changes	
		±		±		%		±		±		%
T-A	58.8	9.7	54.7	10.6	-4.1	-7*	55.2	9.8	57.0	10.2	1.8	3
D	60.4	12.3	55.8	10.1	-4.6	-8**	56.9	10.5	57.8	12.2	0.9	2
A-H	53.0	9.6	49.6	8.7	-3.4	-7	51.0	9.2	55.0	11.6	4.0	7*
V	53.2	9.2	56.1	10.0	2.9	5	51.8	9.4	53.1	8.2	1.3	2
F	57.6	11.3	55.3	9.6	-2.3	-4	55.4	8.4	56.3	9.8	0.9	2
C	62.7	12.7	55.7	11.0	-7.0	-13**	58.3	9.9	57.7	10.2	-1.0	-1

\*p>0.05, \*\*p>0.01T test, f=22, 2tail

T-A: Tension-Anxiety, D: Depression-Dejection, A-H: Anger-Hostility, V: Vigor, F: Fatigue and C: Confusion

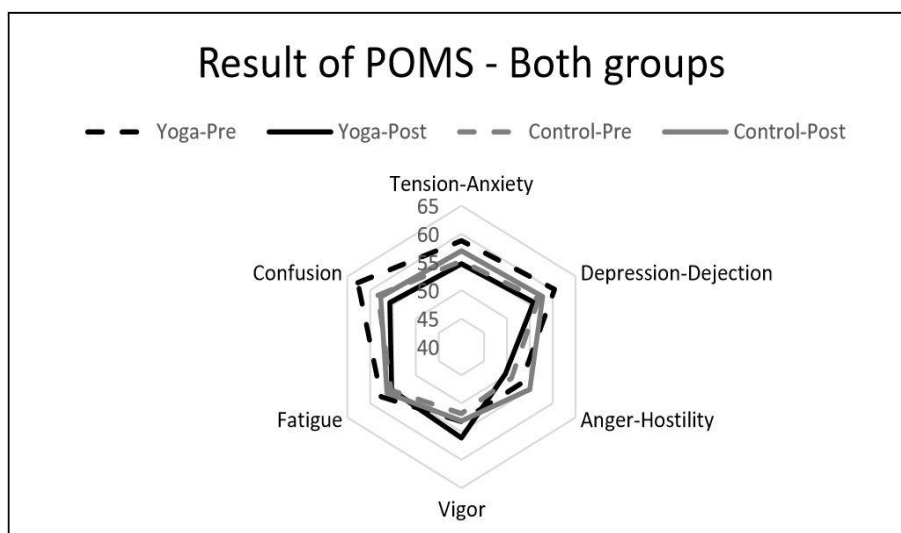
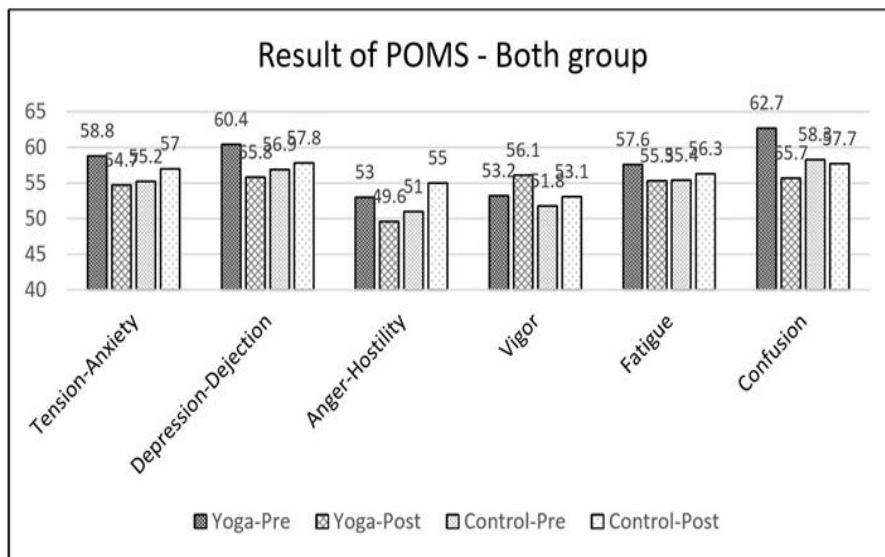
Profile of Mood States (POMS) was taken in terms of “Tension-Anxiety”, “Depression-Dejection”, “Anger-Hostility”, “Vigor”, “Fatigue” and “Confusion” defined by answering 65 words/statements (fatigued, tense, miserable, confused, active and relaxed, etc.) that describe feelings people have, and its result is following.

