

ISSN: 2456-4419

Impact Factor: (RJIF): 5.18

Yoga 2019; 4(1): 1512-1515

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www.theyogicjournal.com

Received: 11-11-2018

Accepted: 05-01-2019

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## Effect of 3-weeks of surya nadi pranayama on maximal oxygen consumption (VO<sub>2</sub> max)

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### Abstract

**Study Aim:** Aim of this investigation was to determining the effect of 3-weeks of Surya Nadi Pranayama on Maximal Oxygen Consumption (VO<sub>2</sub> max).

**Material and Methods:** Twenty-four, university level girls of Department of Physical Education (T), Guru Nanak Dev University, Amritsar between the age group of 21 - 26 years volunteered to participate in the study. The subjects were purposively assigned into two groups: Group-A: Experimental (n<sub>1</sub> = 12) and Group-B: Control (n<sub>2</sub> = 12). All the subjects were informed about the objective and protocol of the study. The sample size (N=24) was calculated using the G\*Power 3.1.9.7 software. A power of 0.80 (1-β err prob) and significance level (α) of 0.05. Cooper's 12-minute run test was used to measure maximal oxygen consumption (VO<sub>2</sub> max).

**Statistics:** Statistical analyses were performed using the Statistical Package for the Social Sciences for Windows version 16.0 software (SPSS Inc., Chicago, IL). Data is expressed as the mean ± SD. Student t test for paired samples was utilized to compare the means of the pre-test and the post-test. The level of significance was set at 0.05.

**Results:** The t-value in case of experimental group was 0.843 and for control group it was 0.312. The data does suggest that the differences between pre-test and post-test of Maximal Oxygen Consumption (VO<sub>2</sub> max) in experimental and control group are insignificant.

**Keywords:** Pranayama, surya nadi, Maximal Oxygen Consumption (VO<sub>2</sub> max)

### Introduction

Yoga is a methodical effort towards self-perfection by the development of the potentialities latent in the individual. It is a process by which the limitations and imperfections can be washed away resulting in a super human race [1]. Yoga is universally benefiting all people of all ages. The study of Yoga is fascinating to those with a philosophical mind and is defined as the silencing of the mind's activities which lead to complete realization of the intrinsic nature of the Supreme Being [2]. The science of Yoga Nidra is based on the receptivity of consciousness [3]. Obesity is a medical condition in which excess body fat has accumulated to the extent that it may have a negative effect on health, leading to reduced life expectancy and/or increased health problems. Increasing evidence suggests that meditation and yoga practices have positive effects on the regulation of the hypothalamic-pituitary-adrenal axis and inflammatory processes [4, 5, 6]. Studies have suggested that yoga and other contemplative practices may be equally effective as pharmacotherapy in the treatment of mood disorders such as anxiety and depression [7, 8].

### Material and Methods

#### Participants

Twenty-four, university level girls of Department of Physical Education (T), Guru Nanak Dev University, Amritsar between the age group of 21 - 26 years volunteered to participate in the study. The subjects were purposively assigned into two groups:

- Group-A: Experimental (n<sub>1</sub> = 12)
- Group-B: Control (n<sub>2</sub> = 12)

Experimental group was subjected to 3-weeks of Surya Nadi Pranayama. All the subjects were informed about the objective and protocol of the study. The sample size (N=22) was calculated using the G\*Power 3.1.9.7 software.

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A power of 0.80 (1-β err prob) and significance level (α) of 0.05. The Protocol of power analysis is brought forth in at **Error! Reference source not found.**

**Procedure**

Cooper’s 12-minute run test was used to measure maximal oxygen consumption (VO<sub>2</sub> max). All the measurements were collected three times and average of three data sets was taken for further analysis. A study flow diagram is presented in

