

Immediate Effect of *Nadi Shodhana Pranayama* on Blood Glucose, Heart Rate and Blood PressureManoranjan Tripathy¹ & Bisweswari Sahu²¹Ph.D Scholar, Dev Sanskriti Vishwavidyalaya, Haridwar, Uttarakhand, India. manoranjanonly@gmail.com²Ph.D Scholar, H.N.B.G, Garhwal, Srinagar, Uttarakhand, India. bisweswari1978@gmail.com

Abstract: Background: *Nadi shodhana Pranayama* ensures that the whole body is nourished by an extra supply of oxygen. The beneficial effects of practicing *Nadi shodhana Pranayama* on body functions and ability to combat stressors in our daily life has been well recorded in our ancient yogic books. Yogic discipline aims at disciplining of organ system functions acting at cortical level. **Objectives:** The present study aimed at comparing the immediate effect of *Nadi shodhana Pranayama* practice on blood glucose level, heart rate and blood pressure. **Methods:** The study was conducted on male yogic practitioners from Dev Sanskriti Vishwavidyalaya, Haridwar who gave consent and performed *Nadi shodhana Pranayama* correctly were included in the study. (N=25, mean and SD of age respectively 20±2 as the scores were normally distributed). A detailed demographic profile with a structured questionnaire and observational checklist was filled for data collection. The data were collected on the subjects on selected physiological variables before and after the immediate practice of *Nadi shodhana Pranayama*. The blood glucose level, heart rate and blood pressure were measured by glucometer, heart rate monitor and sphygmomanometer during mentioned time. The tests were administered before *Nadi shodhana Pranayama* and immediately after *Nadi shodhana Pranayama* practice at early morning in empty stomach. **Results:** A Paired t-test was employed as statistical analysis to compare the mean at 5% level of significance. Finally, significant difference was shown in blood glucose level from 89.40± 2.30 to 74.80± 3.10 and heart rate was significantly decreased from 69.70 ± 5.47 to 66.40 ± 6.43. Significant difference was found in systolic blood pressure (from 128 ± 3.15 to 122 ± 3.28) during *Nadi Shodhana Pranayama* where diastolic blood pressure was significantly decreased after *Nadi Shodhana Pranayama* (from 84 ± 3.45 to 82 ± 3.34). **Conclusion:** Thus, it can be concluded that *Nadi Shodhana Pranayama* could reduce the blood glucose level, heart rate and blood pressure by activating the parasympathetic nervous system which enhance the healthy cardiovascular functioning of the body control high blood glucose by stimulating the insulin secretion from pancreas. The data were entered in SPSS and Statistical analysis was done using version 20.

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Key Words: *Nadi shodhana Pranayama*, Blood Glucose Level, Heart Rate & Blood Pressure.

Introduction:

In the present era stress is a common problem that affects almost all of us at some point in our lives and increasing day by day. Prolonged psychological stress may negatively impact health such as cognitive impairment with aging, depressive illness, and expression of disease through accelerating the sympathetic nervous activity which results on increased heart rate, blood pressure and hormonal activity. It is observed that stress increases both short-term and long-term blood glucose levels and if it increases beyond the normal limits, then it can cause persistent high blood glucose levels resulting into diabetes mellitus (Kim, 2014). Many ways can be adopted (e.g., regular physical exercise, change of lifestyle, change of food habit, etc.) to cope up with stress. Earlier it has been reported that yoga and slow *pranayamic* breathing are beneficial for the treatment of cardiopulmonary diseases, autonomic nervous system imbalances, and psychological or stress-related disorders as one of the best relaxation techniques

(Brown, Gerbarg, & Muench, 2013). Tripathy (2018) conducted a study on of aggression and self confidence among the different disciplines of university male students and found that among different discipline of University male students in relation to self-confidence ($p < 0.05$). On the basis of findings it was concluded that the mean score of aggression of Computer Science students (89.17) is more than the Journalism & Mass Communication and Tour & Travel Management students and the mean score of self-confidence of Journalism & Mass Communication students (27.57) is more than the Computer Science and Tour & Travel Management students. Tripathy & Sahu (2018) conducted a study on Adjustment of High school students in Relation to their gender boys and girls and found that there is no significant difference in Home, School and Emotional adjustment of boys and girls high school student. But there is significant difference in Social adjustment of boys & girls high school students at 0.05 levels. It means boys Social adjustment are better than girls.

