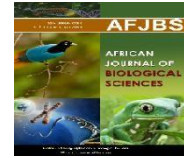


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### Effect of OM chanting on emotional regulation and it's effect on hypertension

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**Abstract:** The emotional significance of om chanting, whether in a spiritual or religious context, is highly valuable in contemporary times. Despite extensive study in the topic (K. Milbury, 2013), the gender disparities between chanting and non-chanting groups remain mostly uninvestigated.

**Goal:** Consequently, a randomized study was undertaken in India to examine the correlation between chanting, emotional control, and quality of life in middle-aged men and women.

**Methodology and experimental materials:** The Perceived Stress Scale and Positive and Negative Affect Schedule (PANAS) (Gellman, 2013) are self-administered questionnaires that assess moods and emotions using various descriptive phrases. The Emotion Regulation Questionnaire (ERQ) by Magyar-Moe (2009). The Gross & John Perseverative Thinking Questionnaire (PTQ), Rumination Response Scale (RRS), and World Health Organization-Quality of Life (Brief version) were given to a group of 115 Indian middle-aged people, ranging in age from 25 to 60 years. The statistical methods employed were the Independent Sample T-Test and Pearson's Product Moment Correlation.

**Findings:** All the parameters show statistically significant difference between control and yoga groups. Except the expressive suppression, all the scores got improved in the yoga group compared to the control group.

**Conclusion:** Chanting has varying effects on emotional regulation and quality of life in various genders (Harinath, 2005). Additionally, there is a gender disparity in the link between emotional regulation and quality of life among middle-aged individuals.

**Keywords:** om chanting, well-being, emotional regulation, quality of life, health.

**Introduction:** Repeating the sacred phrase/mantra "om" is a longstanding worldwide tradition used to calm the mind and cultivate concentrated attention (Mekonnen, 2019). Various civilizations and cultures have distinct approaches to this activity. Individuals have the option to engage in this activity either silently or by speaking out loud. They can choose to do it alone or with others, and they may opt for a responsive style where one person leads the chant and others repeat it in unison. It often accompanies spiritual activities and may entail shared belief systems, although it is also utilized in non-religious settings. Chanting, similar to meditation and other relaxation practices, is regarded as a non-pharmacological strategy for addressing psychological discomfort and promoting overall well-being and life improvement (Jain, 2000). It is also regarded as a component of complementary alternative medicine (CAM) because of its impact on the mind-body connection. Consequently, the investigation of the psychological impacts of chanting has garnered significant interest. This study aims to investigate the impact of chanting on psychological variables such as emotional regulation and quality of life in middle-aged people. Emotional regulation refers to the external and internal processes responsible for overseeing, assessing, and adjusting emotional responses, namely their intensity and duration, in order to accomplish objectives. In a study conducted by Zhang, Peng, and Chen, it was found that chanting has an impact on the way we evaluate and process emotions in response to a stimulus. This suggests a connection between the act of chanting and how we interpret and experience emotions in our daily lives. Quality of life is the measure of the overall well-being of a population or a person, taking into account both positive and negative elements of their existence at a particular moment. The possible impact on quality of life (Patel, 2019) arises from the social impacts of group chanting, the physiological benefits of chanting activities (such as enhanced cognitive capacity), and the stress reduction (Nizamie, 2013) facilitated by the parasympathetic nervous system's influence on chanting.

**Objective:** The objective of the analysis is to

1. To study the change in the parameters both in control and yoga groups is statistically significant or not (Hagins & Marshall, 2007)
2. To understand whether the change in set of 15 parameters from both physiological and psychological groups, can influence the change in the systolic blood pressure and diastolic blood pressure.
3. Quantify the impact of 15 parameters on the following measures using machine learning models
  - a. SBP
  - b. DBP

The change in parameters is defined as the difference between pre and post values for each of the parameters. Example, for the parameter WHOQOL social relationship, the score ranges from 5 to 15. More the score, better is the social relationship.

