

Effects Of Music Therapy On Clinical And Biochemical Parameters Of Metabolic Syndrome

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Abstract

Background: Music therapy is a new approach being used for the management of metabolic abnormalities and stress related illness. **Objective:** To study the effect of Music therapy on various clinical and biochemical parameters of Metabolic Syndrome. **Methods:** This cross sectional study was carried out on 100 patients of metabolic syndrome selected randomly. These patients were divided into two equal groups after age, sex adjustment. In control group (group I) 50 patients underwent the conventional treatment. 50 patients in study group were treated with supervised music protocol along with conventional treatment. The Body Mass Index, ;Waist-Hip ratio, Blood pressure, Fasting blood sugar were monitored weekly while HbA_{1c} and lipid profile were determined at the baseline and after three months of exposure to music therapy. Statistical analysis was performed by employing student t- test. **Results:** In the study group there was a significant decrease in BMI (27.18±5.02 to 25.44±3.49 kg/m², p<0.05), waist hip ratio (0.95±0.05 to 0.93±0.05 cm, p<0.05), Fasting blood sugar (196.00±47.80mg/dl to 152.00±16.19mg/dl, p<0.001), HbA_{1c} (8.41±1.31% to 7.08±0.78 % p<0.001), Systolic Blood Pressure (151.00±12.10 to 136±9.04 mmHg p<0.001), Diastolic Blood Pressure (94±4.80 to 86.44±3.16 mmHg, p<0.01), Mean serum cholesterol (257.80±18.92 to 229.12±17.82mg/dl, p<0.001) and triglycerides (180.86±14.04 to 136.50±8.92mg/dl, p<0.001), LDL (167.97±14.40 to 140.20±15.41mg/dl, p<0.001), and VLDL (33.60±2.88 to 28.04±3.08mg/dl, p<0.001) and increase in HDL (33.32±3.38 to 39.71±3.41mg/dl, p<0.001), when compared with those of control group not receiving the music therapy along with the conventional treatment. **Conclusion:** The promising outcomes of Music therapy showed that it may be considered as a useful adjunct to conventional treatment in management of the metabolic syndrome. This study advocates music therapy to establish it from a general well being concepts to a neuroscience guided model.

Key words: Metabolic Syndrome, Music Therapy

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Introduction

The metabolic syndrome is a clustering of metabolic abnormalities that has been found to be associated with a risk of coronary artery disease, stroke and cardiovascular mortality greater than that of its

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individual component.¹ The insulin resistance comprises a spectrum of disorders, which include hyperglycemia, hypertension, dyslipidemia and accelerated cardiovascular disease. This constellation of metabolic derangements is termed as metabolic syndrome.²

The traditional classical music of India, offers a balanced and holistic multi-modality approach to treat metabolic syndrome. The sound of music travels in the form of waves, transmitting energy and vibrating the medium it travels in. It is this transfer of energy which can be utilized in therapy. Sound has the power to affect the body, emotions and mind. To understand the power of music utilized to enhance growth we can read in the ancient texts how Lord Krishna's flute playing promoted the bewitching verdure (a trance like situation) in the forests and gardens of Vrindavan. Shehnai / Nagswaram in temples, piano in churches, and harmonium in Gurudwaras prove the importance of music in religions. However, Music is beyond religions. It has a tremendous capacity to bring different religions together. Indian Classical Music gives soothing effect to the body, lowers mental tensions and has been recommended for patients suffering from heart diseases, high blood pressure, diabetes etc.^{3,4}

Alfred Einstein in his famous book *Short History of Music (1917)* says "To the man who in prehistoric times first perceived musical sound as it originated in the beating of a hollow object, or by the swing and whirl of the staff it was something incomprehensible, and therefore mysterious and magical. The mere sound of percussion instruments excited him to the pitch of intoxication. From them he discovered the power of rhythm, which inflamed and ordered the ritual dance and also co-ordinated the movements of labour, and as if by magic lightened toil."⁵ The empirical studies on therapeutic evaluation of the classical ragas have shown interesting results.⁶

Raga *Bhairavi* has been found to uproot certain diseases like asthma, chronic cold, cough, tuberculosis, some of the sinus and chest related problems etc.

