

RESEARCH ARTICLE

Assessment of Effects of Traditional Exercise on Galvanic Skin Response, Pulse Rate, and Blood Pressure in Prehypertensive Patients Attending Out-patient Department Clinic of Janaki Medical College, NepalRajesh Chandra Das^{1*}, Bibeka Nanda Jha²¹Department of Medicine, Janaki Medical College, Janakpur, Nepal, South Asia, ²Department of Dermatology, Janaki Medical College, Janakpur, Nepal, South Asia**Received: 15 June 2019; Revised: 15 July 2019; Accepted: 09 October 2019****ABSTRACT**

Psychological stress, in this era of urbanization, has become a part and parcel of our lives, has led to a serious problem affecting different life situations and carries a wide range of health-related disorders, and has to observe the effects of traditional exercise pranayama on galvanic skin response (GSR), pulse rate, and blood pressure (BP). This was an open-labeled, prospective, uncontrolled, single-centered, single-arm, comparative, and clinical intervention study conducted in the Department of Medicine, Janaki Medical College, for 2 months period January–February 2018 on 15 prehypertensive subjects. Of which 10 were male and 5 were females, all in the age group of 22–35 years with a body mass index of 19.63–30.11 with an average of 24.80. No significant change was seen when baseline GSR reading was compared with 15th-day reading, but on 30th day significant change observed. When the baseline value of pulse was compared with that of the 15th and 30th days, a good positive change was seen in resting pulse. Similarly, BP recording also showed a good positive effect when baseline value was compared with that 15th and 30th days. The study concludes that practicing Pranayama on a regular basis increases the parasympathetic tone and blunts the sympathetic tone of the body. This has shown good beneficial effects on pulse, BP, and GSR.

Keywords: Galvanic skin response, pranayama, sympathetic tone**INTRODUCTION**

Cardiovascular diseases are one of the leading causes of mortality and morbidity around the globe.^[1] High blood pressure (BP) is a major risk factor and is associated with several types of cardiovascular disease.^[2] A significant proportion, i.e., 57% of all stroke deaths and 24% of all coronary heart disease deaths in India can be attributed to hypertension.^[3] Studies have shown that nearly two-fifths of the Indian adult population are hypertensive.^[4] Although no direct cause has been identified for primary/essential hypertension, the contributing factors are sedentary lifestyle, smoking, stress, visceral obesity,

potassium deficiency, obesity, salt sensitivity, alcohol intake, and Vitamin D deficiency. Out of the above, the most important risk factors are obesity and psychological stress.^[5] Psychological stress, in this era of urbanization, has become a part and parcel of our lives. Chronic stress has become a serious problem affecting different life situations and carries a wide range of health-related disorders such as cardiovascular disease, cerebrovascular disease, diabetes, and immunological disorders.^[6] There are no direct ways to quantify stress, but its surrogate markers can be identified and measured. One such parameter is the galvanic skin response (GSR), which can be measured with the help of a POLYRITE Machine.^[7] The GSR is a highly sensitive parameter to measure the sympathetic outflow. Changes in GSR following exercise can be used to assess the stress patterns in an

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individual.^[8] Several researchers have reported that a non-pharmacological measure, Pranayama, is effective in stress-related conditions. Pranayama is an age-old science that has been practiced for thousands of years. It consists of ancient theories, observations, and principles about the mind and body connection. Pranayama is a Sanskrit word meaning “extension of the prana or breath” or, more accurately, “extension of the life force.” Many yoga teachers advise that Pranayama and exercise should be a part of our daily routine.^[9] It helps by regulating the autonomic functions of the body and thereby controls the BP.^[10] As the prehypertensive population is increasing day by day, efforts need to be taken to control hypertension at an early stage before starting the drugs. Keeping this in mind, we conducted a study in antihypertensive drug naïve prehypertensive patients with the objectives to observe the effects of traditional exercise Pranayama on GSR, pulse rate, and BP.

MATERIALS AND METHODS

This was an open-labeled, prospective, uncontrolled, single-centered, single-arm, comparative, and clinical intervention study conducted in the Department of Medicine, Janaki Medical College Teaching Hospital for 2 months period January–February 2019 on 15 prehypertensive subjects. The intervention was Pranayama and the parameters measured were galvanic skin response (GSR), pulse rate, and BP before and after the intervention. The study commenced after obtaining approval from the Institutional Ethics Committee and written informed consent was taken from all the subjects. Prehypertensive subjects of either sex aged between 18 and 50 years who understood the study procedures and those who were willing to cooperate and give consent to the investigators were included in the study. Subjects were randomly selected from the teaching staff and postgraduate residents of pharmacology department. JNC 7 classification was used to label subjects as prehypertensive.^[11]