S. No	Parameter	Scoring indicator	Preferred change
1	SBP	High SBP → High score	Low
2	DBP	High DBP → High score	Low
3	PSS	High stress → High score	Low
4	PANAS Positive Score	High positive → High score	High
5	PANAS Negative Score	High negative → High score	Low
6	ERQ - Cognitive Reappraisal	High regulation → High score	High
7	ERQ – Expressive Suppression	High regulation → High score	Low
8	PTQ – Core Features RNT	Higher the RNT → High score	Low
9	PTQ – Unproductiveness	Higher the UNP → High score	Low
10	PTQ – Mental Capacity	Higher the MC → High score	Low
11	RRS – Total Score	High rumination → High score	Low
12	WHOQOL – Physical Health	Good condition → High score	High
13	WHOQOL – Psychological Health	Good condition → High score	High
14	WHOQOL - Social Relationship	Good condition → High score	High
15	WHOQOL - Environment	Good condition → High score	High

#### Change = Post parameter value - Pre parameter value

S.No	Pre SBP	Post SBP	Pre social relationship score	Post social relationship score	Post - Pre SBP	Post – Pre social relationship score
1	140	132	7	9	-8	-2
2	132	140	9	7	8	2

The difference: 'post-pre' is computed for all 15 parameters.

Applied hypothesis tests to compare the change (Tyagi, 2016) in control and yoga groups to understand the difference in the change is statistically significant or not. From the below table, it is evident that all the parameters are showing statistically significant difference between control and yoga groups. (Sharma, 2014)

Variable	Control, N = 106*	Yoga, N = 108*	p-value1
SBP_change	-4 (-11, 0)	-8 (-12, -4)	0.005
DBP_change	0 (-6, 4)	-2 (-6, 0)	0.002
PSS_change	1.0 (-1.8, 2.0)	-4.0 (-8.0, -0.8)	<0.001
PANAS_PositiveScore_change	0 (-4, 4)	5 (-1, 12)	<0.001
PANAS_NegativeScore_change	0 (-6, 7)	-7 (-12, -1)	<0.001
ERQ_CognitiveReappraisal_change	-0.25 (-0.67, 0.17)	0.67 (0.29, 1.17)	<0.001
ERQ_ExpressiveSuppression_change	0.75 (0.00, 1.25)	-1.00 (-1.56, -0.25)	<0.001
PTQ_CoreFeatures_change	0.0 (-2.0, 2.0)	-4.0 (-7.0, -2.0)	<0.001
PTQ_Unproductiveness_change	0.50 (-1.00, 1.00)	-2.00 (-3.00, 0.00)	<0.001

PTQ_MentalCapacity_change	0.00 (-1.00, 1.00)	-1.00 (-2.00, 0.00)	0.001
RRS_TotalScore_change	2 (-4, 7)	-8 (-11, -3)	<0.001
WHOQOL_PhysicalHealth_change	-1.0 (-3.8, 2.0)	4.0 (2.0, 6.0)	<0.001
WHOQOL_PsychologicalHealth_change	1.0 (-2.0, 2.0)	3.0 (1.0, 5.0)	<0.001
WHOQOL_Social_Relationship_change	-1.00 (-3.00, 1.00)	1.00 (0.00, 3.00)	<0.001
WHOQOL_Environment_change	1.0 (-2.0, 2.8)	1.5 (-1.0, 4.0)	0.016

\* Median (IQR)

1 Wilcoxon rank sum test

**All the parameters are showing statistically significant difference between control and yoga groups. Except the expressive suppression, all the scores got improved in the yoga group compared to the control group.**

**Model Building:** To explain the change in SBP and DBP used following machine learning models to explain the influence of each variable.

1. stepwise linear regression
2. Non-linear models
  - a. Gradient Boosting Algorithms
  - b. Random forest

Stepwise regression model results

Parameter	DBP change			SBP change		
	Beta	95% CI1	p-value	Beta	95% CI1	p-value
(Intercept)	8.2	1.9, 14	0.011	3.5	-3.0, 10	0.3
SBP_change	0.28	0.16, 0.40	<0.001			
ERQ_ExpressiveSuppression_change	-0.69	-1.6, 0.19	0.12			
WHOQOL_PhysicalHealth_change	0.2	-0.03, 0.44	0.091			
WHOQOL_PsychologicalHealth_change	-0.25	-0.53, 0.04	0.093			
Age	-0.16	-0.29, -0.03	0.019	-0.2	-0.34, -0.06	0.005
Group						
GroupYoga	-2.9	-5.6, -0.22	0.034			
DBP_change				0.33	0.19, 0.46	<0.001
WHOQOL_Social_Relationship_change				-0.85	-1.2, -0.53	<0.001