Raga *Asavari* is effective in eliminating the impurities of blood and related diseases.

Raga *Malhar* pacifies anger, excessive mental excitements and mental instability.

Raga *Surat* and Raga *Jaijaivanti* have also been found effective in curing mental disorders and calming the mind.

Raga *Hindola* helps sharpening the memory and enhancing mental concentration

A research study at the Berlin University showed that the vibrations of the bugle sound could destroy bacteria and germs in the surrounding. More specifically, it was found that if the *Shankha* is played by infusing (through the mouth) twenty-seven cubic feet of air per second, within a few minutes it will kill the bacteria in a surrounding area of two thousand two hundred square feet.⁴

Despite considerable literature being available on the music and its relation to human health, very little scientific work has been done to study the effects of music on various parameters related to metabolic syndrome. This paper aimed to study the effect of the use of music therapy as an intervention along with conventional treatment to see the effect on some clinical and biochemical parameters of metabolic syndrome.

Methods

This cross sectional study was carried out on 100 patients of both sexes of metabolic syndrome who were selected randomly keeping in mind the exclusion criteria from amongst the outdoor and indoor patients of Diabetes Care and Research Center, Sardar Patel Medical College, Bikaner, India. The total procedure and motive of the study was explained to the patients and informed consent was taken from them. The approval of the study protocol was obtained from the Ethics Committee, Sardar Patel Medical College and associated group of hospitals, Bikaner. Detailed history of each patient was obtained regarding the age, sex, year of diagnosis, age at onset and duration, associated risk factors and family history. Patients suffering from liver disease, Arthritis, Pulmonary Tuberculosis, Malabsorption, Alcoholism were excluded from the study. Metabolic syndrome was diagnosed according to NCEP Adult Treatment Panel III guidelines⁷ presented in Table I.

Table I: Criteria for diagnosis of metabolic syndrome as per NCEP ATP III guidelines

| Sex | Blood Pressure | Waist Circumference | Triglycerides | HDL | Fasting Glucose |
|--------|----------------|---------------------|---------------|-----------|-----------------|
| Male | >140/>90 mmHg | >102 cm | >150 mg/dl | <40 mg/dl | >110 mg/dl |
| Female | >140/>90 mmHg | > 88 cm | >150 mg/dl | <50 mg/dl | >110 mg/dl |

The patients were advised to stick to the treatment plan to keep them euglycemic and after age then they were divided into two groups randomly. In Group I (control) 50 patients were under conventional treatment i.e. diet, medicine and exercise. But 50 patients in Group II(study) were administered supervised music protocol on daily basis for 3 month duration in addition to conventional treatment.

Music Protocol

Music sessions of 45 minute duration with two short break of 5 minute each, were delivered to the study group. The music was played on audio speaker system in a large hall occupied by the patients.

Patients also listened to various pre-recorded musical concerts having soothing action on minds & hearts. These included: “Bansuri Vadhan” by Pandit. Hari Prasad Chaurasia, “Shehnai” by Bismillah Khan, “Tabla” by Ustad Zakir Hussain, “vocal” by Pandit. Bhimsen Joshi, “Santoor “ by Shiv Sharma.

Ragas used in the music therapy to treat various parameters of metabolic syndrome are presented in table II.

Table II: Various Ragas and associated ailments.

| Raga | Application |
|--------------------|---------------------------|
| Bageshri | Diabetes, Hypertension. |
| Bhupati Todi, Ahir | High Blood Pressure. |
| Bhairav, Kalyan | |
| Chandra Kaun | Heart ailments, Diabetes. |

The procedure was repeated continuously for three month duration.

Blood samples were taken after 8 hours of fasting. BMI, W/H ratio, Fasting blood sugar and Blood pressure of all patients were recorded weekly. HbA_{1c} and Lipid profile were estimated initially and after 3 months.

