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EFFECT OF YOGIC PRACTICES ON SELECTED PHYSIOLOGICAL AND BIOMECHANICAL VARIABLES AMONG SCHOOL BOYS

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Abstract

The word yoga is derived from the Sanskrit root Yuj meaning to bind, join, to attach, and Yoke, to direct and concentrate one's attention on, to use and apply. It also means union or communion. It is the true union of our will the will of God. _It thus means, _says Mahadev Desai in his introduction to the Gita according to Gandhi, _the yoking of all the powers of body, mind and soul to God; it means the disciplining of the intellect, the mind, the emotions, the will, which that yoga presupposes; it means a poise of the soul which enables one to look at life in all its aspects evenly. Everyone desires good health and it is the ultimate objective of all those who want happiness in life. Each and everyone have to follows good health practices in their routine life minor health disorders are quite common to all. In the case of major health problems the precautionary measures are plenty. Some people control their diseases like blood pressure, diabetes, acidity asthama etc., by taking medicines regularly but such practices does not in any way completely eliminate the health disorders. On the other hand it leads several other adverse health problems the continuous, systematic and regular practice of yoga is an effective tool to maintain good health and also help to eliminate all the dreadful disease from the human body .The purpose of the study was to find out the effect of yogic practices on selected physiological and biomechanical variables among school boys. For this purpose, one hundredan fifty (150) boys aged between 15 to 17 were randomly selected from the Government Higher Secondary School, Kuttalam, Nagapattinam District, Tamil Nadu, India as subjects. The selected subjects were categorized into Experimental group I (n=50), Experimental group II (n=50) and Control group (n=50). The Training programme was designed for sixteen weeks and Experimental group I (Standing, sitting, Kneeling position of Asanas) for five days a week and 90 minutes/day, Experimental group II (Pron, Supine positions of Asanas, Suryanamaskar, Pranayama) for five days a week and 90 minutes/day, and group III (n=50) acted as Control group which did not undergo any specific Yogic training programme other than their regular life style. Yogic practices is treated as Independent Variable. The physiological variables such as Forced vital capacity and Biomechanical variables such as Anterior Average Trajectory, were treated as

Dependent variables respecively. The selected variables for the study were assessed by the standard tests. ANCOVA statistics was given, the findings of the study showed that there was a significant difference found between the Experimental group I and Experimental group II and compare to the Control group. The Scheffe's post-hoc method was used for testing the significance between paired adjusted post hoc test mean and the level of significance was fixed at 0.05 level. The results of the study showed that physiological variable on Forced vital capacity and biomechanical variable on Anterior Average Trajectory found significant improvement on Experimental group I and Experimental group II and compare to the Control group.

Key-words: Yogic practices, Physiological variables, Biomechanical variables, Forced vital capacity, Anterior Average Trajectory.

Introduction

We cannot relax our body unless
Our mind if relaxed

\- ***Saraswathi Nandha***

Today we are in millennium world there is a landmark development in the science and technology including space defense atomic energy, computer, internet service etc., by the internet invention we can collect required information within a fraction of second from any parts of the Universe, and due to this advanced scientific technological invention the body movements of the human being have been restricted. Tension and Competitive feeling increased man has been felt into the prey of stress, hypo kinetic and psychosomatic diseases so time has come that man should not ignore the importance of healthy life.

Everyone desires good health and it is the ultimate objective of all those who want happiness in life. Each and everyone have to follows good health practices in their routine life minor health disorders are quite common to all. In the case of major health problems the precautionary measures are plenty. Some people control their diseases like blood pressure, diabetes, acidity asthama etc., by taking medicines regularly but such practices does not in any way completely eliminate the health disorders. On the other hand it leads several other adverse health problems the continuous, systematic and regular practice of yoga is an effective tool to maintain good health and also help to eliminate all the dreadful disease from the human body **(Pradhan, 2008).**

