

# Effect of Rajyoga meditation on galvanic skin response: Cross-sectional study

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## Abstract

**Background:** Rajyoga meditation is a mental process of connecting self with supreme consciousness and is simple and scientific technique to elicit physical and mental relaxation responses. Galvanic Skin Response (GSR) is one of the physiological indicators of autonomic nervous system balance and mental status. This study was designed to assess the effect of Rajyoga meditation on GSR. **Objective:** To evaluate and compare the effect of Rajyoga meditation on GSR. **Methods:** This cross-sectional study was conducted on 30 subjects doing Rajyoga meditation since more than 6 months and 30 age-matched control subjects not doing Rajyoga meditation. GSR was recorded using standard instrument. **Results:** It was found that the GSR in subjects doing Rajyoga meditation (mean GSR = 34.63) was significantly less ( $p < 0.0001$ ) than the GSR in control subjects not doing Rajyoga meditation (mean GSR = 46.6). **Conclusions:** Rajyoga meditation practitioners have lower GSR which may indicate lower stress levels in them.

**Key Word:** Sympathetic Nervous System, Stress, Sweat glands

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## INTRODUCTION

The 21st century is said to be an “Era of anxiety and stress”. Stress is a ‘non-specific response of the body to any noxious stimuli’, and the stress response is associated with a heightened sympathetic nervous activity.<sup>1</sup> Stress is the most substantial risk factor for many diseases today. Meditation is now considered a method of choice to relieve stress. Meditation is a wakeful hypometabolic state which is associated with a reduced breathing pattern, decreased heart rate and reduced blood pressure.<sup>2</sup> Various types of Meditation are 1- Transcendental meditation, 2- Vipassana meditation, 3- Zen meditation, 4- Rajyoga meditation.

Philosophy of Rajyoga- The word ‘Yoga’ means ‘to unite’. Rajyoga is said to be a practice or art of uniting or linking the mind with God by focusing attention on Him as an incorporeal being of light and thinking of his divine qualities. This takes one into a state of absorption in bliss, peace and happiness through positive thinking. Rajyoga meditation consists of a series of positive, powerful and purposeful thoughts with clear visualization. It is said to be awareness of the self and absorption of one’s mind in loving and purposeful consciousness of God and his divine attributes. Method of Rajyoga meditation involves: Sitting in a comfortable position with eyes open, Visualising a point of light at the centre of forehead like shining star, thinking about the seven inner qualities of the self namely- peace, love, happiness, purity, power, knowledge, bliss and feel them. It is done at least for 20 minutes.<sup>3</sup> Galvanic skin response (GSR): It is a method of capturing the autonomic nerve responses as a parameter of sweat gland function. It refers to the voltage measured between two electrodes placed on the skin (on two fingertips) which fluctuates with the emotional state like stress, anxiety. GSR measurements also form part of the “lie detector” tests used all over the world. The biofeedback is obtained when skin electrodes are placed on two fingers. Exposure to external stimuli

causes changes in sweat gland secretion. It creates a shift in the relative conductance of a small electrical current, which runs over the skin between the two electrodes.<sup>4</sup>

## METHODS

**Study design:** Cross-sectional study. Thirty subjects aged between 35-50 years, practising regularly Rajyoga (Rajyoga Meditators) for more than six months, daily at least for one hour were included in the study. Thirty age-matched healthy controls that do not perform Rajyoga or similar meditation (Non-Meditators) were also included. **Exclusion Criteria** were: Other types of meditation practitioners, Subjects suffering from Fever, known cases of Hyperthyroidism, Hypertension, glucose metabolism disorders, Hyperadrenalism, Psychiatric disorders or any major disease and persons taking drugs like antipyretics, caffeine, morphine, alcohol, etc. or having an addiction like smoking, tobacco chewing. Ethical committee approval was taken before conducting the study. Informed Consent was taken after explaining the complete procedure to the subject. The instrument to measure GSR consists of two electrodes which can be fixed on two fingers. It also contains an amplifier to boost signal amplitude and a digitiser to transfer the raw analogue signal into binary data streams. Digital screen on the instrument expresses the skin conductance in microsiemens ( $\mu$ S). Microsiemens is a unit of conductance. All Rajyoga meditation practitioners were seated in a quiet and cool room at 8.30-9.30 am. GSR was recorded using two silver chloride disc electrodes filled with electrode jelly placed on palmer surface of two right-hand fingers. Under the same conditions and settings, GSR of subjects who were not practising Rajyoga meditation was also recorded. Statistical analysis-Student's t-test was applied to analyse the data. Data was analysed using Graph Pad Prism software.