Fasting Blood Sugar , Serum Triglyceride , Total Cholesterol , HDL-Cholesterol was estimated by Glucose Oxidase method, CHOD-PAP with ATCS enzymatic kit, CE-Co-PAP enzymatic end point respectively by colorimeter. VLDL and LDL were calculated by Friedewald formula. HbA_{1c} was estimated by DS5 Drew Scientific machine (Ion exchange chromatography). In addition, Waist Circumference was measured at a level midway between the lower rib margin and iliac crest with the tape all around the body in horizontal position and Hip Circumference was measured as the maximal circumference over the buttocks, gridlines in a mirror are used to verify that the measuring tape is in a horizontal position all around the body during measurement.

Blood Pressure was recorded in the sitting position in the right arm with a mercury sphygmomanometer. Two readings were taken 5 minute apart and the mean of the two was recorded as the blood pressure. Statistical analysis was performed according to Intention to Treat (ITT) analysis. The analysis was performed by employing student t- test .

Results

Anthropometric and Biochemical parameters in control group when compared between baseline and post treatment with conventional therapy showed significant difference except BMI and WH ratio (Table III).

Table III: Mean \pm SD Anthropometric and biochemical parameters in Control group.(n=50)

| Parameters | Baseline (0 weeks) | Post Treatment (3 months conventional) | P value |
|--------------------------|-----------------------|---|---------|
| BMI (kg/m ²) | 28.43 \pm 2.55 | 27.89 \pm 2.46 | >0.05 |
| WH Ratio | 0.95 \pm 0.05 | 0.94 \pm 0.05 | >0.05 |
| SBP (mmHg) | 152.61 \pm 8.73 | 146.39 \pm 4.17 | <0.001 |
| DBP (mmHg) | 95.96 \pm 2.25 | 93.17 \pm 3.57 | <0.001 |
| FBS(mg/dl) | 201.46 \pm 65.80 | 164.80 \pm 27.17 | <0.001 |
| HbA _{1C} | 8.89 \pm 1.68 | 8.15 \pm 8.09 | <0.02 |
| TG(mg/dl) | 176.52 \pm 8.79 | 151.39 \pm 5.90 | <0.001 |
| TC (mg/dl) | 258.74 \pm 9.27 | 232.35 \pm 1.29 | <0.001 |
| HDL(mg/dl) | 32.85 \pm 4.10 | 36.78 \pm 4.17 | <0.001 |
| LDL(mg/dl) | 169.49 \pm 10.26 | 152.40 \pm 11.40 | <0.001 |
| VLDL(mg/dl) | 35.30 \pm 1.76 | 30.28 \pm 1.18 | <0.001 |

Again the mean BMI, waist hip ratio significantly ($p < 0.05$) decreased and significant ($p < 0.001$) improvement in SBP and DBP were observed in study group after 3 months music therapy. The mean fasting blood sugar and HbA_{1c} and all the lipid parameters in the study group had significant ($p < 0.001$) improvement in music therapy treated group. (Table IV)

Table IV: Effect of Music Therapy on anthropometric and biochemical parameters in study group

| Parameters | Baseline (0 Week) | Post treatment (after 3 months music therapy & conventional treatment) | P value |
|--------------------------|----------------------|--|---------|
| BMI (kg/m ²) | 27.18 \pm 5.02 | 25.44 3.49 | < 0.05 |
| WH Ratio | 0.95 \pm 0.05 | 0.93 \pm 0.05 | <0.05 |
| SBP (mmHg) | 151.00 \pm 12.10 | 136 \pm 9.04 | <0.001 |
| DBP (mmHg) | 94 \pm 4.80 | 86.44 \pm 3.16 | <0.001 |
| FBS(mg/dl) | 196.00 \pm 47.80 | 152.00 \pm 16.19 | <0.001 |
| HbA _{1C} | 8.41 \pm 1.31 | 7.08 \pm 0.78 | <0.001 |
| TG(mg/dl) | 180.86 \pm 14.04 | 136.50 \pm 8.92 | <0.001 |
| TC (mg/dl) | 257.80 \pm 18.92 | 229.12 \pm 17.82 | <0.001 |
| HDL(mg/dl) | 33.32 \pm 3.38 | 39.71 \pm 3.41 | <0.001 |
| LDL(mg/dl) | 167.97 \pm 14.40 | 140.20 \pm 15.41 | <0.001 |
| VLDL(mg/dl) | 33.60 \pm 2.88 | 28.04 \pm 3.08 | <0.001 |

The demographic and clinical profiles of both the groups (control & study) were studied for different variables in the beginning of study and there were no significant differences in baseline characteristics shown in Table V.