Mordern life-style fosters unfitness. Many technological advances are intended to eliminate physical exertion from every day activities. The automobile and television are key contributors, to our sedentary life-style, and we have become accustomed to other automated energy savers, elevators, riding lawnmovers, motorized golf carts, power steering, and power windows on automobiles. At the same time, the competitive society is characterized by pressing domestic problems, business obligations and deadline tensions. These types of stresses are inter connected with the physiological systems of the body and appear to effect one's statenofnhealth. **(Barrow,1983)**

Research is common parlance refers to a search for knowledge. Once can also define research as a scientific and systematic search for pertinent information on a specific topic. A care full investigation or inquiry specially through search for new facts in any branch of knowledge. In Biomechanical analysis of Body mass index study was enriched systemized effort to gain knowledge in movement analysis, actually a voyage of discovery.

Physiology is the study of life itself. It is the study of function of all parts of living organisms, as well as of the whole organism. Physiology becomes progressively more complicated and vast as it extends through the study of higher and higher forms of life such as cells, plants, lower animals and finally human beings. **(Guyton, 1982)**

Physiology of fitness is an upto-date guide to th prescription of exercise for fitness, weight control and health. These are atleast two distinctly different ways to approach the study of fitness, one is objective and physiological the othr is subjective, emotional and psychological. The former is concerned with laps, heartbeats and calories, while the latter "tunes" on sensations, "turn on" with activity, and "gets high" on hormones. **(Sharkey, 1984)**

Yoga is one of the most ancient cultural heritage of India. The word yoga in Sanskrit means "to unite", and so yoga can be said to connote a unitive discipline. In this sense, it is an exercise in moral and mental cultivation that generates good health (arogya), contributes to longevity (chirayu), and the total intrinsic discipline culminates into positive and perennial happiness and peace. Therefore, Yoga is the said to be indispensable to the ultimate accomplishment in life. It is a science that affects not only the conscious self but the subconscious as well. It is a practical physiological training (kriya yoga), which if practiced, can exalt man to the 'supra mundane level'.

Yoga is commonly viewed as a safe and effective means of increasing the strength, flexibility, and functional capacity of seniors. For example, the National Recreation & Park Association recommends Yoga as a "total-solution exercise" for older adults [1]. Similarly, the National Institute of Diabetes & Digestive & Kidney Diseases publication Healthy Eating and Physical Activity across Your Lifespan states, "yoga combines balance, flexibility, and strengthening benefits [2]." While we concur that Yoga holds great promise as a path to wellness in seniors, little scientific research quantifies to the physical demands, efficacy, and safety of Yoga programs for older men and women. Formal study is warranted because we must understand the potential benefits and risks of Yoga in seniors – and how to maximize the former and minimize the latter. As a step toward this end, we conducted the Yoga Empowers Seniors Study (YESS). This manuscript provides a brief overview of the rationale and design of the study but mainly details the asana series that were used in the project. In general, older adults have less joint range of motion, less strength and poorer balance than do younger persons [3]. With aging come more limiting musculoskeletal conditions, such as osteoarthritis and low back syndromes that likely put seniors at higher risk of musculoskeletal side effects from yoga and that demand targeted asana modifications. In our prior clinical trial of yoga for excess thoracic curvature (hyperkyphosis), conducted in men and women aged 60-90 years of age, approximately 60% of the 120 participants developed musculoskeletal soreness and/or pain significant enough to require additional variations of their poses (versions adapted for seniors with kyphosis were already being used) [4]. Further, participants with preexisting musculoskeletal conditions (even quiescent ones) developed side effects earlier in the hyperkyphosis study than did those without pre-existing conditions. While yoga for seniors may have several positive outcomes beyond the physical, YESS is focused on achieving muscular strength gains in a safe manner. In particular, YESS is attempting to create asana series that train major muscle groups, especially those that are associated with fall risk, such as the hip abductors [5,6]. We used a biomechanics approach to capture information about the physical demands placed on the muscles and joints by the specific asanas we employed, as well as the functional performance adaptations (e.g. gait, strength or balance changes) associated with practicing these postures. In-depth descriptions of the biomechanics methods and results will be the topics of other reports. Here we will present the senior-adapted YESS asana series and the additional modifications provided when participants had physical limitations.

