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Study of the effect of *Kalyani raga* in Anxiety-like conditions in female Wistar rats

Research Article

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Abstract

Stress is a medical condition. It can be managed without any internal interventions through Raga therapy as it is healing therapy. It works effectively in psychological conditions if performed with particular harmony. To study the effect of Kalyani raga on the behavioural pattern of female Wistar rats, stress and anxiety were induced in rats with mild stressors. Effects were recorded, compared, and analysed. In 10 days pilot study, we studied two groups of 10 female Wistar rats in which mild stressors were induced for 7 days before 2 days and post-study 1-day observation. In group one, we intervened with *Kalyani Raga* and observed the behavioural pattern while another group was observed for the same without any intervention. The observation was recorded by a high-quality video camera. Parameters studied were locomotion, Climbing on the cage, Digging, Sitting, Feeding, Drinking, defecation, sleeping, and rubbing. Both groups were exposed to mild stressors during the recording. *Kalyani* Raga activates neurons and remarkably engages the brain. Even after stressors, Improvement in feeding within group 1 and the gross motor activities of group 1 with the intervention of *Kalyani* raga have been seen by a decrease in locomotion, digging, rubbing, and an increase in sleep showing the soothing effect of *Kalyani* raga which also showed a significant effect on sleep despite stress as compared to group 2 with no intervention. There is huge scope to perform the same study with a large sample size to get the evidence that can prove the effect of *Kalyani raga* in stressful conditions.

Keywords: Anxiety, Behavioural pattern, *Kalyani Raga,* Music therapy, Stress, Stressors, Wistar rats.

Introduction

In this modernised era, the individual deals with numerous things in their daily schedule which leads to an increase in the stressful events of life. Sometimes it is important to give special attention to it and to manage it effectively. Stress is a medical condition but it can be managed without any internal interventions. For this type of psychological circumstance, it is supposed that Raga therapy works effectively if therapy is performed at the proper time with particular harmony. That is why *Raga* therapy is also called healing therapy. The proposed study aims to observe the effect of *Kalyani raga* in anxiety-related conditions of female Wistar rats. *Kalyani raga* which is the type of *Melakarta* Raga is part of Carnatic music. We studied two groups of 10 female Wistar rats under mild stressors for 7 days. In one group we intervened with *Kalyani Raga* and observed the behavioural pattern while another group was observed for the same without any intervention.

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Origin of *Raga*

The *Raga, Sangeet* is the system of Indian music. It can be tracked down from a Vedic ode nearly around two thousand years ago. The temples are the fundamental source of all Indian music (1). 7 major *chakras* are explained in Ayurveda. And in Universe there is 7 *sura*, these *suras* are according to the chakra present in the body. There are a certain number of scientific publications on Indian classical music as a healing therapy (2).

Mind and *Raga*

The vibrations emanating from *Ragas* help in upthrust the level of consciousness, alertness, calmness, and relaxation. The brain is primarily communicated with the nervous system with the help of an electrical wave. The human brain tends to change its EEG frequency towards the frequency of a dominant external stimulus, such as music, or sound (3) The human brain receives 4 waves mainly. They are alpha waves, beta waves, theta waves, and delta waves. The Alpha waves (7-13Hz) which are deal with wakefulness, relaxation, Calm, and expressions. Beta waves (13-35 Hz) are related to consciousness, strong emotions, brain activities, and motor behaviours, mainly with open eye beta waves recorded. Theta wave (4-7 Hz) is recorded when brain activities are low and mainly during meditating sleep and drowsiness. Delta waves (0-4 Hz) are recorded when brain activities are very low and it deals with deep sleep and mood. (4)(5). During *Raga*

therapy, dopamine hormones are released. Mostly, neurotransmitters have a crucial role in the functioning of cognitive, emotional, and behavioural functions. Due to classical *ragas* pain threshold increases and helps to decrease the stress and anxiety-like condition (3).

Raga as a treatment (*Raga chikitsa*)

The Maratha King Raja Serfojihad built *Tanjore's Saraswati Mahal* Library to fight against widespread common ailments and illnesses through the treasure *Raga therapy*. They contained *ragas* and spells out their application.