Table V: Comparison of different parameters between the groups at baseline

| Parameters | Group I Mean \pm SD | Group II Mean \pm SD | P- Value |
|--------------------------|--------------------------|---------------------------|-------------------|
| BMI (kg/m ²) | 28.43 \pm 2.55 | 27.18 \pm 5.02 | 0.1 ^{NS} |
| WH Ratio | 0.95 \pm 0.05 | 0.95 \pm 0.05 | - |
| SBP (mmHg) | 152.61 \pm 8.73 | 151 \pm 12.1 | 0.4 ^{NS} |
| DBP (mmHg) | 95.96 \pm 2.25 | 94 \pm 4.8 | 0.4 ^{NS} |
| FBS(mg/dl) | 201.46 \pm 65.8 | 196 \pm 47.8 | 0.5 ^{NS} |
| HbA _{1C} | 8.89 \pm 1.68 | 8.41 \pm 1.31 | 0.2 ^{NS} |
| TG(mg/dl) | 176.52 \pm 8.79 | 180.86 \pm 14.04 | 0.8 ^{NS} |
| TC (mg/dl) | 258.74 \pm 9.27 | 257.80 \pm 18.92 | 0.6 ^{NS} |
| HDL(mg/dl) | 32.85 \pm 4.10 | 33.32 \pm 3.38 | 0.5 ^{NS} |
| LDL(mg/dl) | 169.49 \pm 10.26 | 167.97 \pm 14.40 | 0.4 ^{NS} |
| VLDL(mg/dl) | 35.30 \pm 1.76 | 33.60 \pm 2.88 | 0.4 ^{NS} |

NS = p > 0.05

When post treatment halves for different parameters in control group were compared with that of study group, it showed statistical improvement in all parameters except waist/hip ratio in study group shown in Table VI.

Table VI: Comparison of different parameters between the groups at post-treatment

| Parameters | Group I Mean \pm SD | Group II Mean \pm SD | P value |
|-------------------|--------------------------|---------------------------|------------|
| BMI | 27.89 \pm 2.46 | 25.44 \pm 3.49 | < 0.005 |
| WH Ratio | 0.94 \pm 0.05 | 0.93 \pm 0.05 | < 0.9 |
| Systolic | 146.39 \pm 4.17 | 136 \pm 9.04 | < 0.005 |
| Diastolic | 93.17 \pm 3.57 | 86.44 \pm 3.16 | < 0.001 |
| FBS (mg/dl) | 164.80 \pm 27.17 | 152 \pm 16.19 | < 0.005 |
| HbA _{1C} | 8.15 \pm 1.29 | 7.08 \pm 0.78 | < 0.001 |
| TC (mg/dl) | 232.35 \pm 8.09 | 229.12 \pm 17.82 | < 0.001 |
| TG (mg/dl) | 151.39 \pm 5.90 | 136.50 \pm 8.92 | < 0.001 |
| HDL (mg/dl) | 36.78 \pm 4.17 | 39.71 \pm 3.41 | < 0.001 |
| LDL (mg/dl) | 152.40 \pm 11.40 | 140.20 \pm 15.41 | < 0.001 |
| VLDL (mg/dl) | 30.28 \pm 1.18 | 28.04 \pm 3.08 | < 0.001 |

The weekly recording of BMI, W/H, SBP, DBP, FBS showed their steady decrease throughout the course in both groups but more markedly decreased in study group (Figure 1-5). Again HbA_{1C} was compared between baseline and post-treatment in both groups but the mean value was found significantly lower only in study group (Figure 6).