1 CI = Confidence Interval

#### DBP

1. 1 unit increase in the Systolic blood pressure increases the diastolic blood pressure by 0.28 units
2. 1 unit increase in the Regulation of Expressive suppression score decreases the diastolic blood pressure by 0.69 units
3. 1 unit increase in the physical health score increases the diastolic blood pressure by 0.2 units
4. 1 unit increase in the psychological health score decreases the diastolic blood pressure by 0.25 units

5. 1 year increase in the age decrease the diastolic blood pressure by 0.16 units
6. Compared to Control group, Yoga practice decreases the diastolic blood pressure by 2.9 units

#### SBP

1. 1 year increase in the age will decrease the systolic blood pressure by 0.2 units
2. 1 unit increase in the diastolic blood pressure increases the systolic blood pressure by 0.33 units
3. 1 unit increase in the social relationship score decreases the systolic blood pressure by 0.85 units

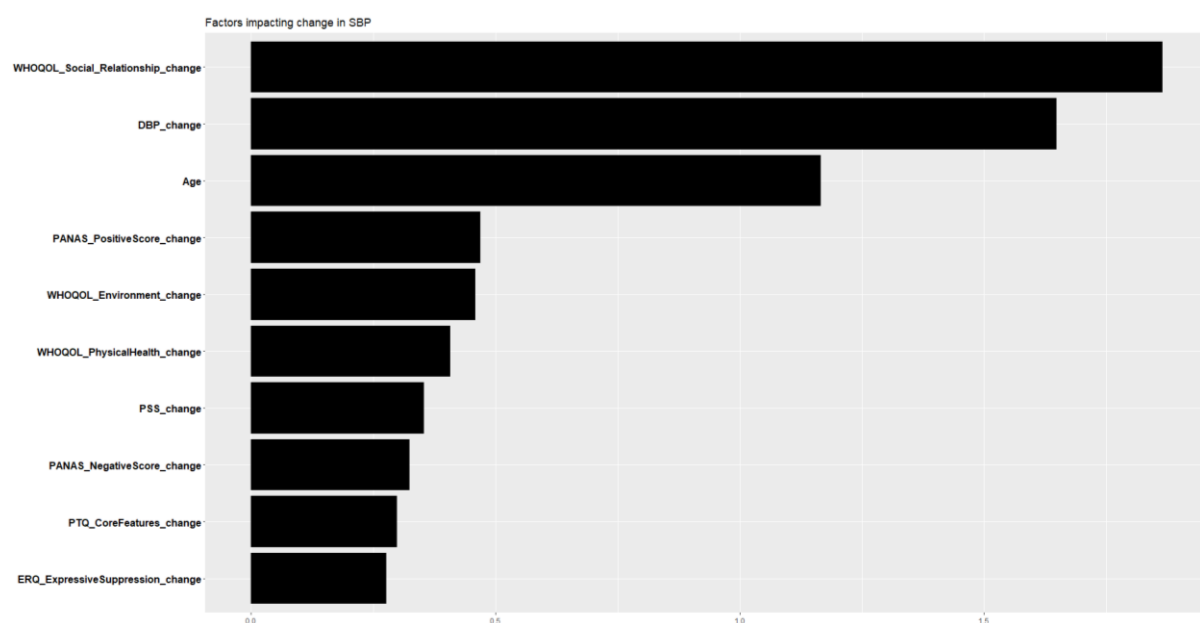
Also, the impact of change in SBP on DBP is the same as the impact of DBP on SBP

#### XGBoost model results

The below graph shows importance/contribution of each of the parameters to explain the change in systolic blood pressure. Importance is computed using shapley values.

#### Age group 25-45 , 45-60

#### Factors impacting change in SBP



It is interesting to note that the top 3 variables from XGBoost is the same as significant variables obtained from step linear regression model.

Below is the graph showing the Shapley values. The interpretation of the Shapley value is: Given the current set of feature values, the contribution of a feature value to the difference between the actual prediction and the mean prediction is the estimated Shapley value.