Yoga is a physical and mental discipline that was developed in India over 2000 years ago and is gaining popularity in Western societies (Roland, Jakobi, & Jones, 2011). It is being practiced in health clubs, private studios and homes all over North America (Hagins, Moore, & Rundle, 2007). It is estimated that participation has tripled between 2006 and 2011 (Roland et al., 2011). In a recent survey, researchers found that 6.9% of

Americans are practicing yoga, with an additional 18.3 million expressing an interest in trying it (Roland et al., 2011). Many participants practice yoga to treat neck and back pain (Williams et al., 2005) and improve overall mental and physical health (Hayes & Chase, 2010). Western doctors and therapists are recommending yoga to their patients as a medical therapy (Hayes & Chase, 2010). In the growing field of yoga therapy, professionals are seeking to establish yoga as an independently viable healing practice, as well as integrate it into the current Western medical model (Hayes & Chase, 2010). However, as with the evaluation of all therapies seeking legitimacy, evidence of yoga therapy's benefits must withstand the scrutiny of the scientific inquiry (Uhlig, 2012). In an article by Mueller (2002), the author cautions health authorities and potential yoga participants about the risks of selecting an inappropriate yoga style, studio and teacher for the specific needs of the individual. Further evaluation of the benefits of yoga will aid health care providers and fitness professionals in recommending the most beneficial yoga practice to their patients **(Cowen & Adams, 2005; Hayes & Chase, 2010).**

Research has been completed in various fields of yoga, but few studies focused on the biomechanics of yoga. There are few studies directly exploring the kinetics and kinematics of yoga movement, and as a result, the gaps in the scientific literature are great and there is a limited understanding of the health implications related to the proper and efficient biomechanics of yoga when compared to activities of daily living (ADL). In a critical review by Roland et al. (2011), the authors enumerate a number of concerns with studies emerging in the field of yoga. They recommend that studies include larger sample sizes, that researchers should utilize reliable assessment instruments and that they must specify inclusion and exclusion criteria. For example, in a pilot study conducted by Westwell, Bell, and Õunpuu (2006), the yogic movements of one male participant were analyzed. The results of the study could not be statistically significant, yet the researchers reported a number of clinical applications (i.e. comparing yoga to other exercises as well as using the motion pattern as a way to optimize yoga performance while reducing and treating injuries). Without an adequate sample size, such comparisons with various therapies and physical activities should not be used as the basis for universal applications. More participants were recruited to complete DiBenedetto et al. (2005) study where a total of 19 healthy older participants (aged 62-83 years) completed the 8-week yoga intervention program exploring the changes in gait. Based on pre and post-intervention measurements there was an increase in stride length and peak hip extension as well as a trend towards reduced average pelvic tilt based on yoga practice frequency. In this study however, no kinematic data was collected throughout the yoga movements, therefore it is unclear what mechanism led to these gait changes. Many cross-sectional studies are in agreement that the practice of yoga leads to improved mobility based on improved isokinetic and isometric muscle strength and joint flexibility (Tran, Holly, Lashbrook, & Amsterdam, 2001), increased range of motion (ROM) (M. S. Garfinkel, Schumacher Jr, Husain, Levy, & Reshetar, 1994; Haslock, Monro, Nagarathna, Nagendra, & Raghuram, 1994) reduced pain in those with osteoarthritis (OA) (M. S. Garfinkel et al., 1994; M. S. Garfinkel et al., 1998), improved balance and coordination in elderly patient with stroke (Bastille & Gill-Body, 2004). Data on the kinetics and kinematics common activities of daily living is available. Data of level walking, stair ascent and stair descent has been previously acquired in our lab (N. H. Law, 2013; Lee, 2011) (table 6). This information (table 10 and 20) is useful as it provides a clear reference point for the minimum standards necessary to complete the required activity. It is reported that gait is improved with the practice of yoga, further studies may help determine what other ADL can be improved with this practice. Yoga shows promise as a means of improving ADL capacity in older adults. If yoga is to fulfill this promise as an attractive and inexpensive way to improve the quality of life and maintain functional mobility, it is important to understand the movement pattern and caution any restrictions or modifications before prescribing it. Though yoga