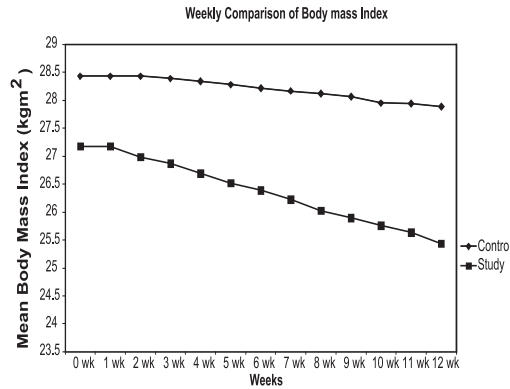


Figure 1: Weekly comparison of body mass index in both groups.(n=100)

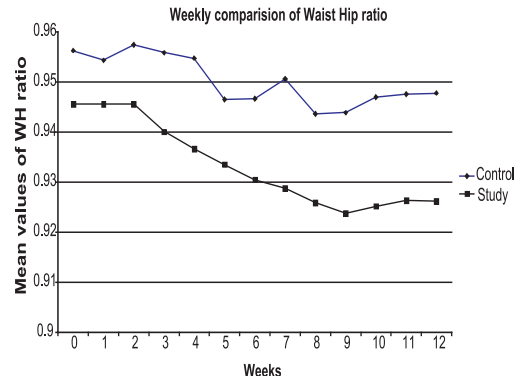


Figure 2: Weekly comparison of W/H in both groups(n=100)

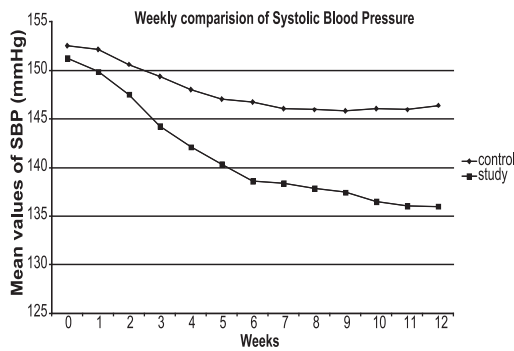


Figure 3: Weekly comparison of SBP in both groups(n=100)

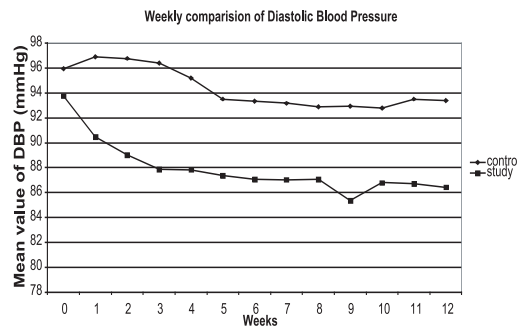


Figure 4: Weekly comparison of DBP in both groups(n=100)

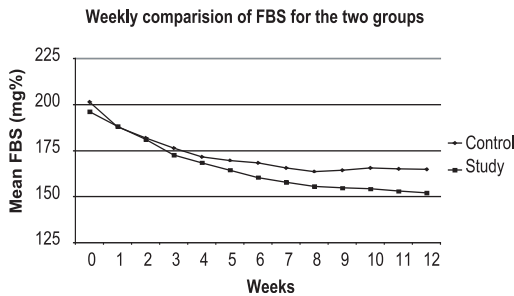


Figure 5: Weekly comparison of FBS in both groups(n=100)

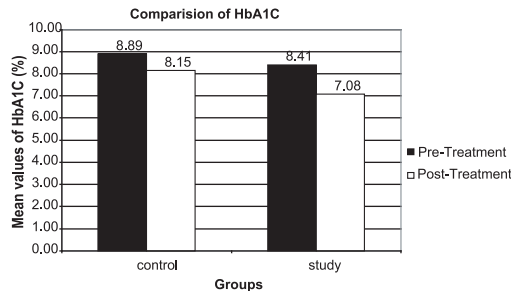


Figure 6: Mean HbA_{1c} in different group at baseline and post treatment (n=100)

Discussion

Indian classical music shows that specific *Shastriya Ragas* enhance the level of vital energy. Apart from the classical ragas played on musical instruments, the rhythmic sounds of the temple bells and *Shankha* (conic shell or bugle) produced during devotional practices have also been found to have therapeutic applications.⁸

The present study was performed to observe the effect of music therapy on clinical and biochemical parameters of Metabolic Syndrome.