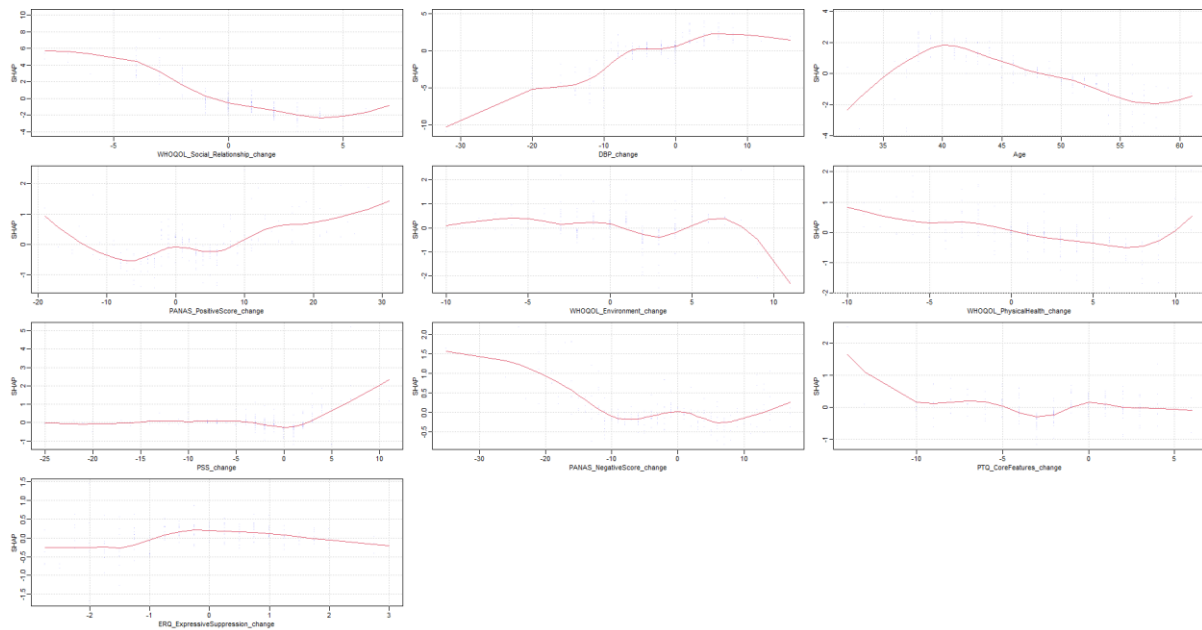


Figure 1 Change in the change Shapley scores w.r.to multiple factors

From the above graph, as the social relationship score change increases on x axis from -5 to 5, the Shapley are values decreasing till it reaches low at 0 and becoming stabilized till reaching score of 5 and then gradually tappers off there after showing non-linear relationship. In other words, the increasing the social relationship score will contributes more in explaining the change in the systolic blood pressure. As the change in the score decreasing, the Shapley scores are decreasing, indicating that the large the difference the bigger the score in explaining the change in SBP.

The increase in the diastolic blood pressure is directly proportional to the increase its Shapley values indicating its contribution to explain the change in the SBP(Khalsa,2019).

Till the age reaches 40, the change in the Shapley values is showing increasing trend and it reverses trend at age 40 showing non-linear relationship. It's impact gradually increases with the age at the Age 45.