is often viewed as a form of therapy and healing, it is important to highlight that the practice of yoga can also cause injury (Bianchi, Cavenago, & Marchese, 2004; Fishman, Saltonstall, & Genis, 2009; Patel & Parker, 2008). In a survey where 1336 Yoga teachers responded (Fishman et al., 2009), the structures believed to be most at risk were the cervical spine, the low back and the knees. It was believed by surveyed participants that yoga injuries most often occurred due to poor technique or position alignment, previous injuries, excess effort, and insufficient instructions from the yoga instructor. Studying yoga movement helps to shed light on potential mechanisms of injury by using the motion pattern as baseline values in future intervention research in order to suggest precautions.

Hypothesis

It was hypothesized that there would be a significant difference exists on the effect of Experimental Group I (yogic practices) on selected physiological variable on Forced Vital Capacity among school boys.

It was hypothesized that there would be a significant difference exists on the effect of Experimental Group II (yogic practices) on selected Biomechanical variable on Anterior Average Trajectory among school boys.

Review of related literature

Prashanth & Sivakumar (2017) examined the effect of yogic practice and aerobic exercise on selected physiological variables. For this purpose, forty five middle aged men of Uduppi town, Mangalore district, Karnataka state in the age group of 35 – 40 years were selected. They were divided into three equal groups (n = 15), each group consisted of fifteen subjects, in which group – I underwent yogic practice, group – II underwent aerobic exercise and group – III acted as control group who did not participate in any special training. The training period for this study was five days in a week for twelve weeks. Prior to and after the training period the subjects were tested for vital capacity and blood pressure (systolic and diastolic). Vital capacity was assessed by using wet-spirometer and blood pressure was assessed by using sphygmomanometer respectively. The analysis of covariance (ANCOVA) was used to find out the significant difference if any, among the experimental groups and control group on selected criterion variables separately. Since there were three groups involved in this study the Scheffẻ S test was used as pos-hoc test. It was concluded from the result of the study that the yoga practice and aerobic exercise has positively altered the criterion variables, such as, vital capacity and blood pressure (both systolic and diastolic).

Methodology

The purpose of the study was to find out the effect of yogic practices on selected physiological and biomechanical variables among school boys. For this purpose, one hundredan fifty (150) boys aged between 15 to 17 were randomly selected from the Government Higher Secondary School, Kuttalam, Nagapattinam District, Tamil Nadu, India as subjects. The selected subjects were categorized into Experimental group I (n=50), Experimental group II (n=50) and Control group (n=50). The Training programme was designed for sixteen weeks and Experimental group I (Standing, sitting, Kneeling position of Asanas) for five days a week and 90 minutes/day, Experimental group II (Pron, Supine positions of Asanas, Suryanamaskar, Pranayama) for five days

a week and 90 minutes/day, and group III (n=50) acted as Control group which did not undergo any specific Yogic training programme other than their regular life style. Yogic practices is treated as Independent Variable. The following physiological variables Forced vital capacity and Biomechanical variables Anterior Average Trajectory, were treated as Dependent variables. The selected variables for the study were assessed by the standard tests. Pre-test and Post-test were conducted before and after the sixteen weeks of yogic training. The collected data was analyzed by dependent 't' test. The level of significance was fixed at 0.05 level. The findings of the study showed that there was a significant difference found between the Experimental group I and Experimental group II and compare to the Control group.