In the study it was observed that the mean BMI and Waist-Hip ratio decreased significantly in the Study group. Podolasky stated in his book *Music for your health* (1945) that music increases metabolic rates and decreases extra fat in the muscle.⁹ We observed that systolic blood pressure as well as diastolic blood pressure also decreased significantly in the Study group. Previous studies done showed a correlation between increased calcium levels in the brain and increased dopamine secretions. Dopamine is a brain neurotransmitter that generates feelings of pleasure and well being. A research study conducted in 2004 by Denetsu Sutoo and Kayo Akiyama, reported that music leads to increased calcium/CalModulin (CaM) dependent DA synthesis in the brain, thus causing a reduction in blood pressure.^{10,11} Teng XF, Wong MY, Zhang YT et. al. observed, *The effect of music on hypertensive patients*, that listening to certain type of music serves to reduce high SBP and therefore music therapy may be an alternative for hypertension treatment.^{12,13}

Several investigators suggested various explanations for the beneficial effect of music therapy on blood pressure. Some studies suggest that music leads to increased Calcium/CalModulin (CaM) dependent DA synthesis in the brain thus causing reduction in blood pressure. Music might regulate or affect various brain functions through dopaminergic neuro transmission, and might therefore be effective for rectification of symptoms in various diseases

that involve DA dysfunction. According to Dr. Petersi music has the capability to reduce blood flow volume in brain hence peaceful music controls the blood pressure.⁸⁻⁹

The significant fall in fasting blood sugar and HbA1c was observed in music therapy treated group. Arnald Altoson stated in his article "The musicians approach to musical therapy" that heart and pancreas are the easily affected by music.¹⁴ Some studies suggested that in diabetes, the carbohydrate supply to the liver is low, due to deficient storage primarily as consequence of lack of insulin.¹⁵ Because of that lacking sugar cannot pass from the blood into to the liver and other cells and thus blood sugar level is high. The sugar is in the form of complex carbohydrate, which is released into the blood stream on demand- the demand typically being the action of epinephrine. Classical music, a refined sound, stimulates the α cell activity in the organ and ensures normality over a period in all aspects.⁹

There was significant reduction in lipid profile showing that music therapy lowers blood lipid levels. Reduction in total cholesterol, serum triglyceride & LDL, VLDL and increased serum HDL was observed in the study group. There were no literature or studies found to see the effect of music therapy on lipid profile parameters, but some factors attributed to rising blood lipid levels such as stress, metabolic rate, some endogenous factors and chemical changes in blood were suppressed by music therapy. Barnason S, Zimmerman L et al. observed the effects of music interventions on anxiety in the patient after coronary artery bypass grafting.¹⁶

The understanding of music's role and function in therapy and medicine is undergoing a rapid transformation based on neuro-scientific research showing the reciprocal relationship between studying the neurobiological foundations of music in the brain and how musical behavior through learning and experience changes brain and behavior function. Possible

benefits of music therapy are music acts on our mind before being transformed into thought and feeling, music influences the lower and higher cerebral centers of the brain, music therapy is an important tool in the treatment of psychological disorders, Music therapy stimulates good vibrations in the nerves of the listeners, music brings about a sense of mental well being in individuals, music therapy enhances the concentration level of children, music improves the capacity of planning, music training helps to express refined exhibition of emotions and clarity in cognition.

Conclusion

Through the outcome of this research we can conclude that the success of therapeutic use of music in clinical practice can shift its status from a social science model based on cultural exercise and general well being concepts, to a neuroscience guided model based on brain function and music perception. The present study is also confirming the beneficial effect of music therapy in patients with metabolic syndrome. This finding highlights the potential of music therapy as an adjunct to medical treatment.

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