**Factors impacting change in DBP**

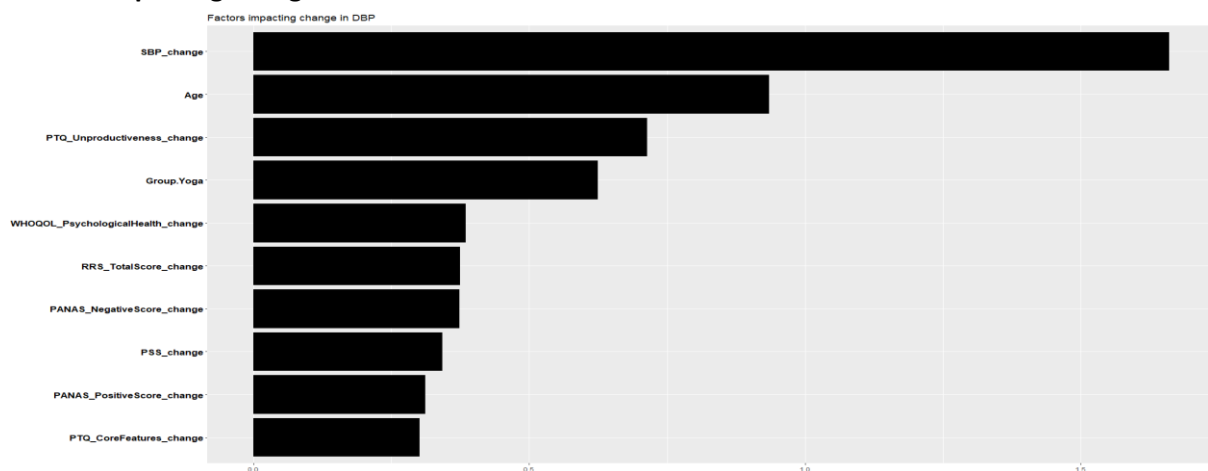


Figure 2 factors impacting DBP

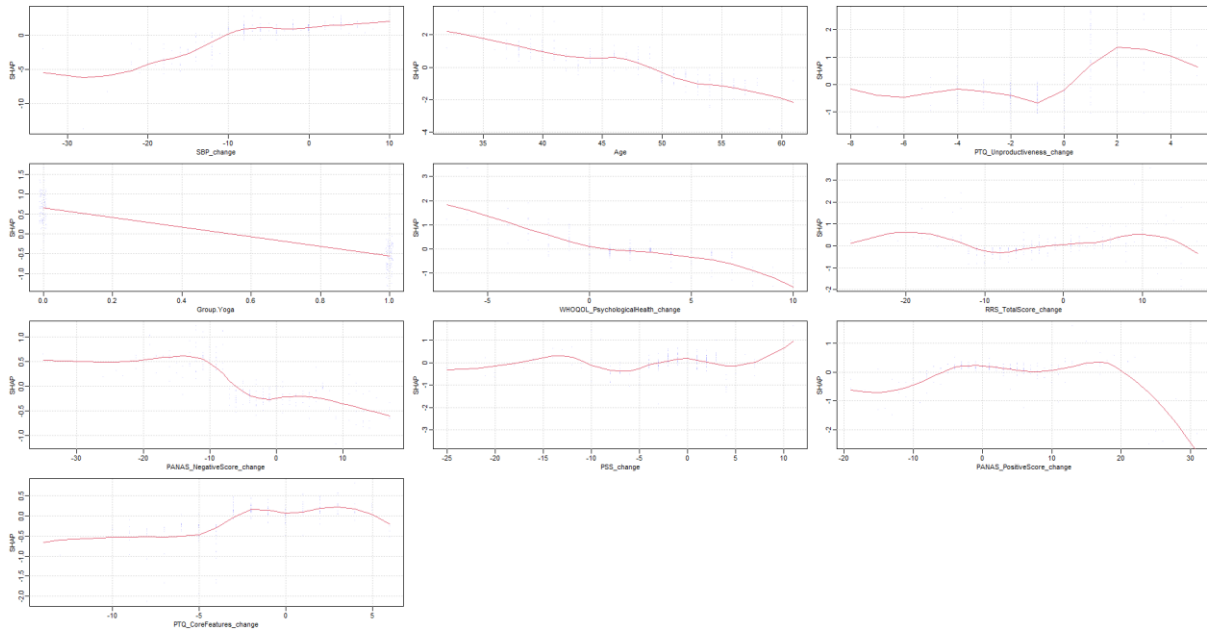


Figure 3 Shapley values for each parameter - SBP

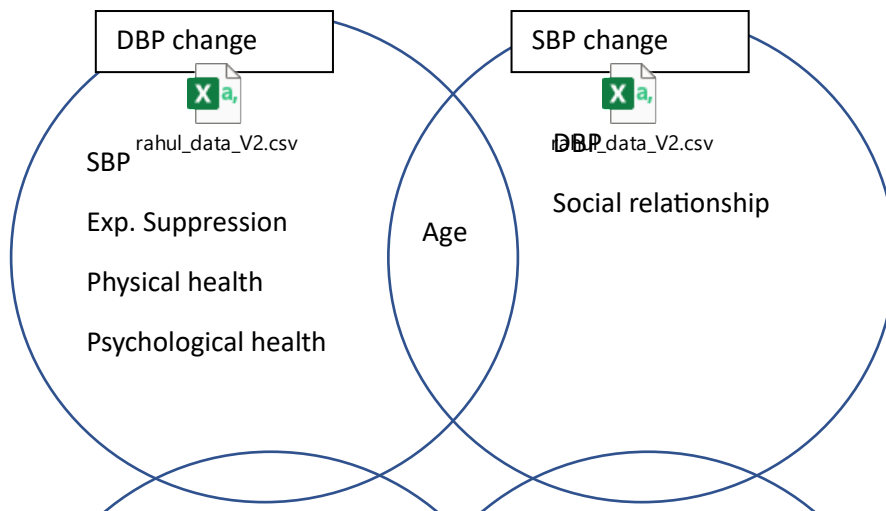


Figure 4 Top 5 factors from Linear regression

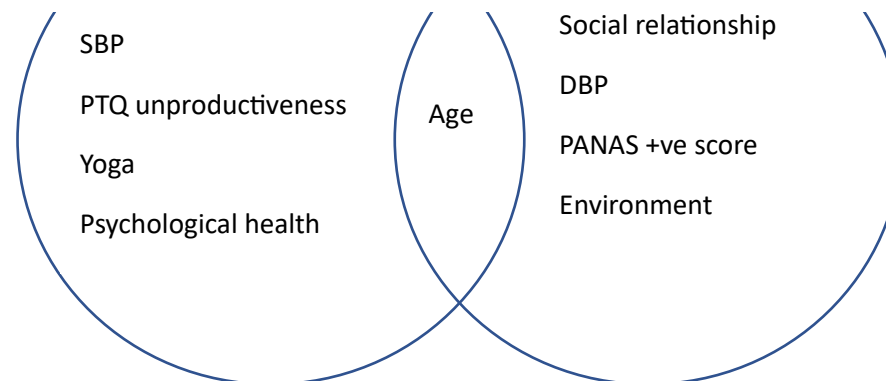


Figure 5 Top 5 factors from XGBoost

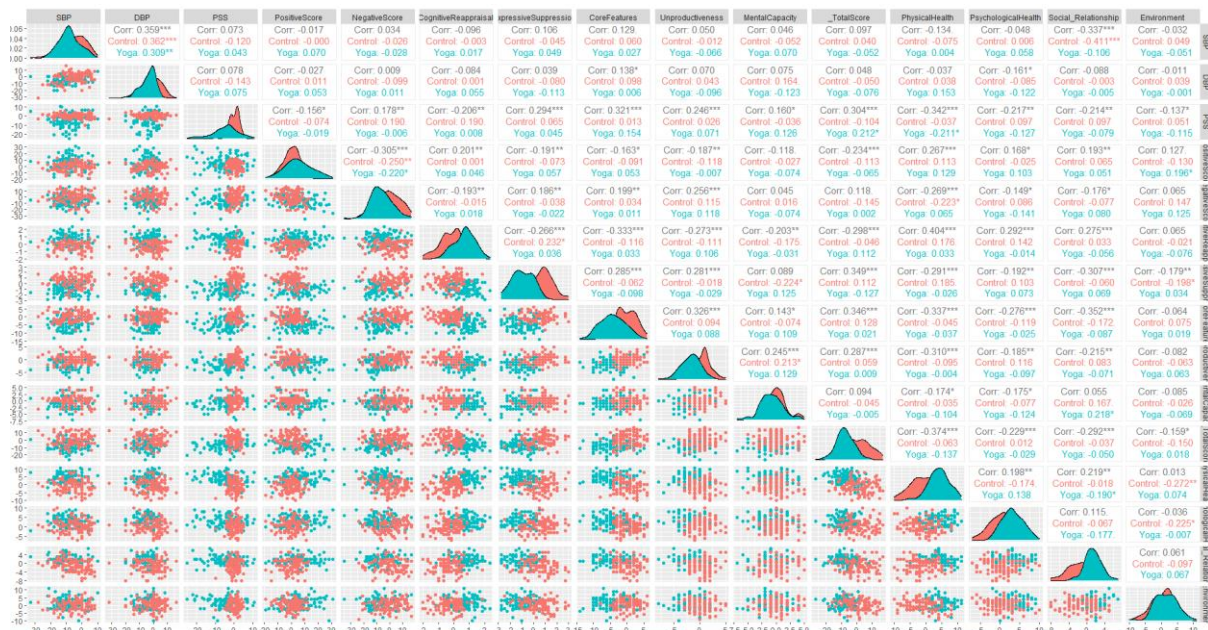


Figure 6 Correlations in Yoga and control groups

The change in parameters is defined as the difference between pre and post values for each of the parameters. Example, for the parameter WHOQOL social relationship, the score ranges from 5 to 15. More the score, better is the social relationship. Studying the psychological and physiological effects of mantric recitation, (Bharshankar, 2005) especially in yogic activities, helps us understand how holy symbols may be applied to the mind and body. The source cited is ROSU, 1988. A mantra is a linguistic tool that, when repeated, has the ability to generate a state of calm or mental stillness without requiring intense focus or attention. It consists of sounds, words, or syllables and is derived from the combination of two Sanskrit words: "manas" meaning mind and "mantra" meaning tools or instruments. This research aims to comprehensively examine the existing studies on Om meditation, examining their methodologies and investigating the identified benefits of Om meditation that have been explored thus far. Several research have explored the impact of Om meditation on individuals via several methodologies such as electroencephalography (EEG), neuroimaging, Evoked Potentials, (Cohen & David, 2016) and other methods. (Bhargav, 2016). Chanting "Om" is a highly effective method of meditation. Meditation is a collection of practices that regulate emotions and attention, while also modifying mental and physical experiences, via the deliberate concentration on a certain state of attention. The process of inducing and maintaining a meditative state (Posadzki, 2014) relies on certain brain systems