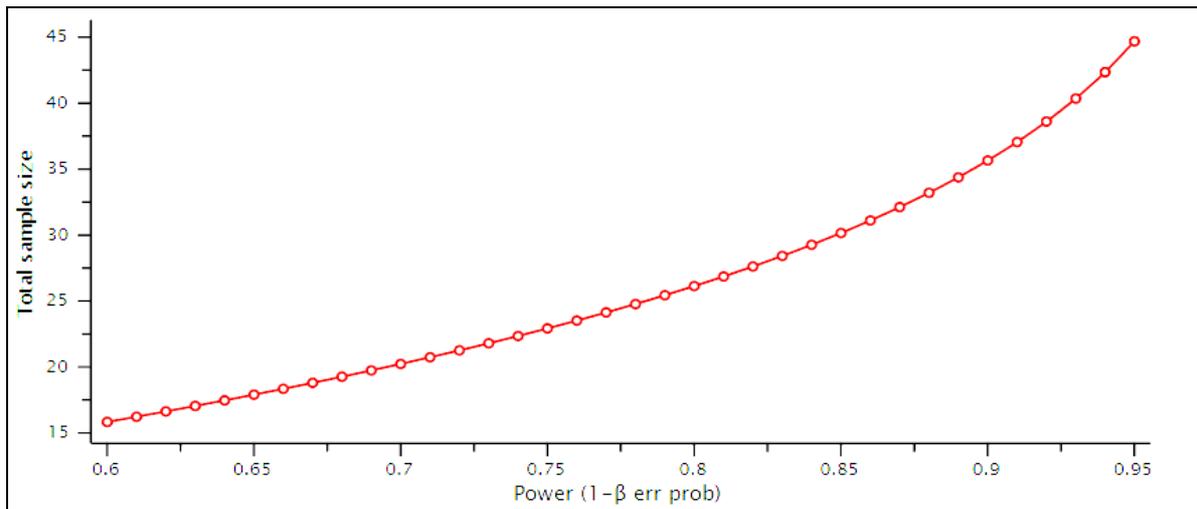
figure 2.

**Statistical Analysis**

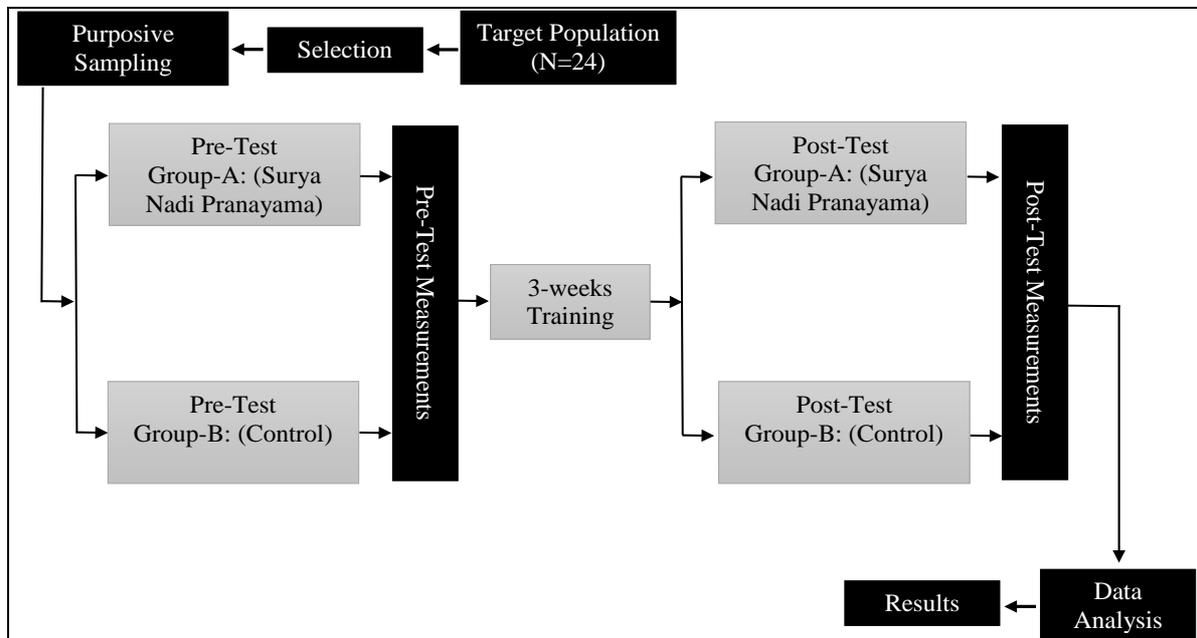
Statistical analyses were performed using the Statistical Package for the Social Sciences for Windows version 16.0 software (SPSS Inc., Chicago, IL). Data is expressed as the mean ± SD. Student t test for paired samples was utilized to compare the means of the pre-test and the post-test. The level of significance was set at 0.05.

