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EFFECT OF INDIAN CLASSICAL VOCAL MUSIC ON OXYGEN SATURATION LEVEL, A FACTOR ASSOCIATED WITH DEPRESSION

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Abstract

Lower oxygen saturation levels are associated with depressive disorders, anxiety, stress, mood disorders and other allied symptoms. Applications of music in improving these ailments is well proven. The present study aims at examining whether Indian classical vocal music has any effect on oxygen saturation levels in women having depression. This is a pre- post- repeated measure study conducted in a destitute home in Punjab with their women residents. Vocal musical interventions were designed with Indian Raags and were pre-recorded. The outcome of the experiment suggests that Indian classical vocal music significantly increased the oxygen saturation levels of the participants.

Keywords: Indian classical vocal music, Raags, music intervention, oxygen saturation level, factors of depression, hypoxemia, hypoxia

INTRODUCTION

INDIAN CLASSICAL MUSIC FOR HEALTH PROMOTION

Music was a part of our everyday living since time immemorial when it was being used for nurturing and upholding health. Application of Indian music as healing modality through evidence-based practices has started gaining prominence over the past few decades. Therapy with Indian classical music interventions such as Raag therapy is an evolving and promising field where both empirical and experimental studies are being conducted for objectively establishing the effect of Indian classical musical components for better management of various diseases and disorders. Music interventions are non-invasive and are accepted well by people living in diverse communities. Indian classical music is part of a larger Indian knowledge system that includes Yoga, Nada Yoga (Ruma Chakravarty (2019)), spirituality, psychology, anatomy and more. Our ancient scholars and musicologists have narrated various components and techniques of Indian music, which are being used effectively by the Indian music therapists today as per today's evolved Indian music. Examples include, involvement of body parts by Saman singers while singing Saamagana; Bhava and Rasa aspects of music that are entwined with our aesthetics, emotion, sentiment, feelings and therefore with our psychology; scientific explanations of the production of Nada and Swara, association of Ayurveda and music and more. Each of these components and techniques of Indian music influence our holistic health positively. Indian Raags embody the ethos of our culture, geography, regions and people; and thus, Raags heal us from within (Ruma Chakravarty (2023)). Today, effectiveness of Indian Raags is being experimented worldwide for boosting

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its use as therapeutic modality both independently and as an integrative measure with medical treatment, psychology and other genres of health practices.

WOMEN IN DESTITUTE HOME AND DEPRESSION

Women living in destitute homes are susceptible to facing physical, mental, social and financial burdens. Some may not even know where they belonged while some have tormented pasts. The condition worsens if they suffer from any specific disease. Many of the inhabitants live under mental disorders such as depression. Depression is a complex mental health condition that is characterised by various symptoms including depressed mood, anhedonia, stress, anxiety, sadness, irritability, insomnia, psychosis and more. Depression can be mild (5 symptoms), moderate (6 to 7 symptoms) or severe (8 to 9 symptoms). India state-level disease burden initiative mental disorders collaborators (Rajesh Sagar et al.) through their study in 2019 reported that females are more prone to depression than men (3.9% female to 2.7% male). This finding is supported by some reasoning why females are more depressed than men. Meike Bartels et al. found that females reported significantly more internalising problems than men when they examined the association between subjective well-being (SWB) and psychopathology of adolescent twins and their non-twin siblings. Internalising problems corresponded to somatic complaints, anxious, withdrawn and depressed behaviours.

OXYGEN SATURATION LEVEL, A FACTOR OF DEPRESSION

A number of factors are reported to aggravate these depressive symptoms, severity and behaviour. Lower oxygen saturation (SpO2) level is found to be one of those factors of depression and its allied symptoms. Oxygen saturation level is an indicator of how healthy a person is based on the percentage of oxyhaemoglobin bound to blood. Various health issues including breathing issues, anxiety, stress, depression, restlessness, hallucination etc. are linked to low oxygen saturation level in both blood and tissues. Low oxygen saturation level in the tissues is known as hypoxia. The primary cause of hypoxia is hypoxemia, which is insufficient oxyhaemoglobin in the blood. Normal level of oxygen saturation is 95% - 100% in healthy adults. Blood oxygen level is a direct indicator of tissue oxygen saturation and thus, pulse oximetry is used for good estimation of hypoxia. In hypoxemia, partial pressure of oxygen (PaO2) is decreased to less than 60 mm Hg and is an indicator of hypoxia. Hypoxia results when the oxygen saturation is less than 90% (ScienceDirect). Oxygen saturation level has always been a key measure for the patients only in clinical setup until recently when Covid-19 symptoms forced to make it a routine to measure this parameter at home as well because of symptoms such as unstable SpO2, difficulty in respiratory system including breathing, hypoxemia, hypoxia etc.

REVIEW OF LITERATURE

Johannes Burtscher et al. in their study recounted that severe chronic hypoxia or dysfunctional hypoxia can contribute to the development of anxiety and depressive disorders.