associated with selective perception, such as the temporal-parietal junction, ventro-lateral prefrontal cortex, frontal eye fields, and intraparietal sulcus. These systems are responsible for sustaining attention during meditation. Contemporary medical systems are now facing a lack of success in finding answers to these issues. According to Sachdeva I, P, how effective is a medical system that lacks the ability to address physical ailments in treating mental and emotional disorders? They possess a high level of subtlety and are deeply internalized (Sachdeva, 1978). Currently, there is a widespread sense of optimism and anticipation regarding the wisdom and scientific insights contained within the ancient books of India.



Physicians worldwide are currently drawn to spiritual medicine in their pursuit of a comprehensive healing system. The global perspective on this matter has undergone a significant transformation recently. The perspectives of wise individuals around the globe have undergone a remarkable transformation. The public perception has also been altered and transformed in relation to this matter. This medical methodology is not a novel approach, but rather the ancient Vedic method originating from India. Spiritual medicine encompasses a comprehensive framework for understanding, diagnosing, and treating many disorders (Lutz A, 2008). In the past, spiritual beliefs, procedures, and tests were disregarded as lacking scientific validity. World intellectuals have begun to believe that rejecting spiritual methods and practices without empirical examination is the epitome of unscientific behavior. (Udupa, 1980)

An investigation of the acoustic properties of the "Om" chant and its impact on the neurological system suggests that it leads to brain stability, elimination of worldly thoughts, and an increase in energy (Gurjar et al.). This study examined the waveforms of male and female participants as they chanted the sound "Om" in a certain rhythm. Based on the research, the act of chanting and focusing on the Om mantra progressively shifts our