Computation and analysis of Data

The 'f' ratio was computed for Forced vital capacity and Anterior Average Trajectory by using the mean difference and the standard error of the difference between means of Experimental group I, Experimental group I, and Control group shown in Table I and Table II

TABLE-I

COMPUTATION OF ANALYSIS OF COVARIANCE OF MEANS OF YOGIC PRACTICES GROUP I & II AND CONTROL GROUPS ON FORCED VITAL CAPACITY (measured in litres)

	YPG –I	YPG -II	CG	Source of Variance	Sum of Squares	Df	Means Squares	F-ratio
Pre-Test Means	4.43	4.50	4.40	BG	0.019	1	0.019	1.37
				WG	1.380	98	0.014	
Post-Test Means	4.61	4.83	4.41	BG	1.075	1	1.075	55.08*
				WG	1.913	98	0.020	
Adjusted Post-Test Means	4.61	4.83	4.41	BG	0.913	1	0.913	58.55*
				WG	1.512	97	0.016	

B- Between Group Means

W- Within Group Means

df- Degrees of Freedom

* - Significant

(Table Value for 0.05 Level for df 1 & 98 = 3.93)

(Table Value for 0.05 Level for df 1 & 97 = 3.93)

Results Of Forced Vital Capacity

The table – VI shows that the pre test means of experimental group I, experimental group II and control groups were 4.43, 4.50 and 4.40 respectively. The attained F-ratio for the pre-test was 1.37 and the table F-ratio was 3.93. Hence compared to table F-ratio the obtained F-ratio was insignificant at 0.05 level of confidence for the degree of freedom 1 and 98. In this study that there were no significant difference between the experimental and control groups indicating that the procedure of randomization of the groups was ideal while conveying the subjects to groups.

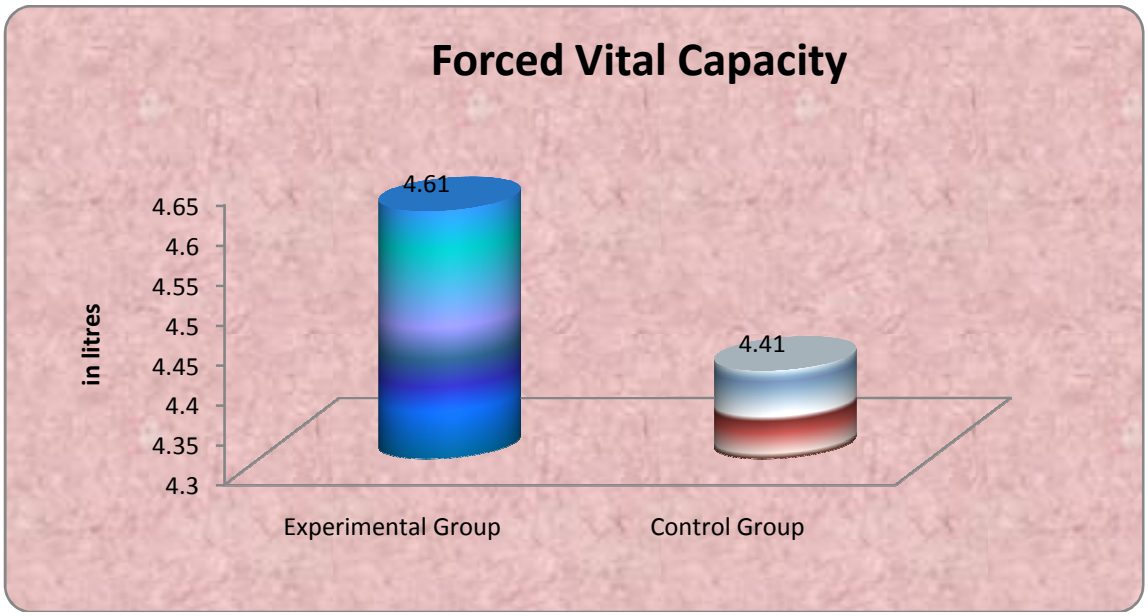
The post-test means of the experimental group I, experimental group II and control groups were 4.61, 4.83 and 4.41 respectively. The attained F-ratio for the post-test was 55.08 and the table F-ratio was 3.93. Hence compared to table F-ratio the obtained F-ratio was significant at 0.05 level of confidence for the degree of freedom 1 and 98. In this study was established that the differences between the post test means of the subjects were significant.