Tripathy (2018) observed the effect of *Chandra Namaskara* and Om Meditation on the aggression level of male adolescents. For this study 45 subjects (college boys) were randomly selected from Bhawanipatna Government College, Bhawanipatna, Kalahandi (Odisha) by using simple random sampling without Replacement. Results indicated that the *Chandra Namaskara* and Om Meditation significantly decrease the aggression level of the participants.

Pranayama is generally defined as breath control. The word *Pranayama* is comprised of two word i.e. (*Prana + Ayama*). *Prana* means vital energy and *Ayama* is defined as extension or expansion. Thus *Pranayama* means extension or expansion of the dimension of *Prana*. The techniques of *Pranayama* provide the method where by the life force can be activated and regulated in order to go beyond one's normal boundaries or limitations and attain a higher state of vibratory energy. (**Satyananda, 2002**). Different types of *pranayama* techniques are adopted resulting different physiologic responses. *Kapalbhati Pranayama* was found to cause autonomic activation results in increased blood pressure and heart rate whereas *Nadishodhana Pranayama* act as parasympathetic activation (**Raghuraj, et al. 1998**).

According to **Satyananda (2002)** the word *Nadi* means channel or flow of energy and *Shodhana* means purification. *Nadi Shodhana* means the practice which purifies the *nadis*. Most of the studies have shown the effect of different regular *Pranayama* practices for a period a time (e.g. 1 month, 2 month, 3 month). In this present study the immediate effect of *Nadi Shodhana Pranayama* has been examined on heart rate variability, blood pressure and blood glucose level and hypothesized that there would be significant difference between before and after the *Nadi shodhana Pranayama* practice of 20 minutes (5minutes of 4 phase and with 30 seconds rest between each phase).

Aim & Objective:

The present study aimed at comparing the immediate effect of *Nadi Shodhana Pranayama* practice on blood glucose level, heart rate and blood pressure. Following are the objectives of the present study:

1. To analyze the efficacy of *Nadi shodhana Pranayama* on blood glucose level.
2. To analyze the efficacy of *Nadi shodhana Pranayama* on heart rate.
3. To analyze the efficacy of *Nadi shodhana Pranayama* on blood pressure (systolic).
4. To analyze the efficacy of *Nadi shodhana Pranayama* on blood pressure (diastolic).

Hypothesis:

In present research, researcher formulated the following null hypotheses for empirical verification. Which are as follows:

H₀₁: There is no significant effect of *Nadi shodhana Pranayama* on blood glucose level.

H₀₂: There is no significant effect of *Nadi shodhana Pranayama* on heart rate.

H₀₃: There is no significant effect of *Nadi shodhana Pranayama* on blood pressure (systolic).

H₀₄: There is no significant effect of *Nadi shodhana Pranayama* on blood pressure (diastolic).

Population:

In the current study, the male yogic practitioners studying in the Dev Sanskriti Vishwavidyalaya, Haridwar constitute the population and age range between 18-22 years.

Sample & Sampling:

Samples of 25 subjects by the simple random sampling technique (Lottery Method) were taken for the purpose of the present study.

Design of the Study:

Single group pre-post design were used to fulfill the purpose of finding out the efficacy of *Nadi Shodhana Pranayama* practice of 20 minutes on blood pressure, blood glucose and heart rate.

Training Protocol:

The subjects were practice the *Nadi Shodhana Pranayama* for 20 minutes. The subjects were instructed to sit in any meditative posture, adopt *Nasika Mudra*, close the right nostril with the right thumb and exhale completely through the left nostril. Then inhale deeply through the left nostril, close the left nostril with ring and little finger of *Nasika Mudra*, release the right nostril. Now exhale slowly and completely through the right nostril. Inhale deeply through the right nostril then close the right nostril and exhale through the left nostril. This is 1 round of *Nadi Shodhana Pranayama* repeat it 20 rounds.