**Table 1:** Distribution and demographics of subjects.

Distribution and Demographics (Mean ± S.D.)			
Variables	Total (N = 24)	Surya Nadi Pranayama (n <sub>1</sub> = 12)	Control Group (n <sub>2</sub> = 12)
Age (yrs)	23.70±1.26	23.83±1.19	23.58±1.37
Height (cm)	158.62±3.84	159.33±3.79	157.91±3.91
Weight (kg)	56.19±3.39	56.35±2.96	56.03±3.90



**Fig 1:** Mean Difference between two dependent means α err prob – 0.05, Effect size dz – 0.5.



**Fig 2:** Study flow chart

**Results**

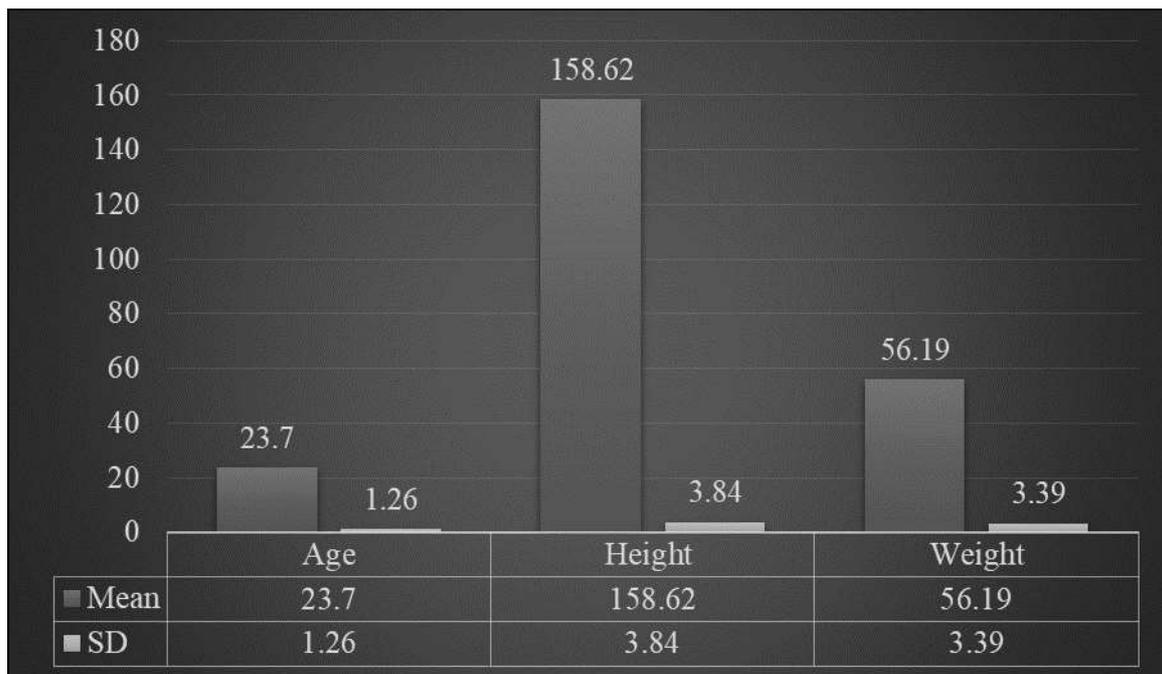
**Table 1:** Descriptive statistics of maximal oxygen consumption (VO<sub>2</sub> max) of experimental (pre-test & post-test) and control (pre-test & post-test).

	<b>Experimental (Pre-Test)</b>	<b>Experimental (Post-Test)</b>
Sample size	12	12
Arithmetic mean	34.8900	35.2383
95% CI for the mean	32.6838 to 37.0962	33.2565 to 37.2202
Variance	12.0573	9.7295
Standard deviation	3.4724	3.1192
Standard error of the mean	1.0024	0.9004
Mean difference		0.3483
Standard deviation of differences		1.4320
Standard error of mean difference		0.4134
95% CI of difference		-0.5615 to 1.2582
Test statistic t		0.843
Degrees of Freedom (DF)		11
Two-tailed probability		P = 0.4174
	<b>Control (Pre-Test)</b>	<b>Control (Post-Test)</b>
Sample size	12	12
Arithmetic mean	32.3600	32.2042
95% CI for the mean	30.2229 to 34.4971	29.9588 to 34.4495
Variance	11.3132	12.4884
Standard deviation	3.3635	3.5339
Standard error of the mean	0.9710	1.0201
Mean difference		-0.1558
Standard deviation of differences		1.7310
Standard error of mean difference		0.4997
95% CI of difference		-1.2557 to 0.9440
Test statistic t		0.312
Degrees of Freedom (DF)		11
Two-tailed probability		P = 0.7610