**Tension-Anxiety (T-A)-** Yoga group Tension-Anxiety was decreased significantly by 4.1 point (-7%, 0.03, 2-tail) compared with Control group Tension-Anxiety was increased by 1.8 point (3%).

**Depression-Dejection-** Yoga group Depression-Dejection was decreased significantly by 4.6 point (-8%, 0.00, 2-tail) compared with Control group Depression-Dejection was increased by 0.9 point (2%).

**Anger-Hostility-** Yoga group Anger-Hostility was decreased by 3.4 point (-7%) compared with Control group Anger-Hostility was increased significantly by 4 point (7%, 0.03, 2-tail).

**Vigor-** Yoga group Vigor was increased by 2.9 point (5%) compared with Control group Vigor was



## 4. DISCUSSION

### 4.1 Physiological Parameters Results

#### 4.1.1 Immediate effect of CM on 35th day

Measurement 6 vs 7:-Significant decrease of Salivary Amylase (SA) and Pulse Rate (PR), and significant increase of Blood Oxygen Level (BOL) in Yoga group indicate significant reduction of stress levels due to CM practice compared to Control group without CM practice.

This 35<sup>th</sup> result showed effect of long term CM practice. Yoga group SA was decreased significantly by 12.1 point (-44%, 0.04, 2-tail) as against Control group SA was increased significantly by 8.2 point (14%, 0.04, 2-tail) on 35<sup>th</sup> day. This difference of SA changes (difference is 20.3 point) between both groups was larger than result on 14<sup>th</sup>



day; it was increased by 5.4 point from 14.9 point on 14<sup>th</sup> day. In addition, Yoga group SA and PR were more decreased from its result of 14<sup>th</sup> day, it indicates that long term (more than 5 weeks) CM practice has more effectiveness of immediate relaxation as well as immediate cooling down than short term (less than 2 weeks) CM practice.

As mentioned in ancient literature review, continuous practice of CM is considered that it can reduce physical fatigue or stress efficiently after sports training. Ancient Yogi Patanjali has already said that “Resort to yoga for thinning of the kleśās<sup>7</sup> and achieving higher states of consciousness featured by lesser stresses and emergence of greater capacities.”

This object result indicate that Yoga helps to thin out stresses, and proved why ancient Yogi Patañjali has used the term thinning. It is considered that stress is not eliminated suddenly, hence we should reduce it gradually and systematically. Systematic practice of relaxation technique can improve the ability to reduce physical stress or cope with its stress, and it may have immediate effect of physical rest also.

#### 4.1.2 Immediate effect of CM on 14th day

Measurement 3 vs 4- Measurement 1 vs 5:- Although there were no significant change of SA in Yoga group, its SA showed decrease of 9.6 point (-38%) as against Control group SA was increased significantly by 5.3 point (13%, 0.01, 2-tail). This difference indicated that CM practitioner feel less stress after CM practice immediately, but participants who spent time with normal cooling down exercise after some time of CA feel more stress than after CA soon.

In addition, Yoga group has showed more decrease of PR score (14.7 point, -19%) than decreased Control group PR score (7.3, -11%). This difference between both groups can be considered that CM practice help to calm down excessive body activity or fatigue after sports training immediately toward body relaxation or taking rest.

There can be correlation between SA and PR, decreased SA can lead to reduce excessive PR and the same with the converse. Moreover, Control group result showed that PR is decreased naturally without any special relaxation technique, but it is necessary for decrease of SA to do some relaxation technique after CA, sports training.