attention and enables us to delve further into our innate state, therefore alleviating stress (Brown, Richard, 2005) and enhancing vitality. Devi et al. employed both male and female participants to do spectral analysis on the Om mantra. The investigation conducted by Lolla in 2017 revealed the major frequencies and sub-harmonics of the Om mantra. Furthermore, there have been further occurrences within this sequence of events (Kjellgren, Anette, 2010). Scientific medicine has seen several failures and had significant adverse effects across all its domains. It is well recognised that the majority of individuals have dedicated the entirety of the twentieth century to engaging in persistent battles and contending with the repercussions. As a result of these adverse effects, some individuals without fault have succumbed to death while sleeping. A plethora of novel diseases have emerged as an unintended consequence of efforts to find a cure for a specific condition. Leaders worldwide have deliberated on this matter, expressing apprehension, however have been unable to ascertain a resolution. Ultimately, the focus of everyone's attention shifted towards alternative medicine. Various approaches such as magnet therapy, colour therapy, and acupuncture have been experimented with. Spiritual approaches were also evaluated in this phase. According to the findings of eminent psychiatrist (Chu, 2017) Dr. Brian Weiss, complete realisation of life can only be achieved by adhering to spiritual principles (Sinha, 2016) and engaging in spiritual practice. The occurrence of scientific failures in medicine is sometimes attributed to a lack of balanced perspectives. According to scientific understanding, humans are considered to be physical entities, however this perspective may not fully capture the complete essence of a human being. Our existence is a synthesis of the physical, spiritual, intellectual, and emotional aspects. According to Weiss (2008), spiritual vision is necessary to comprehend all of these aspects.

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