## OBSERVATIONS

Table 1 shows the baseline characteristics of the study subjects. It was found that the GSR (Conductance) in subjects doing Rajyoga meditation (mean GSR = 34.63) was significantly less ( $p < 0.0001$ ) than the GSR in control subjects not doing Rajyoga meditation (mean GSR=46.6) as indicated in Table 2.

Table 1: Baseline characteristics

| Parameters               | Rajyoga Meditators | Non-Meditators   |
|--------------------------|--------------------|------------------|
|                          | (n = 30)           | (n = 30)         |
|                          | (Mean $\pm$ SD)    | (Mean $\pm$ SD)  |
| Age (years)              | 41.80 $\pm$ 5.22   | 43.42 $\pm$ 5.58 |
| Height (meters)          | 1.58 $\pm$ 0.07    | 1.55 $\pm$ 0.06  |
| Weight (kg)              | 56.24 $\pm$ 9.02   | 55.39 $\pm$ 8.59 |
| BMI (kg/m <sup>2</sup> ) | 22.64 $\pm$ 3.56   | 22.14 $\pm$ 2.25 |

Table 2: GSR in Study Groups

| Group              | GSR           |
|--------------------|---------------|
| Rajyoga Meditators | 34.63 + 9.76  |
| Non-Meditators     | 46.60 + 11.46 |
| p value            | <0.0001*      |

Readings are in  $\mu$ S. \* Statistically highly significant

## DISCUSSION

Stress provokes body's "fight or flight" response and causes secretion of adrenaline. Chronic stress is detrimental to both physical and mental health and is a risk factor for hypertension, Diabetes Mellitus, Coronary Artery Disease, Inflammatory Bowel Disease, Gastro-oesophageal Reflux disease, back pain, depression, anxiety disorders etc. It is difficult to manage stress, and it is difficult to measure the stress levels. Number of physiological markers is used to assess stress like GSR, Blood Pressure (BP), Heart Rate, Respiratory Rate, etc.<sup>5</sup> Autonomic Nervous System (ANS) regulates body's major activities like heart's electrical activity, gland secretion, BP, respiration. Sympathetic branch of ANS mobilises the body's resources for action under stress. But parasympathetic part relaxes and stabilises the body in the steady state.<sup>5</sup> GSR is used to assess the balance between sympathetic and parasympathetic arms of ANS. GSR is a type of electro-dermal response. It is a method of capturing the autonomic nerve responses as a parameter of sweat gland function.<sup>6</sup> As stress level increases, sympathetic over activity causes sweat gland to increase secretion. It increases galvanic skin conductance which is picked up during GSR. <sup>6</sup> Meditation causes tilting of autonomic balance from sympathetic to parasympathetic and reduces the galvanic skin conductance. Meditation elevates the beta-endorphin levels that may be responsible for a relaxed and calm state.<sup>7</sup> Johnson and Lubin in their research found that states of relaxation are accompanied by high skin resistance i.e. decrease conductance, which reaches its maximum during sleep.<sup>8</sup> Singh Y *et al.* found that the galvanic skin conductance decreases due to the practice of meditation. After the meditation sessions practised for one month, subjects showed physiological relaxation response indicated by a significant decrease in GSR, and they also showed improved cognition.<sup>9</sup> Telles *et al.* found that during meditation, meditation practitioners showed a small but statistically significant reduction in heart rate and GSR compared to the control group. Reduction in heart rate shows the relaxation response during meditation.<sup>10</sup> Bharshankar *et al.* also found a significant decrease in GSR in Rajyoga meditation practitioners as compared to non-practitioners. It may be due to the sympathetic activation in meditation practitioners in response to stress was lesser due to changes attributed to the head ganglion of autonomic nervous system (hypothalamus) by regular

practice of meditation.<sup>11</sup> The study limitation is cross-sectional collection of data which can only reflect the GSR values in study groups with no cause and effect relationship establishment. Longitudinal cohort studies should be done to assess the change in GSR in those practising Rajyoga and control subjects to ascertain the impact of Rajyoga on GSR further and also other stress parameters should be studied to better evaluate the association of Rajyoga with the reduction in stress levels.

### CONCLUSIONS

Rajyoga meditation is effective in reducing the stress level as indicated by change in galvanic skin conductance. It can become an adjuvant with drug therapy to treat various psychosomatic and lifestyle related disorders.

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