#### 4.1.3 Long term effect of CM for before CA

Measurement 1 vs 5:- Yoga group SA was decreased by 12.8 point (-46%) but Control group SA was decreased by just short of 0.8 point (-9%), and Yoga group PR was also decreased 2.9 point (-4%) compared with significant decrease of Control group PR 0.8 point, (-1%).

Above Yoga group changes showed that there was more improvement in terms of reduced stress levels than Control group, and those indicate that participant who practice CM continuously became to feel less stress before CA as well as after schoolwork. Its condition, less stress levels before CA, can be expected to do more high quality of CA (sports training) and it can lead more efficient effect of CA for practitioner. Moreover, it can be considered that CM practice or immediate relaxation after CA can help to reduce schoolwork stress levels also.

#### 4.1.4 Long term effect of CM on effect of CA

Measurement 1-2 vs Measurement:- Test of difference of both groups' changes have not showed any significant change, but Yoga group showed decrease in PR (-0.4, -2%) as

---

<sup>7</sup> The great sage Patanjali uses Kleśā which aptly describes stress.

against Control group PR was increased (3.1, 11%). Although it is hard to consider that effect of CA can be affected by CM practice, CM practice can reduce increase in PR by effect of CA. In addition, this result is related mental condition indicated by POMS result. All participants equally got effect of CA such as increase of SA or PR.

There are some reasons can be considered that mentioned in limitations on this study, or is an athletic tendency such as "CA itself can be an opportunity to emit stress for some of them." Some participants' SA showed decrease indicating reduction of stress levels after CA in both groups. High school athletes who have joined this study have sports experience at least a year, maximum 8 years. Almost of all them are not beginners, thus CA (sports training) has already became their habit. CA itself can be an opportunity to emit stress, such as caused by schoolwork, for some of them.

#### **4.2 Psychological Questionnaire Results**

Yoga group showed significant decreases in "Tension-Anxiety", "Depression-Dejection" and "Confusion" as against Control group showed increases in those, though did not show significant change. This result indicate significant reduction of mental stress levels due to CM practice in Yoga group.

Control group "Anger-Hostility" was increased significantly by 4 point (7%, 0.03, 2-tail), "Fatigue" was increased by 0.9 point (2%) compared to Yoga group "Anger-Hostility" was decreased by 3.4 point (-7%), "Fatigue" was decreased by 2.3 (-4%). This result also indicate reduction of mental stress levels due to CM practice in Yoga group.

In addition, Yoga group "Vigor" showed larger increase (5%) than Control group (2%). This result showed that effect of CM practice can be regarded as not only reduction of mental stress but also increase in energy, or reduction of mental stress levels enables energy to be increased.

Although they have done not only CA but also schoolwork, private-tutoring school, housework and so on for the duration of this study, POMS result showed significant reduction of mental stress levels only in Yoga group. It strongly indicates that effect of CM practice helps to cope with stress in daily activities also. Conversely, effect of long term (more than 35 days) CA with general cooling down exercise can make mental stress levels increased.

#### **4.3 Overall Effect**

There is a correlation between physiological reaction and emotions. Yoga group "Tension-Anxiety", "Depression-Dejection" and "Confusion" scores were decreased significantly as well as SA and PR were decreased significantly. Control group "Anger - Hostility" was increased significantly as SA was increased significantly. In addition, decrease in Yoga group SA can be regarded as cause of increase in "Vigor" also. Thus there is considered strong correlation between physiological stress level and mental stress level. Body reaction can affect mental condition and the same with the converse.

#### **4.4 Sports, Schoolwork, Stress and Yoga**

Competitive anxiety and tension/anxiety mood states are statistically related to injury frequency, and that tension/anxiety, anger/hostility, and total negative mood state (indicated by Profile of Mood States [POMS]) are statistically related to injury severity (Lavalley and Flint, 1996). McLeod, Curtis Bay, and etc. (2009) suggested in their study that clinicians need to recognize the full spectrum of negative influences that injuries may have on Health-related quality of life (HRQOL) in adolescent athletes. HRQOL is a global concept

that takes into account the physical, psychological, and social domains of health. Reduction of physical and mental stress helps to reduce the injury opportunity or its severity.