The adjusted post-test means of the experimental group I, experimental group II and control groups were 4.61, 4.83 and 4.41 respectively. The obtained F-ratio for the adjusted post-test means was 58.55 and the table F-ratio was 3.93. Hence compare to table f-ratio the obtained f-ratio was significant at 0.05 level of confidence for the degree of freedom 1 and 97. In this study proved that there was a significant difference among the means due to the experimental trainings on forced vital capacity. Scheffe's post hoc test was conducted to find out the paired mean significant difference between means.

The pre, post and adjusted post test means on forced vital capacity among yogic practice and control groups were accessible through bar diagram for enhanced considerate of the results of this study shown in the Figure I.

FIGURE - I

PRE, POST AND ADJUSTED POST TEST MEANS DIFFERENCES OF THE, EXPERIMENTAL GROUP I & II AND CONTROL GROUPS ON FORCED VITAL CAPACITY (measured in litres)



Discussion On Forced Vital Capacity

The results presented in table VI showed that obtained adjusted means on forced vital capacity among experimental group I with mean value of 4.61, experimental group II with mean value of 4.83 and control group with mean value of 4.41. The differences among pre test scores, post test scores and adjusted mean scores of the subjects were statistically treated using ANCOVA and the obtained F values were 1.37, 55.08 and 58.55 respectively. It was found that obtained F value on pre test scores were not significant and the obtained F values on post test and adjusted means were significant at 0.05 level of confidence as these were greater than the required table F value of 3.93. The ANCOVA test proved that due to twelve weeks training of yogic practices has increased forced vital capacity than the control group and the differences were significant at 0.05 level. Further, it clearly indicates that yogic practices group significantly increased forced vital capacity of the school boys.

TABLE - II
COMPUTATION OF ANALYSIS OF COVARIANCE OF MEANS OF YOGIC PRACTICE I & II AND CONTROL GROUPS ON ANTERIOR AVERAGE TRAJECTORY (in centimetres)

	YPG – I	YPG – II	CG	Source of Variance	Sum of Squares	Df	Means Squares	F-ratio
Pre-Test Means	59.19	59.01	59.33	BG	0.518	1	0.518	1.29
				WG	39.357	98	0.402	
Post-Test Means	60.61	61.01	59.39	BG	37.088	1	37.088	51.61*
				WG	70.417	98	0.719	
Adjusted Post-Test Means	60.63	61.08	59.38	BG	38.529	1	38.529	54.54*
				WG	68.524	97	0.706	

B- Between Group Means
W- Within Group Means
df- Degrees of Freedom

* - Significant
(Table Value for 0.05 Level for df 1 & 98 = 3.93)
(Table Value for 0.05 Level for df 1 & 97 = 3.93)

Results Of Anterior Average Trajectory

The table – XI shows that the pre test means of yogic practices I & II and control groups were 59.19, 59.01 and 59.33 respectively. The attained F-ratio for the pre-test was 1.29 and the table F-ratio was 3.93. Hence compared to the table F-ratio the obtained F-ratio was insignificant at 0.05 level of confidence for the degree of freedom 1 and 98. In this study that there were no significant difference between the experimental and control groups indicating that the procedure of randomization of the groups was ideal while conveying the subjects to groups.