Test Administration:

The subjects were asked to sit in comfortable position at morning after overnight sleep and blood pressure, heart rate and fasting blood glucose level were tested. After those 20 minutes *Nadi Shodhana Pranayama* was performed by the subjects under the guidance of researcher and again blood pressure, heart rate, blood glucose level were tested immediately by using sphygmomanometer, heart rate monitor and glucometer respectively.

Statistical Test:

Paired t-test were employed for analysis of the results of selected physiological parameters at 5% level of significance. The data were entered in SPSS and Statistical analysis was done using version 20.

Results:

Paired t-test was employed to analyze the result as the same subjects were tested before and after the *Nadi Shodhana Pranayama*. Table no. 1 shown that significant difference were found ($p > 0.05$) in blood

glucose level. The mean blood glucose level was decreased significantly after 20 minutes of *Nadi Shodhana Pranayama* from 89ml/dl to 74ml/dl and the mean heart rate was also decreased significantly ($p>0.05$) during immediate practice of 20 minutes from 69beat/min to 66 beat/min at 0.05 shown in table no.2. The systolic Blood pressure of the participants shown significant difference ($P<0.05$) after *Nadi Shodhana Pranayama* 128 mmHg to 122 mmHg

where diastolic blood pressure was decreased significantly after the *Pranayama* from 84mmHg to 82mmHg at 0.05 shown in table 4 and 3 respectively. Mean and standard deviation for the different variables are given below: blood glucose level, heart rate, systolic blood pressure and diastolic blood pressure are shown in table 1, and 2, 3 and 4 respectively.

H₀₁: There is no significant effect of *Nadi Shodhana Pranayama* on Blood Glucose Level.

Table no 1. Pre & Post Result of *Nadi Shodhana Pranayama* on Blood Glucose Level

Outcome	N	Pre Intervention		Post Intervention		SE _D	r*	t*
		Mean	SD	Mean	SD			
Blood Glucose	25	89	8.75	74	5.23	1.64	0.40	9.14

df = n-1(For paired group)=24

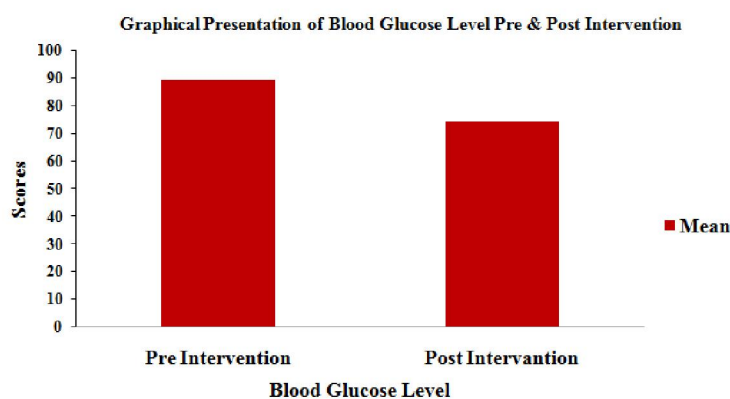


Fig: - 1. Mean Score of Blood Glucose Level Pre & Post Intervention *Nadi Shodhana Pranayama*

H₀₂: There is no significant effect of *Nadi Shodhana Pranayama* on Heart Rate.

Table no 2. Pre & Post Result of *Nadi Shodhana Pranayama* on Heart Rate

Outcome	N	Pre Intervention		Post Intervention		SE _D	r*	t*
		Mean	SD	Mean	SD			
Heart Rate	25	69.70	7.25	66.40	6.23	1.38	0.48	2.39