A *Raga* is a sequence of selected notes (*Swara*) that lend an appropriate 'mood' or emotion in a selective combination. *Raga therapy* is the yoga system, through the instrument of resonating, vibrating, rich sound (4).

Thus, an entire range of emotions and their nuances might be captured and communicated within certain melodies. Playing, performing, and even taking note of appropriate ragas can work as a drug. Music therapy helps memory and imagination. Same because the *Raga Kalyani* or *Yaman* may elevate the mood.

Raga and Ayurveda

The unique peculiarities and the outstanding merits of Indian music are that they have definite times of day and night for performing *Raga* melodies. It is speculated that only during this probationary period the *Raga* appears to be at the peak of its melodic beauty and majestic splendour. Likewise, there are *Raga*, very attractive in the early hours of the mornings, others which appeal in the evenings, yet others are only near the midnight hour. *Ragas* are practices compounding with Ayurveda, the traditional treatment or science of Vedic healing for rendered effective, a *Raga* must be used by keeping in mind the nature of patients according to *Vata, Pitta,* or *Kapha.*

1. *Vata* is responsible for all kinds of movement in the body.
2. *Pitta* is responsible for digestion and metabolism
3. *Kapha* is liable for nourishment for the mind and body

The time assigned to the *Raga* during the day or night is also important. Moreover, it is to be seen whether the time of the day or night is naturally suited to *Vata, pitta, and Kapha*. Early morning is *Kapha*'s predominant time according to Ayurveda. So it is powerful to cure physical imbalance when *Kapha* dominant person is treated in the early morning with the *Raga* like *Bhairav*. The later part of the morning and afternoon is *Pitta* time. During that hour, *Raga Bilawal* should be used to treat patients. The *Vata* time dominates during the Late afternoon and evening. To cure it, *Raga Pooriya Dhanashri* and *Marwa* should be used. It is very important, however, that the Ayurveda constitution of the patient be kept in mind as to whether he or she is a *Vata, Pitta, or Kapha* person(4).

Aims and Objective

1. To induce the stress and anxiety in female rats with mild stressors
2. To record and analyse the effect of **Kalyani raga** on the behavioural pattern of female Wistar rats.
3. To compare the behavioural pattern in rats exposed to *Kalyani raga* with rats not exposed to it.

Material and Methods

- Approval from the Institutional Animal Ethics Committee has been obtained for the study.
- There was No scarification of animals done.
- White female Wistar rats were obtained from the animal house at the Jawaharlal Nehru Medical College, Sawangi (Meghe), Wardha.
- The rats were kept in a separate cage in a well-ventilated room at the standard experimental condition.
- Study design –Female Wistar rats were divided into two following groups of 5 rats in each group. Before exposing them to the mild stressors, both the groups were observed for the first two days to notice any abnormal behaviour. The observation was uneventful. Group 1 intervened with *Kalyani raga*, the intervention group. Group 2 rats were induced with mild stressors without any intervention. An equivalent level of stressors induced in both the group by disrupted light and dark ex poser, bed wetting, exposing to the odour and not providing a one-time meal and drinking water for 7 days. The observation was done based on an observational parameter after stressors exposure. The observation was recorded in a high-quality video camera.

Observational Parameters – based on the behavioural pattern

Sr. no	Behavioral Pattern/Parameters
1	Locomotion
2	Climbing the cage
3	Digging
4	Sitting
5	Feeding
6	Drinking
7	Defecation
8	Sleeping
9	Rubbing

Periods of observation

Observations were done in 3 sessions per day for each group. Time duration of the intervention was 30 minutes. Mild stressors were induced in all A, B, and C sessions.

Sr. No	Session	Group 1	Group 2
1	Session A	Observation for 30 min before the playing of *Kalyani Raga*	Observation for 30 min
2	Session B	Observation for 30 min while playing *Kalyani raga*	Observation for 30 min
3	Session C	Observation for 30 min after playing *Kalyani raga*	Observation for 30 min

Study period

The total duration of the study was 10 days for each group.