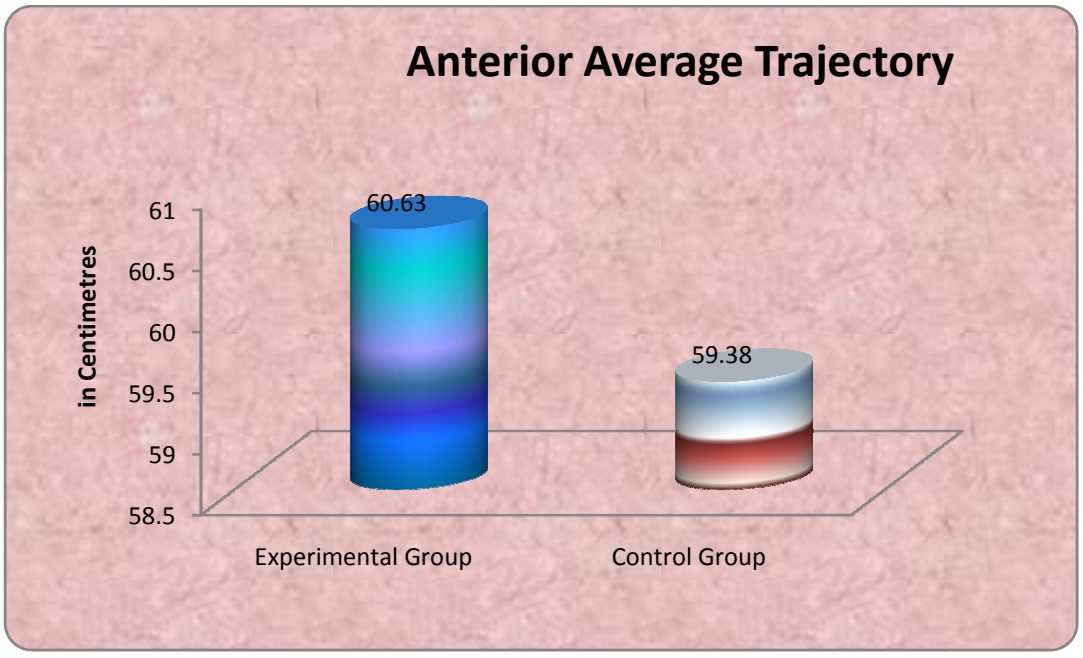
The post-test means of the yogic practice I &II and control groups were 60.61, 61.01 and 59.39 correspondingly. The attained F-ratio for the post-test was 51.61 and the table F-ratio was 3.93. Hence compared to table F-ratio the obtained F-ratio was significant at 0.05 level of confidence for the degree of freedom 1 and 98. In this study was established that the differences between the post test means of the subjects were significant.

The adjusted post-test means of the yogic practice I & II and control groups were 60.63, 61.08 and 59.38 respectively. The obtained F-ratio for the adjusted post-test means was 54.54 and the table F-ratio was 3.93. Hence the adjusted post-test mean F-ratio was significant at 0.05 level of confidence for the degree of freedom 1 and 97. This proved that there was a significant difference among the means due to the experimental trainings on Anterior Average Trajectory. Scheffe's post hoc test was conducted to find out the paired mean significant difference between means.

The pre, post and adjusted post test means on Anterior Average Trajectory were accessible through bar diagram for enhanced considerate of the results of this study in Figure- II

FIGURE - II

PRE, POST AND ADJUSTED POST TEST MEANS DIFFERENCES OF THE, YOGIC PRACTICE AND CONTROL GROUPS ON ANTERIOR AVERAGE TRAJECTORY (in centimetres)



Discussion On Anterior Average Trajectory

The results presented in table XI showed that obtained adjusted means on Anterior Average Trajectory among yogic practices group I & II with mean value of 60.63, 61.08 and control group with mean value of 59.38. The differences among pre test scores, post test scores and adjusted mean scores of the subjects were statistically treated using ANCOVA and the obtained F values were 1.29, 51.61 and 54.54 respectively. It was found that obtained F value on pre test scores were not significant and the obtained F values on post test and adjusted means were significant at 0.05 level of confidence as these were greater than the required table F value of 3.93. The ANCOVA test proved that due to twelve weeks training of yogic practices has increased Anterior Average Trajectory than the control group and the differences were significant at 0.05 level. Further, it clearly indicates that yogic practices group significantly improved Anterior Average Trajectory of the school boys.

Discussion on Hypothesis

This study was proved that there was a significant improvement on physiological variable on forced vital Capacity among yogic practices groups I and II compare to the control group. Hence the hypothesis was accepted in this study. This study was proved that there was a significant improvement on selected Biomechanical variable on Anterior Average Tracetory among yogic practices groups I and II compare to the control group. Hence the hypothesis was accepted.

Conclusions

Analysis of the data, the Yogic Practices has shown significant improvement in all the selected physiological variable forced Vital Capacity and Bio-mechanical variable Anterior Average Tragectory. when compared to the control group.

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