df = n-1(For paired group)=24

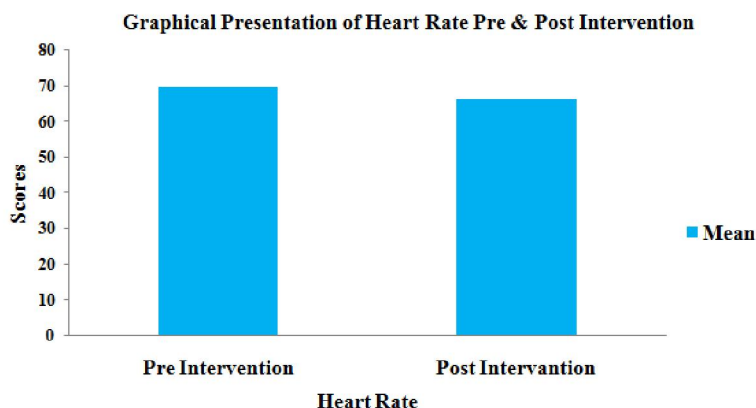


Fig: - 2. Mean Score of Heart Rate Pre & Post Intervention *Nadi Shodhana Pranayama*

H_{03} : There is no significant effect of *Nadi Shodhana Pranayama* on Blood Pressure (Systolic).

Table no 3. Pre & Post Result of *Nadi Shodhana Pranayama* on Blood Pressure (Systolic)

Outcome	N	Pre Intervention		Post Intervention		SE _D	r*	t*
		Mean	SD	Mean	SD			
Blood Pressure (Systolic)	25	128	8.47	122	6.39	1.60	0.45	3.75

df = n-1(For paired group)=24

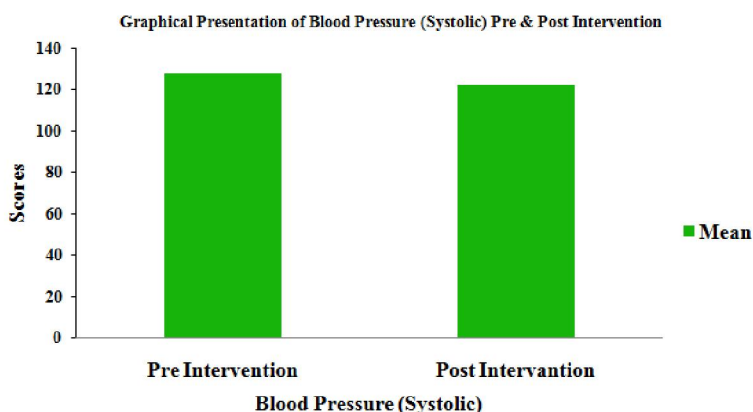


Fig: - 3. Mean Score of Blood Pressure (Systolic) Pre & Post Intervention *Nadi Shodhana Pranayama*

H_{04} : There is no significant effect of *Nadi Shodhana Pranayama* on Blood Pressure (Diastolic).

Table no 3. Pre & Post Result of *Nadi Shodhana Pranayama* on Blood Pressure (Diastolic)

Outcome	N	Pre Intervention		Post Intervention		SE _D	r*	t*
		Mean	SD	Mean	SD			
Blood Pressure (Diastolic)	25	84	4.13	82	3.16	0.81	0.41	2.47

df = n-1(For paired group)=24

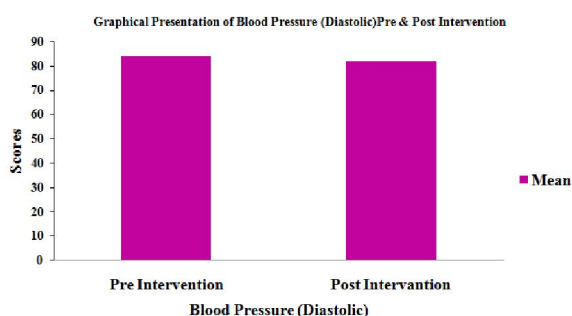


Fig: - 4. Mean Score of Blood Pressure (Diastolic) Pre & Post Intervention *Nadi Shodhana Pranayama*

Discussion & Interpretation:

Pranayama increases frequency and duration of inhibitory neural impulses during inspiration is increased during *pranayama* as lung tissues are being stretched, producing inhibitory signals by action of slowly adapting stretch receptors and hyper polarization current. Both inhibitory impulses and hyper polarization current are known to synchronize neural elements leading to the modulation of the

nervous system and decreased metabolic activity indicative of the parasympathetic state. *Pranayama*'s physiologic mechanism through a cellular and systems level perspective, involving both neural and non-neural elements (Jerath, et al. 2006).