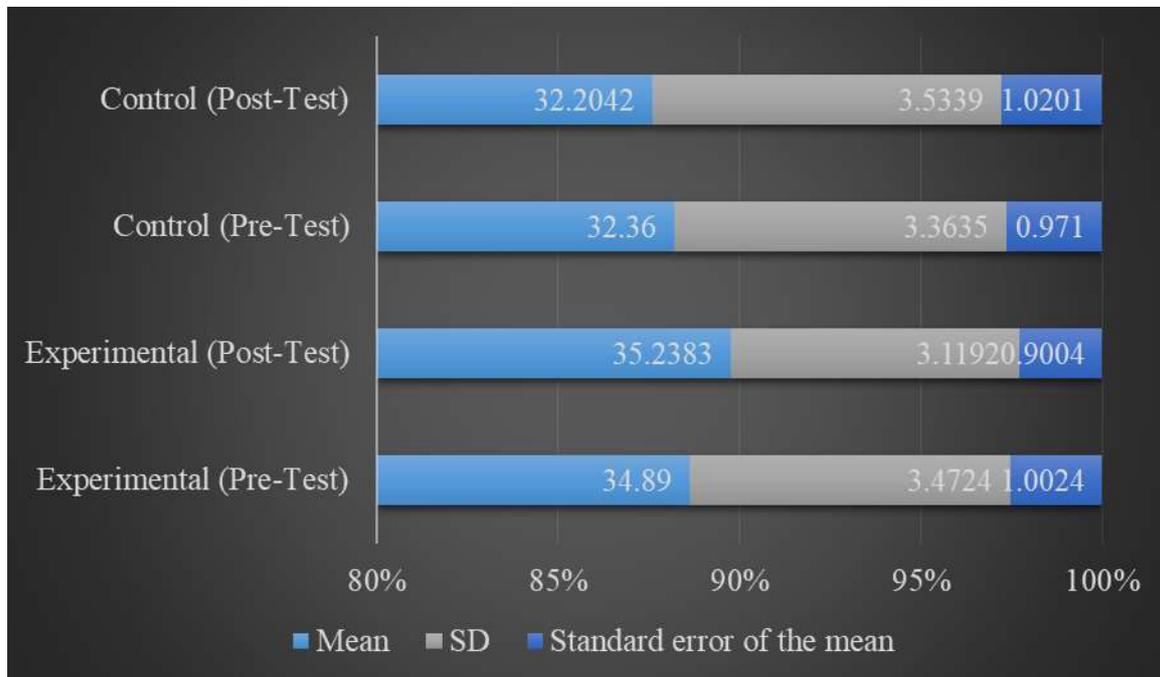
**Maximal Oxygen Consumption (VO<sub>2</sub> max)**

A glance at Table-2 shows the Mean and Standard Deviation values of Maximal Oxygen Consumption (VO<sub>2</sub> max) of pre-test and post-test of experimental group was 34.8900 ± 3.4724 and 35.2383 ± 3.1192 respectively. However, the Mean and Standard Deviation values of Maximal Oxygen Consumption

(VO<sub>2</sub> max) of pre-test and post-test of control group were 32.3600 ± 3.3635 and 32.2042 ± 3.5339. The t-value in case of experimental group was 0.843 and for control group it was 0.312. The data does suggest that the differences between pre-test and post-test of Maximal Oxygen Consumption (VO<sub>2</sub> max) in experimental and control group are insignificant.



**Fig 3:** Distribution and demographics of subjects.



**Fig 4:** Mean, SD and standard error of the mean of maximal oxygen consumption (VO<sub>2</sub> max) of experimental (pre-test & post-test) and control (pre-test & post-test) groups.

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