They mention that hypoxia and mental stress evoke overlapping physiological responses and diverse molecular pathways are activated due to hypoxia, stress, anxiety and depressive disorders. Another research by Szabó K et al. finds that the risk of developing depression will more than double if oxygen saturation level is below 90% during sleep. The researchers further mention that this is a risk factor that increases the chances of severe depression. A study by Zhao F. et al. mentions the role of hypoxic injury on neuronal plasticity in the pathogenesis and treatment of mood disorder, which many a times may alternate with the periodic depression. The study also mentions that hypoxic damage in the brains may manifest as depression, anxiety and physical disabilities. As per various other research studies (Saidi I et al. and Rahman, M. H. et al.), oxygen saturation below 93% in Covid 19 patients were associated with anxiety, depression and depressive symptoms. Hence, as per these established studies, hypoxia is a contributor to depression and depressive disorders that also damages the brain.

In addition to available treatments, management of lower oxygen saturation levels as well as hypoxia may be beneficial with natural therapies, interventions or strategies. Music interventions as natural modalities are employed for optimising oxygen saturation levels in people with diverse health conditions. Positive effects and improvement of blood oxygen saturation with statistically significant results between pre- and post- tests ($p<0.01$) were witnessed with live music intervention in terminally ill patients (Barbara Antoniazza et al.). Another study by Indriani, N. et al. showed that Mozart's music therapy had a significant effect on changes in oxygen saturation ($p=0.008$) in ICU patients with head injury. During the period of hospital procedure, patients often get stressed, anxious and depressed. This affects their oxygen saturation levels among other aspects (Kobus S. et al.).

In the realm of Indian music application, a study found that pre-recorded Raag Kaushik Dhwani Gat (Pt. Shivkumar Sharma) significantly increased SpO2 levels in patients undergoing upper gastrointestinal endoscopy (Padam, A. et al.). Further the study reported reduction in anxiety levels as a result of listening to Indian classical music. Study findings (V K Paul et al.) showed that Indian music therapy helped lowering the fluctuations in SpO2 during 7 days period of observation in premature neonates and helped in steady improvement of oxygen saturation level in preterm neonates. Sunitha. G. et al. reported statistically significant changes in depression, anxiety and stress scores (as measured by Depression Anxiety and Stress Scale [DASS]-21 scale) in individuals with depression after music therapy with Raag Bilahari both instrumental and vocal. Similar results on depression, anxiety and stress level scores with DASS-21 was demonstrated by Asha Achar et al. in preoperative patients undergoing cataract surgeries. Raga Darbari played through a CD player reported to have significantly decreased cortisol levels in patients undergoing cardiopulmonary bypass and that was in the magnitude of 30% less in music group than the blank CD group (Kar SK et al.).

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GAP FROM THE LITERATURE REVIEW:

Literature scan revealed oxygen saturation as a key factor contributing to depression and its allied symptoms that also affects the brain plasticity and other brain functions. It is evident from the literature scan that although there are studies that focus on ascertaining the effect of Indian Raags on depression scores or stress & anxiety levels, however, very few studies focus on the effect of Indian classical vocal music on oxygen saturation levels of people who are clinically diagnosed with depression; further fewer studies are conducted on women under depression and distress.

OBJECTIVE

Objective of this paper is to examine the effect of Indian classical vocal music interventions on oxygen saturation levels in women residents of a destitute home who are under depression. The factor, if managed with music, may help prevent as well as reduce the depressive symptoms of people in the said community with an easy to access natural yet scientific modality.

HYPOTHESIS

Indian classical vocal music will improve oxygen saturation level and help prevent hypoxia in women having moderate depression and depressive symptoms.

MATERIALS AND METHODS

STUDY DESIGN

The research was a paired, repeated measure pre-, post- study with measures at the baseline and post music interventions implementation at the three intervals – end of 1st, 2nd and the 3rd weeks. Here, the subjects are controls of themselves, i.e., they are the paired subjects for pre- and post- repeated measure interventions. Participants took part in receptive Raag music sessions over a period of 3 weeks in a completely naturalistic environment.

SAMPLE

Participants for the study were being selected in a mixed mode sampling technique where convenience and random sampling techniques were used. This study includes 33 women participants having moderate depressive disorders as per clinical diagnosis done by the inhouse psychiatrist of the destitute home.

INCLUSION AND EXCLUSION CRITERIA

Women between the age of 45-65 years having moderate depressive disorders and can follow instructions were included in the study. Participants who were under moderate depression for the past 6 months were considered. Among them residents for whom there was no change in the standard pharmacology for the past two months were eligible to participate in the study. This was to ensure that the effect of music interventions could be realistically measured. Bedridden or terminally ill patients; individuals with hearing impairment, physical disability,

contagious disease, mobility issues; pregnant women, violent and non-responsive women were excluded.