In a study done by Telles, Nagarathna, & Nagendra in 1994 on "Breathing through a particular nostril can alter metabolism and autonomic functions", at Vivekananda yogic research foundation, Bangalore. They observed that whenever a person breaths with a particular nostril i.e., right /left / alternative nostril, there will be variations in GSR, heart rate and Respiratory rate. They also found that the oxygen consumption during any of these methods increased by 18-20%.

In such way, during *Nadi Shodhana Pranayama* breathing parasympathetic response is induced due to synchronization within the hypothalamus and the brainstem which activates increased vagal activity resulting in small reduction in the heart rate (Raghuraj, et al. 1998) which was significantly decreased after immediate practice of *Nadi Shodhana Pranayama*. Both through right and left nostril

breathing has been shown an increased base-line oxygen consumption which is the indication of sympathetic discharge of the adrenal medulla (Telles, Nagarathna, & Nagendra, 1994). A study conducted by Tripathy (2018) the effect of *Anuloma-Viloma Pranayama* and *Kpalabhati* on resting pulse rate and stress of school going children found that effective in reducing perceived resting pulse rate and stress. *Kpalabhati* was more suitable for subjects with stable resting pulse rate and *Pranayama* was more suitable for subjects with stable stress. On post-test analysis, sample size (150 students) was found adequate for the study.

Earlier studies shown that both systolic and diastolic blood pressures are significantly decreased due to decreased in peripheral resistance (Pramanik, et al. 2008). Systolic blood pressure (SBP), diastolic blood pressure (DBP) and heart rate (HR). Imbalances in these lead to cardiovascular disorders such as hypertension, ischemia, infarction, etc., Numerous studies indicate a strong association between compromised ANS (e.g., decreased vagal activity or increased sympathetic activity) and sudden and non-sudden cardiac death (Muralikrishnan, et al. 2012).

Sympathetic tone in the skeletal muscle blood vessels has been withdrawal due to pulmonary stretch receptors leading to widespread of vasodilatation which causing decreased in peripheral resistance (Daly & Robinson, 1968). In this present study both systolic and diastolic blood pressure also decreased significantly.

It has been found that if the carbon dioxide level in the blood decreases through increased elimination of carbon dioxide, the normal respiratory rate becomes slower (Muktibodhananda, 2011). There is an increased release of carbon dioxide causing subsequently relaxed centre and hyperventilation does not occur due to the equal pace of inhalation and exhalation in *Nadi Shodhana Pranayama*.

During the practice of *Nadi shodhana Pranayama* (slow inhalation and deep exhalation) pancreas get messages due to the movement of abdomen (inward and upward) enhancing the insulin secretion which maintain the blood glucose level through glucose utilization and shown significant mean difference (Table & Fig. no. 1) Pre & Post intervention of *Nadi Shodhana Pranayama*.

It is claimed that during *Nadi Shodhana Pranayama* practice (expansion and contraction lungs) the whole body is nourished by an extra supply of oxygen (Satyananda, 2002). Carbon dioxide is efficiently expelled and the blood is purified of toxins and shown significant mean difference (Table & Fig. no. 2, 3 & 4) Pre & Post intervention of *Nadi Shodhana Pranayama*. The brain centers are

stimulated to work nearer to their optimum capacity. It also induces tranquility, clarity of thought and concentration, and is recommended for those engaged in mental work. It increases vitality and lowers levels of stress and anxiety by harmonizing the *pranas*. It clears pranic blockages and balances *ida* and *pingala nadis*, causing *sushumna nadi* to flow, which leads to deep states of meditation and spiritual awakening.

Conclusion:

So it could be concluded that this present study shown there is immediate effect of *Nadi Shodhana Pranayama* on blood glucose level and heart rate and diastolic blood pressure by activating the parasympathetic nervous system which enhance the healthy cardiovascular functioning of the body control high blood glucose by stimulating the insulin secretion from pancreas.

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