International Journal of Yoga, Physiotherapy and Physical Education
www.sportsjournal.in
ISSN: 2456-5067
Received: 18-03-2022, Accepted: 04-04-2022, Published: 19-04-2022
Volume 7, Issue 2, 2022, Page No. 69-71

Effects of different modes of yoga practice on muscular endurance and vital capacity among middle aged obese men

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Abstract
The purpose of the present study was to find out the effect of different modes of yoga practice on muscular endurance and vital capacity among middle aged obese men with BMI of > 0.30 (kg/m^2). For this purpose, forty five middle aged obese men residing around Annamalainagar, Chidambaram, Cuddalore district, Tamilnadu, were selected as subjects. The age of the subjects were ranged from 45 to 50 years. They were divided into three equal groups, each group consisted of fifteen subjects, in which experimental group - I underwent Bihar School of yoga practice, experimental group - II underwent B.K.S. Iyengar yoga practice and group - III acted as control that did not participate in any special activities apart from their regular and routine activities. The training period for the study was six days (Monday to Saturday) in a week for twelve weeks. Prior and after the experimental period, the subjects were tested on muscular endurance and vital capacity. Muscular endurance was assessed by conducting sit –ups test and vital capacity was measured by using expirograph. The Analysis of Covariance (ANCOVA) was applied to find out any significant difference between the experimental groups and control group on selected criterion variables. The result of the study shows that the Bihar School of Yoga practice group and B.K.S. Iyengar Yoga practice group were increased the muscular endurance and vital capacity significantly. It was concluded from the results of the study that Bihar School of Yoga practice and B.K.S. Iyengar Yoga practice has bring positive changes in muscular endurance and vital capacity as compare to the control group. Moreover it was also concluded that there was no significant difference found between the experimental groups in muscular endurance and vital capacity.

Keywords: Bihar School of Yoga and B.K.S. Iyengar Yoga, muscular endurance, vital capacity, ancova

Introduction
Yoga is one of the most ancient cultural heritages 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. [1] Yoga is one of the orthodox systems of Indian philosophy. It was collated, coordinated and systematized by Patanjali in his classical work, the Yoga Sutras, which consists of 185 terse aphorisms. Yoga is a complete science of life that originated in India many thousands of years ago. It is the oldest system of personal development in the world, encompassing body, mind and spirit. [2]

Bihar School of Yoga (Swami Satyananda Saraswati) is a type of yoga which integrates intellect, emotion and action: the head, heart and hands. Known as Satyananda Yoga or Bihar Yoga (the School lies in Bihar in India), the system embraces many different philosophies and encourages students to examine the very essence of their being and make gradual changes to improve their awareness. Satyananda Yoga is considered truly holistic and suitable for everyone. [3] Iyengar Yoga, named after and developed by B.K.S. Iyengar, is a form of Hatha Yoga that has an emphasis on detail, precision and alignment in the performance of posture (asana) and breath control (pranayama). [4]

Recent scientific studies of the effects of yoga and meditation on health validates its ability to improve virtually every aspect of our functioning—brain function, hormonal function, sleep, mood, balance, etc. More active practices followed by relaxing ones lead to deeper relaxation than relaxing practices alone, documented by research from Swami Vivekananda yoga research foundation near Bangalore city and possibility of neuroplasticity bringing about changes in the hypo-pituitary–pancreatic axis. [5] The improvement in the lipid levels after yoga could be due to increased hepatic lipase and lipoprotein lipase at cellular level, which affects the metabolism of lipoprotein and thus increase uptake of triglycerides by adipose tissues. [6, 7] Direct stimulation of the pancreas by the postures can rejuvenate its capacity to produce insulin. [8] Regeneration of pancreatic beta cells could occur by yoga exercises that promote blood circulation in the region of the pancreas and yoga asanas that stimulate the meridian of pancreas also could assist in some diabetic patients. [9] Pranayama practices, stretches the lung tissue producing inhibitory signals from action of slowly adapting receptors and

hyperpolarizing currents. These inhibitory signals coming from cardio-respiratory region involving vagi are believed to synchronize neural elements in the brain leading to changes in the autonomic nervous system; and a resultant condition characterized by reduced metabolism and parasympathetic dominance. [10]

Methodology

Thirty middle aged obese men with BMI of > 0.30 (kg/m^2) residing around Annamalainagar, Chidambaram, Cuddalore district, Tamilnadu were selected as subjects. The age of the subjects were ranged from 45 to 50 years. The selected subjects were divided into three equal groups, each group consisted of fifteen subjects, in which group - I (n = 15) underwent Bihar School of Yoga practice, experimental group - II (n = 15) underwent B.K.S. Iyengar Yoga practice and group - III (n = 15) acted as control, which did not participate in any special activities apart from their regular curricular activities. Different modes of yoga practices were conducted six days (Monday to Saturday) per week for twelve weeks. The researcher consulted with the yoga experts and selected the following variables as criterion variables: 1. muscular endurance and 2. vital capacity. The muscular endurance was assessed by conducting sit-ups test and vital capacity was measured by using expirograph. For the purpose of collection of data the subjects were asked to report at early morning, one day prior and one day after experimental period.