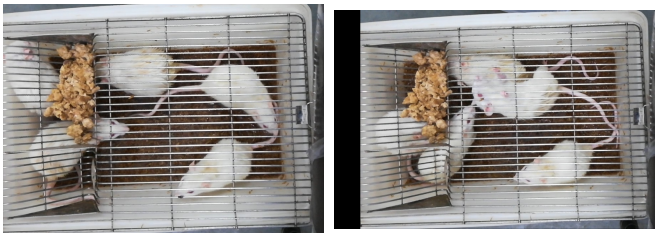
Observation and Result

Table 1: Observations of Group -1(Intervention group) and Group 2 (Control group) after Intervention Mann Whitney U Test

Parameters	Group A	Group B	Mean Difference	z-value	p-value
Locomotion	2±1.15	5.71±0.48	3.71±0.47	7.83	0.0001, **S**
Climbing the cage	1.71±0.75	5.57±0.53	3.85±0.34	11.02	0.0001, **S**
Digging	2±0.81	4.14±0.37	2.14±0.34	6.30	0.0001, **S**
Sitting	4.14±1.21	2.42±0.77	1.71±0.54	3.13	0.009, **S**
Feeding	3.71±1.11	1.71±0.95	2±0.55	3.61	0.004, **S**
Drinking	0±0	1.42±0.53	1.42±0.20	7.07	0.0001, **S**
Defecation	2.85±0.69	4.57±0.53	1.71±0.32	5.19	0.0001, **S**
Urination	1±0	2.00±0.81	1±0.30	3.24	0.007, **S**
Sleeping	3.85±1.06	1.28±0.48	2.57±0.44	5.78	0.0001, **S**
Rubbing	2.85±0.89	4.85±0.69	2±0.42	4.66	0.001, **S**

Figure 1: Observation of Group 1 and Group 2

Female Wistar Rats of group 1 **Female Wistar Rats of group 2**



Locomotion was observed in the group is (2±1.15) while in group 2 is (5.71±0.48) its mean difference is (3.71±0.47), z value is 7.83 with statistical significance (p = 0.0001, S). (See Table 1)(Fig. 1). In group 1 Before intervention (4.71±1.11) and after Intervention (2±1.15) of Kalyani raga there was a significant difference noted after intervention (p =0.0001, S). (Table 2) (fig.2-5). Climbing in the cage was found (1.71±0.75) in group 1 and (5.57±0.53) in group 2 (p=0.0001, S). (See Table -1) (fig. 1). Within group 1, climbing activity was (4.14±1.46) before and (1.71±0.75) after playing *Kalyani raga* which is statistically significant (p=0.001,S). (See table 2). (fig.2)Group 1 showed, (2±0.81) of digging while group 2 showed (4.14±0.37) they explained it as statistically significant. (p= 0.017708). There was a decrease in the digging activity in group 1 (See Table 1)(fig.1)In group 1 sitting was seen at 70% and 83% in group 2 (p = 0.000881). sitting was more observed in group 2. Drinking activity didn't show any difference. (See table 1)(fig 1). Both groups 1 and 2 did almost the same feeding, 86% and 90% respectively with p= 0.276211. (table 1, figure 1) But within the group, the difference between before and after was statically significant p= 0.019464.(see Table 2,fig.2-3). Defecation rate in group 1, was found 57% and it was 81% in group 2. It shows the decline in the rate of defecation in group 1 with statistical significance, p= 0.000219 (See Table -1) (fig. 1). Group 1 rats showed a 93% of sleeping rate while group 2 showed 64% with a statistical significance of p= 0.015878. We observed an increase in the sleeping activity in group 1. (See Table -1) (fig. 1). Rubbing activity in group 1 was found at 62% while in group 2, it was seen at 90% (p= 0.026586). (See Table -1) (Fig. 1). The result of Group 1 and Group 2 was found statistically significant, p = 0.04 (See table 1). Within the group, the observation of the parameters before and during playing the *Kalyani raga* was found statistically significant, p =0.039. Also, there was a significant difference in the activities of rats before and during the playing of *Kalyani raga*, p = 0.04. The difference between during and after was not statistically significant. p= 0.44 (See table 2).