In addition, less feelings of “negative emotion in daily activity” and “anxiety” are regarded as factors in high adaptability for high school athletic clubs (Aoki and Matsumoto, 1997), and “adjustment to athletic clubs”, “self-efficacy” and “coping skills” are significantly related to adjustment to school (Aoki, 2003).

Yoga, Cyclic Meditation (CM), can reduce athletic injury opportunity or severity by reduction of physical and mental stress, and improve “adjustment to athletic clubs”, “coping skills” and “adjustment to school” also. Thus Yoga, especially CM, is suitable relaxation technique for high school athletes.

#### **4. SUMMARY**

Physiological measurement showed significant reduction of physical stress levels (indicated by significant decrease in Salivary Amylase (SA) ( $p=0.04$ , 2-tail) and Pulse Rate (PR) ( $p=0.04$ , 2-tail), and significant increase in Blood Oxygen Level (BOL) ( $p=0.00$ , 2-tail) due to Cyclic Meditation (CM) practice in Yoga group on 35<sup>th</sup> day, as immediate effect of CM on 35<sup>th</sup> day, and it was larger than immediate effect of CM on 14<sup>th</sup> day. This difference indicate that Yoga helps to thin out stresses, and proved why ancient Yogi Patañjali has used the term thinning. It is considered that stress is not eliminated suddenly, hence we should reduce it gradually and systematically by use of techniques such as CM.

In addition, psychological questionnaire (Profile of Mood States [POMS]) result indicate significant reduction of mental stress levels indicated by significant decreases in "Tension-Anxiety ( $p=0.03$ , 2-tail)", "Depression-Dejection ( $p=0.00$ , 2-tail)" and "Confusion ( $p=0.01$ , 2-tail)" due to CM practice in Yoga group. It strongly indicates that effect of CM practice helps to cope with stress in daily activities also because participants have done not only CA but also schoolwork, private-tutoring school, housework and so on for the duration of this study. Conversely, effect of long term (more than 35 days) CA with general cooling down exercise can make mental stress levels increased.

There is a correlation between physiological reaction and emotions. Yoga group "Tension-Anxiety", "Depression-Dejection" and "Confusion" scores were decreased significantly as well as SA and PR were decreased significantly. Control group "Anger - Hostility" was increased significantly as SA was increased significantly. Moreover, decrease in Yoga group SA can be regarded as cause of increase in “Vigor” also. Thus there is considered strong correlation between physiological stress level and mental stress level. Body reaction can affect mental condition and the same with the converse.

#### **5. CONCLUSION**

The study indicates that 35 days of regular practice of Cyclic Meditation (CM) leads to significant immediate effect of CM in reduction of stress levels in high school athletes who practice sports 4hrs /day. Also long term (35days) practice of CM decreases stress levels (as can be seen by Salivary Amylase [SA], Pulse Rate [PR] and Blood Oxygen Level [BOL] in Measurements 1 and 5) compared to the control group. This is also supported by the Psychological parameters as felt by the participants and measured through Profile of Mood States (POMS). This result encourages those who are into sports to adopt CM as a part of their daily schedule to reduce the stress levels. This also encourages a longer duration study such as 2 months intervention would have given a significant effect on long term effect of CM on SA, BOL and PR.

## 6. SUGGESION

Thus this study suggested that Yoga, especially CM, is suitable relaxation technique for high school athletes.