Exclusion criteria

Subjects on antihypertensive, anxiolytics, antidepressants, and psychotropic drug therapy,

those consuming more than 2 units of alcohol per day (1 unit is equal to 30 ml of hard spirits/300 ml of beer/250 ml of wine), those with any other comorbid conditions, for example, diabetes, asthma, and hypertension category beyond the prehypertension stage as per the JNC 7, and those using any other non-pharmacological measures for stress reduction or BP control were excluded from the study. Baseline readings for GSR, pulse, and BP were taken on 16 channeled POLYRITE Machine (Model PP-16, Manufacturer-Medicaid System) in the department of pharmacology. POLYRITE machine has the capacity to record various parameters such as electrocardiogram, electroencephalogram (EEG), electrooculogram, electromyography, electronystagmogram, nerve conductions, pulse front tilt, wave over-lap facility, pulse analysis, and heart rate variability analysis and identifies frequency component of EEG signal delta, theta, alpha, and beta waves. Out of these, in our study, we have recorded only the GSR, pulse rate, and BP. All the subjects were trained under proper expert guidance on the method of Anuloma Pranayama. They performed breathing exercises every alternate day for 30 min under observation, in the department of pharmacology, and at home on advice for a month. Anuloma pranayama was done by the subjects sitting in padmasana position also called as the lotus posture in which the individual sits cross-legged and feet are placed on opposite thighs, head, and neck relaxed, shoulders moved backward and the ribcage lifts, the hands rested on the knees in Jnanamudra, in a well-ventilated room and it was ensured that they had no nasal obstruction. In the first step subjects were asked to close their right nostrils with the thumb and to exhale the air slowly through the left nostril and then inhale back the air slowly through the same nostril. Then, they were asked to close their left nostril with the ring finger and were asked to exhale the air slowly through the right nostril, and then inhale back the air slowly through the same nostril. These two steps were repeated in a cycle for 30 min in morning every day for a month. Parameter such as GSR, pulse, and BP was recorded on 15th day and 30th day of the cycle. Data obtained on the 15th and 30th days were compared with each other and with the pre-test recordings. The data were represented

as mean and standard deviation. The student's t test was used to determine the statistical significance at $P < 0.05$.

RESULTS

A total of 15 subjects who were borderline hypertensive/prehypertensive, according to the JNC 7 classification, were enrolled in the study. Of which 10 were male and 5 were females, all in the age group of 22–35 years with body mass index of 19.63–30.11 with an average of 24.80. No significant change was seen when baseline GSR reading was compared with 15th day reading, but on 30th-day significant change observed. When the baseline value of pulse was compared with that of 15th and 30th days, a good positive change was seen in resting pulse. Similarly, BP recording also showed a good positive effect when baseline value was compared with that 15th and 30th days.

DISCUSSION

The three parameters which we measured in our study were GSR, pulse, and BP. GSR is the electrical resistance offered by the skin to the passage of a feeble electric current between two electrodes placed on the skin of the forearm. The GSR of the skin depends on a number of factors, the most important being the presence or absence of sweat. Sweat contains water and electrolytes and hence decreases the resistance to passage of current, thereby decreasing the GSR. An increase in the sympathetic tone increases sweating and thereby decreases the GSR. A significant increase in the GSR reading was observed on the 30th day of the study while a slight increase was seen on the 15th day. This indicates a significant decrease in the sympathetic tone following daily practices of Pranayama. Pranayama helps decrease the sympathetic tone and simultaneously increases the parasympathetic tone by a number of mechanisms.^[12,13] It causes an increase in the sensitivity of the baroreceptor reflex^[14] improves the tissue oxygenation^[13] and favorably affects the nervous system metabolism and autonomic functions.^[15] In contrast, a significant decrease

was seen in the baseline reading of pulse and on 15th and 30th days, which indicates a significant positive effect of Pranayama on pulse. A significant drop in the systolic and diastolic BP was also noted on 15th and 30th days of the study; this also shows a positive effect of Pranayama on BP. Similar findings were seen with other studies conducted previously in hypertensive patients.^[16,17]

CONCLUSION

The study concludes that practicing traditional exercise Pranayama on a regular basis increases the parasympathetic tone and blunts the sympathetic tone of the body. This has shown good beneficial effects on pulse, BP, and GSR. Hence, Pranayama practice can be alternative to the available non-pharmacological treatments used for hypertension. However, our study was a short span study; whatever observation made cannot as such imply to the larger population. Further studies on a large number of individuals and for a long duration are required to confirm the findings on a large scale.

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