Table 2: Comparison of scores in group A (Intervention Group) before and after treatment Wilcoxon Signed Rank Test

Parameters	**Before Intervention**	**After Intervention**	**Mean Difference**	**z-value**	**p-value**
Locomotion	4.71±1.11	2±1.15	2.71±0.75	9.500	0.0001,**S**
Climbing the cage	4.14±1.46	1.71±0.75	2.42±0.97	6.584	0.001,**S**
Digging	3.28±1.11	2±0.81	1.28±0.75	4.500	0.004,**S**
Sitting	2.57±0.97	4.14±1.21	1.57±0.97	4.260	0.005,**S**
Feeding	2.28±0.75	3.71±1.11	1.42±1.13	3.333	0.016,**S**
Drinking	1.57±0.53	0±0	1.57±0.53	7.778	0.0001,**S**
Defecation	4.57±0.78	2.85±0.69	1.71±0.48	9.295	0.0001,**S**
Urination	2.28±0.75	1±0	1.28±0.75	4.500	0.004,**S**
Sleeping	1.71±0.75	3.85±1.06	2.14±0.69	8.216	0.0001,**S**
Rubbing	4.71±0.75	2.85±0.89	1.85±0.69	7.120	0.0001,**S**

Discussion

While playing *Kalyani Raga*, neurons are activated. Music remarkably engages the brain. The brain responds to cellular signal that wakes up emotion with it (12)(13). Significant changes were observed between group 1 and group 2 of the study. After the intervention of *Kalyani raga*, changes were seen in the behavioural pattern of the Wistar rats. Like, Decrease in the locomotive activities in Group 1. It is considered that due to stressors, the open field activities like locomotion, digging, and rubbing are increased(12)(13). Improvement in the gross motor activities of group 1 with the intervention of *Kalyani raga* has been seen by a decrease in locomotion, digging, and rubbing (6). (Seen in Table 1).(fig 1& 2)

Depending on the nature of the raga, it could induce or intensify, joy or sorrow, violence, or peace. These can be observed by physiological activities or by the psychological activities of an individual. It is this quality that forms the basis for musical application. (7) For this research, the activities considered were locomotion, climbing on the cage, digging, sitting, drinking, Feeding, defecation, sleeping, and rubbing. The induced stressors influence these parameters by creating stressful conditions.(12)(13). In stressful conditions, It shows that *Kalyani raga* helps in reducing stress and anxiety-like condition. (Seen in Table 1).(seen in Table 2)(fig.1- 5). Digging tasks depends basically on effectual decision-making, judgment, and learning. This task is best used in the ability assessment of the Brain, like cognitive function and analysing the frontal function in various ways (8)(14). Digging has been decreased in group 1. In this research, we found, that after the intervention of the *Kalyani raga*, there was an improvement in the cognitive function with a decreased rate of digging in Group 1. (see Table-1). (Fig.1-4)Due to stress or anxiety, there is a decrease in the intake of chow. (9). But after intervention in Group 1, there was an improvement in the feeding parameter within the group.(see table - 2)(fig. 1-5).

In stress and anxiety as there is a rise in the rate of defecation. Furthermore, there was a decrease in the defecation of group 1 which showed a reduction in the faecal pellet output in stressful conditions. But in Gastro Journal study of Stress-induced change in intestinal transit in a rat show the faecal pellet output is an increase in stressful and anxiety-like condition (15)(10). (seen in Table 1, Table 2)(fig. 1-5).The stressors used in rats lead to a decrease in sleep. (11) In this research, it was found that there was an increase in the sleeping pattern of Group 1 after an intervention. This shows the better result of *Kalyani Raga* in stressful conditions. (See Table 1). (Fig.1-5).

Conclusion

Kalyani raga has reduced the stress and anxiety-like conditions which were induced by various stressors in female Wistar rats. The changes observed can be the result of improvement and refinement in cognitive function and also the motor function as the effect of *Kalyani raga*. As this was a pilot study, there is huge scope to perform the same study with a large sample size. Human trials of *Kalyani raga* can be a major step toward mental health management.

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