## REFERENCES

- Chofu city. Report of attitude survey of Chofu-citizen's health promotion 2012.** Retrieved May 10, 2016, from Chofu city Web site: <http://www.city.chofu.tokyo.jp>
- Cabinet Office Government of Japan.** The breakdown of suicide in 2014. Retrieved May, 10, 2016, from Cabinet Office Government of Japan Website: <http://www8.cao.go.jp/jisatsutaisaku/toukei/pdf/h26joukyou/s2.pdf>
- Swami Vivekanada** Yoga Anusandhana Samsthana. (2009). *YIC Yoga instructor's course self-learning material*. Bengaluru: Swami vivekanada yoga prakashana. Toward a cognitive-affective model of athletic burnout. *Jpurnal of sport psychology*, 8: 36-50.
- Masaki Nagashima. (2002).** Mental support of sports teens from counseling note of psychiatrist, Kodansha, 2002.
- Ikuo Aoki. (2003).** Sport value consciousness of high school athletes and its correlates. *Study of Physical Education*, 48:207-223
- Ikuo Aoki and Kouji Matsumoto (1997).** The determinant psychosocial factors of the adjustment to athletic clubs in high school athletes. *Study of Physical Education*, 42: 215-232
- Hidetsugu Kobayashi, Shinishi Idemura, Nobuhiko Tada and Zinsaburou Matsusawa (2005).** Indications of chronic fatigue, subjective symptoms in high school students and relationship with stressors in daily life. *Japan Journal of Physical Fitness and Sports Medicine* 54(6), 693, 2005-12-01.
- Tetsuya Hiraomoto, Kazufumi Yoshihara and Chiharu Kubo. (2009).** Effect of yoga on mental health and stress sensitivity. *Subsidized collected papers of medical health research*, March.
- Tkayuki Shibukura, Tamotsu Nishida and Banjou Sasaki. (2008).** Reconstruction of cognitive appraisal scale of athletic stressors for high school athletes. *Japan J. Phys. Educ. Hkth. Sport Sdi.* 53; 147-158.
- Takayuki Shibukura and Yasushi Mori. (2004).** A study of psychological stress process in high school athletes. *Japanese society of Physical Education*, 49: 535-545
- Butzer B, Day D, Potts A, Ryan C, Coulombe S, Davies B, Weidknecht K, Ebert M, Flynn L, Khalsa SB. (2014).** Effects of a classroom based yoga intervention on cortisol and behavior in second- and third grade students: a pilot study. *Journal of Evidence-Based Complementary & Alternative Medicine*, Nov 19.
- Balaram Pradhan and Nagarandra H.R. (2010).** Effect of yoga relaxation techniques on Performance of DLST by teenagers. Sanjib Patra and Shirley Telles. (2009). Positive impact of cyclic meditation on subsequent. *Med Sci Monit*, 15(7): CR375-381.
- Pailoor Subramanya and Shirley Telles. (2009).** A review of the scientific studies on cyclic meditation. *International Journal of Yoga*, Issue 2, Jul-Dec.
- Pailoor Subramanya and Shirley Telles. (2009).** Effect of two yoga-based relaxation techniques on memory scores and state anxiety. *BioPsychoSocial Medicine*, 3;8.
- Masaki Yamaguchi, Takahiro Kanemori, Masashi Kanemaru, Hirofumi Mizuno and Hiroshi Yoshida. (2001).** Correlation of Stress and Salivary Amylase Activity. *Japanese Journal of Medical Electronics and Biological Engineering*, 39-3, 234/239.
- Takahiro Nakano and Gaku Suzuki (2009).** Utility of including amylase activity values for saliva as the index of physical condition of the athlete, *Journal of Nagoya Gakuin University Humanities and natural sciences* 46(1), 45-54, 2009.
- Atsunori Nakano and Masaki Yamaguchi. (2011).** Evaluation of Human Stress using Salivary Amylase. *Study of Biofeedback*, Vol.38, No.1(2011), Japan Feedback Association, pp.3-9.