MUSIC INTERVENTIONS

The participants received pre-recorded classical vocal music interventions designed with Indian Raags. A Tarana based on Raag Tilak Kamod and a Bandish based on Raag Kedar were used as receptive music interventions. Predominant with Shudh Swaras (straight ~notes), both the Raags create a positive melodious atmosphere with their characteristic movements of Swaras. Tarana was used especially to raise a natural curiosity in the participants with its captivating syllables. Bandish in Raag Kedar had happy tunes with lyrics describing the beauty of nature. Both the interventions were consciously designed with Raags that create an atmosphere of cheerfulness. Each intervention was offered for 20 minutes with a gap of 5 minutes in between. The sessions were conducted 5 days a week for three weeks in the destitute home.

TOOLS USED

Pulse oximeter was used to measure oxygen saturation levels and pulse rates as a standard monitoring method both in clinical and other setups.

DATA COLLECTION PROCEDURE

Pre/ baseline observations for all participants were recorded before starting the music intervention implementation procedure. First and second observations post- music employment were recorded at the end of 1st and 2nd weeks respectively. Third and final set of data was collected on completion of the music administration procedure post 3rd week of the experiment.

ANALYSIS OF DATA

Data was analysed using Statistical Package for the Social Sciences (SPSS) for Windows, Version 20, SPSS Inc. by International Business Machines Corporation (IBM), Chicago, Illinois, USA. Descriptive statistics were measured at the baseline and at three intervals. Paired Samples t-test was done to analyse and compare means of two measurements from the same groups in two different time points of pre- and post- tests.

RESULTS

A paired-samples t-test was conducted to evaluate the impact of classical vocal music interventions on the participants' oxygen saturation level and pulse rate as measured with Pulse oximeter comparing baseline to the 3rd week observations.

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				Paired Differences					t	df	Sig. (2-tailed)
				Mean	SD	Std. Error Mean	95% Confidence Interval of the Difference				
		Mean	Std Deviation				Lower	Upper			
Pair 1	O2SatPre	88.39	6.25	-5.55	4.58	0.8	-7.17	-3.92	-6.95	32	.000
	O2SatPost3	93.94	3.11								
Pair 2	PulsePre	79.94	9.48	13.97	8.56	1.49	10.93	17.01	9.37	32	.000
	PulsePost3	65.97	5.85								

Table 1: Results of Paired Samples t-test to analyse and compare Oxygen Saturation levels and Pulse Rate at the baseline and after 3rd and final week of music administration

The results showed a significant increase in the oxygen saturation levels of the participants pre-intervention (M=88.39, SD=6.25) to post-intervention (M=93.94, SD=3.11), t(32)=-6.95, p<0.000 (2-tailed). Mean increase in the oxygen saturation level was 5.55 with a 95% confidence interval ranging from -7.17 to -3.92.

A significant change in pulse rate of the participants pre-intervention (M=79.94, SD=9.48) to post-intervention (M=65.97, SD=5.85), t(32)=9.37, p<0.000 (2-tailed) was seen. Mean decrease in the pulse rate was 13.97 with a 95% confidence interval ranging from 10.93 to 17.01.

Oxygen Saturation Levels ▶	<=90%	>90% and <95%	>=95%
Baseline	51.4	30.4	18.2
After 1st week	42.4	36.4	21.2
After 2nd week	33.2	39.5	27.3
After 3rd week	15.1	51.5	33.4

Table 2: Percentage improvement of Oxygen Saturation levels each week post music administration compared to the baseline percentage

Percentage of people having <=90% oxygen saturation levels (i.e. hypoxia) at the baseline were

51.4% that reduced to 15.1% post 3rd week of music administration. Post receptive music sessions for three weeks, the percentage of people having >=95% oxygen saturation levels increased from 18.2% at the baseline to 21.2%, 27.3% and 33.4% after 1st, 2nd and 3rd weeks.

DISCUSSION

This study investigated if there is an effect of Indian classical vocal music on the oxygen saturation levels in women with depression. From the results, it can be inferred that vocal music interventions with Raags were significantly effective in stabilising and improving the pathophysiological parameter such as oxygen saturation level, a vital contributor to

depression. Music interventions also optimised the pulse rates of the participants. A gradual improvement was witnessed through the three weeks of music administration. The outcome of the study supports our hypothesis inferring that Indian classical vocal music can be used for improving oxygen saturation level as well as preventing hypoxia in women having moderate depression and depressive symptoms.

Subjects of this study had difficulties in focusing or carrying out their daily activities, however they regularly participated in the musical activities and all the thirty-three participants completed the study. The limitation of the study is that it has been conducted with a small sample size and thus in order to replicate the results, a larger-scale experiment based on the present study outcomes is required.

CONCLUSION

Lower oxygen saturation levels such as hypoxia mediate depression, depressive disorders, stress and anxiety through a variety of complex processes in our body including damaging the brain. As is inferred from the results and discussion of the study, classical vocal music interventions can be utilised as a natural, inexpensive, accessible and easy-to-use modality to improve oxygen saturation levels of women under depressive disorders. Long-term administration of Indian classical interventions may be more beneficial for the people in this community for their improved overall health and quality of living.

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