Results

The data collected on muscular endurance and vital capacity among experimental and control groups were analyses and the results were presented in Table – I.

Table 1: Analysis of Covariance on Selected Criterion Variables Among Experimental Groups and Control Group

Variable Name	Group Name	Bihar School of Yoga Practice Group	B.K.S. Iyengar Yoga Practice Group	Control Group	'F' Ratio
Muscular endurance (Nos./min)	Pre-test Mean ± S.D	14.87 ± 1.36	15.40 ± 1.30	15.20 ± 1.52	0.56
	Post-test Mean ± S.D.	18.33 ± 1.30	18.93 ± 1.62	15.07 ± 1.50	29.91*
	Adj. Post-test Mean	18.566	18.736	15.031	70.59*
Vital Capacity (Ltrs.)	Pre-test Mean ± S.D	3.44 ± 0.14	3.46 ± 0.12	3.42 ± 0.12	0.352
	Post-test Mean ± S.D.	3.70 ± 0.13	3.71 ± 0.15	3.41 ± 0.16	20.69*
	Adj. Post-test Mean	3.70	3.696	3.430	39.84*

*Significant at.05 level of confidence. (The table values required for significance at.05 level of confidence with df 2 and 42 and 2 and 41 were 3.22 and 3.21 respectively).

Table – I shows that pre-test means 'f'- ratio of Bihar School of Yoga practice group, B.KS Iyengar practice group and control group on muscular endurance were 0.56, which was insignificant at 0.05 level of confidence. The post- and adjusted post-test means 'f' - ratio value of experimental groups and control group was 29.91 and 70.59, which was significant at 0.05 level of confidence. The pre-test mean 'f' - ratio of Bihar School of Yoga practice group, B.KS Iyengar practice group and control group on vital capacity was 0.352, which was insignificant, at 0.05 level of confidence. The post- and adjusted post test mean 'f' - ratio value of experimental groups and control group was 20.69 and 39.84, which was significant at 0.05 level of confidence. Further to find out which experimental group have better influence on selected criterion variables, the Scheffe *S* post-hoc test was applied and presented in Table – II.

Table 2: Scheffĕ S Test for the Difference Between the Adjusted Post-Test Mean of Selected Criterion Variables

Adjusted Post-test Mean on Muscular endurance				
Bihar School of Yoga Practice Group	**B.K.S. Iyengar Yoga Practice Group**	**Control Group**	**Mean Difference**	**Confidence interval at.05 level**
18.566		15.031	3.535*	0.894
18.566	18.736		0.17	0.894
	18.736	15.031	3.70*	0.894
Adjusted Post-test Mean on Vital Capacity				
3.700		3.430	0.27*	0.09
3.700	3.696		0.004	0.09
	3.696	3.430	0.266*	0.09

* Significant at.05 level of confidence.

Table – II shows that the Scheffĕ *S* Test for the difference between adjusted post-test mean on muscular endurance of Bihar School of Yoga practice group and control group was 3.535 and BKS Inyengar Yoga Practice group and control group was 3.70, which were significant at.05 level of confidence. But there was no significant difference was occurred between Bihar School of Yoga practice group and BKS Inyengar Yoga Practice group (0.17). There was a significant difference on vital capacity between Bihar School of Yoga

practice group and control group was 0.27 and BKS Inyengar Yoga Practice group and control group 0.266. But there was no significant difference was occurred between Bihar School of Yoga practice group and BKS Inyengar Yoga Practice group (0.001).

Conclusions

The experimental groups such as, Bihar School of Yoga practice group and B.K.S. Iyengar Yoga practice group have achieved a significant improvement in selected criterion variables such as muscular endurance. This result is in line with the findings of Shiraishilida and Bezerra (2016) [11] also found that young women have significantly improved their muscular endurance after yoga practice. Tran *et al* (2007) [12] also found that Hatha yoga improved the muscular endurance among adults. Senthilkumar and D. Sakthignanavel (2018) [13] found that there was a significant improvement in muscular endurance after yogic practice among silambam practicing students. Vital capacity increases significantly for both the training groups when compared with the control group. Nayak *et al* (2015) [14] found that there was a significant improvement in vital capacity after Kapalabhati practice. Birkel and Edgren (2009) [15] recommended Hatha yoga is a better tool to improve the vital capacity for the college students. Abel, Lloyd and Williams (2013) [16] found that the vital capacity was improved after regular practice of yoga. Hakked, Balakrishnan and Krishnamoorthy (2017) [17] found the young swimmers has improves the lung functions after the yogic breathing practices. It was also found that there was no significant difference found between the Bihar School of Yoga practice group and B.K.S. Iyengar Yoga practice group on selected criterion variables.

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