- Nagao Usui, Hiroshi Oizumi, Satoshi Kurihara and KiheiMaekawa. (1990).** Qualitative measurement of hemoglobin oxygenation state during exercise by near-infrared spectrophotometry. *Science of Physical Stamina*, 39(6), 526,12-01
- YoshikiMuramatsu and Hiroshi Kobayashi. (2014).** Assessment of muscle fatigue by NIRS. *Transactions of the Japan Society of Mechanical Engineers*, 80(814), DR0167-DR0167.
- McNair, D. M., Lorr, M., &Droppleman, L. F. (1971).** *Manual: Profile of Mood States*. San Diego: Educational and Industrial Testing Service.
- Judith M. Fouladbakhsh, Jean E, Davis and Hossein N. Yarandi. (2013).** Using a standardizedViniyoga protocol for lung cancer survivors: a pilot study examining effects on breathing ease. *Journal of Complementary and Integrative Medicine*, 10, 1, 175-187, June 2013.
- Nebojsa Nash Toskovic. (2001).** Alterations in selected measures of mood with a single bout of dynamic Taekwondo exercise in college-age students. *Perceptual and Motor Skills*, 2001, 92, 1031-1038.
- Rabindra M.A., Pradhan B. and Nagendra H.R. (2014).** Effect of short-term yoga based stress management program on mood states of managers. *International Journal of Education & Management Studies*, 2014, 4(2), 150-152.
- Nagendra H.R. and Nagarathna R. (1986).** *New perspectives in stress management*. Bengaluru: Swami Vivekanada yoga prakashana.
- Theodore F. Towse, Jill M. Slade, Jeffrey A. Ambrose, Mark C. DeLano, and Ronald A. Meyer. (2011).** Quantitative analysis of the postcontractile blood-oxygenation-level-dependent (BOLD) effect in skeletal muscle. *J ApplPhysiol* 111: 27–39, 2011.
- Tamara C. Valovich McLeod, R. Curtis Bay, John T. Parsons, Eric L. Sauers and Alison R. Snyder (2009).** Recent Injury and Health-Related Quality of Life in Adolescent Athletes. *Journal of Athletic Training*, 2009;44(6):603–610.
- Lynn Lavalley and Frances Flint (1996).** The Relationship of Stress, Competitive Anxiety, Mood State, and Social Support to Athletic Injury. *Journal of Athletic Training*, 1996; 31(4):296-299
- Ingunn Hagen and Usha S. Nayar (2014).** Yoga for children and young people’s mental health and well-being: research review and reflections on the mental health potentials of yoga. *Frontiers in PSYCHIANTRY*, 2014; (5)35:1-6
- Leslie A. Daly, Sara C. Haden, MarshallHagins, NicholasPapouchis, andPaulMichael Ramirez (2015).** Yoga and Emotion Regulation in High School Students: A Randomized Controlled Trial. *Evidence-Based Complementary and Alternative Medicine* (2015) 794928 : 8-15.
- Joshua C. Felver1, Bethany Butzer, Katherine J. Olson, Iona M. Smith and Sat Bir S. Khalsa (2015).** Yoga in public school improves adolescent mood and affect. *ContempSch Psychol. Sep.* (2015); 19(3): 184–192.
- SoubhagyalaxmiMohanty, PeriVenkataRamanaMurty, Balaram Pradhan and Alex Hankey (2015).** Yoga Practice Increases Minimum Muscular Fitness in Children with Visual Impairment. *Journal of Caring Sciences*, 2015, 4(4), 253-263.
- Leslie A. Daly, Sara C. Haden, Marshall Hagins, Nicholas Papouchis, and Paul Michael Ramirez (2015).** Yoga and Emotion Regulation in High School Students: A Randomized Controlled Trial. *Evidence-Based Complementary and Alternative Medicine*, 2015, 794928, 8-15.
- Atsushi Gotou, Yoshinori Oomomo, Shuichi Morita, KanakoNkashima, Masaru Ueda, Tadaakilkehara and Akira Horii (2002).** Effect of stretching on recovery for muscle fatigue. *Japan Journal of Physical Fitness and Sport Medicine* 51(6), 732, 2002-12.
- Noriakilchihashi and Masaki Yoshida (1991).** The effect of stretching on recovery of muscular fatigue by electromyographic analysis. *Journal of exercise physiology* (4):181-185, 1991