Combined Effect of Music Therapy and Benson’s Relaxation Therapy in Type 2 Diabetes Mellitus Patients on Cognition, Autonomic Function, Stress and Cortisol Levels- an Experimental Study

Stress, Cortisol Levels and Type 2 Diabetes Mellitus

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Abstract:

\textbf{Background:} Perceived stress is related to increase the risk of causing metabolic disease like diabetes mellitus. The lifetime prevalence of stress is 35\% in the young aged population. Elevated serum cortisol levels and cognitive decline in terms of memory and attention in Type 2 DM individuals are seen and have been associated with many factors including lifestyle changes, dietary habits, work stress and physical inactivity.

\textbf{Aim:} The aim was to evaluate the effectiveness of combination of music therapy and Benson’s relaxation therapy in type 2 Diabetes Mellitus patients on stress, cortisol levels.

\textbf{Methods:} 33 adults were recruited in the study. A consecutive 5 days session of Combined Music therapy and Benson’s relaxation therapy was given to the subjects for 30 minutes on each day. The outcome measures used in the study were Serum cortisol levels, PSS, MoCA and GSR Biofeedback machine. All the outcome measures were assessed at the beginning and at the end of the intervention.

\textbf{Results:} The results stated that there was a statistical noteworthy change in the serum cortisol levels. Improvements were also seen in the parameters of PSS, MoCA scores and GSR Biofeedback readings. (p<0.05)

\textbf{Conclusion:} This study concluded that a 5 days Combined music therapy and Benson’s relaxation therapy intervention showed positive improvement in stressed out type 2 DM individuals in terms of their serum cortisol levels, Perceived Stress scale, Montreal Cognitive Assessment scores and GSR Biofeedback readings.

\textbf{Keywords:} Combined music therapy and Benson’s relaxation therapy, Type 2 DM, serum cortisol levels, stress

I. \textbf{Introduction}

Stress is the nonspecific response of the body to any demand.\textsuperscript{[1]} The prevalence was 35\% in middle-aged Diabetics due to work, physical inactivity and the disease itself.\textsuperscript{[2]} T2D accounts 80\%–90\% of the cases.\textsuperscript{[3]} Stress, high cortisol levels and cognitive decline were linked with DM.\textsuperscript{[4,5,6]} The Indian traditional classical music and Benson’s relaxation therapy helps to calm the body and mind for a healthy life.\textsuperscript{[7,8]}

Thus, present study assesses the effect of combined music therapy and Benson’s relaxation therapy in type 2 DM patients on stress, cortisol levels and also assesses for stress, cognition, autonomic response function using PSS, MOCA and GSR Biofeedback respectively.

II. \textbf{Methods}

\textbf{Study Design and Ethics:} It was a pre-post experimental study analysing the combined effect of music therapy and Benson’s relaxation therapy on stress, cortisol levels, cognition and autonomic response. An
independent review committee approved the study protocol. Written informed consent form, approved by the ethics committee, was obtained from all the study participants.

**Study Setting:** Participants were recruited from Tertiary health care hospital in Belagavi from April 2019 to March 2020.

**Participants:** The inclusion criteria were age between 20-40 years, willing to participate in the study. Diagnosed type 2 diabetes mellitus with HbA1c levels ranging between 6.5% or more and duration of 6 years, Perceived stress scale score ranging from 13 and above, on medication for type 2 diabetes mellitus and able to follow commands. Participants having any type 1 diabetes mellitus, uncontrolled type 2 diabetes mellitus (sugar levels 100mg/dl or more), any neurological conditions like multiple sclerosis, stroke etc and cancer were excluded.

**Sample Size:** It had a sample size of 33 with convenience type of sampling.

**Outcome variables:**

1. **Total Cortisol Serum** - Cortisol is the major glucocorticoid regulated by ACTH which is secreted in a circadian rhythm. In certain diseases, such as Addison’s disease and Cushing disease and condition like stress affects the amount of cortisol secretion. The test is used as a diagnostic measure and as a way to assess the functioning of the adrenal and pituitary glands. Normal serum cortisol ranges from 6 and 23 micrograms per deciliter (mcg/dL). [9]

2. **The Perceived Stress Scale** - It is a psychological instrument and it is a self-reported measure which assesses the degree to which the respondent has perceived situation within the past month as stressful. The test/retest reliability of the scale is 0.85.[10]

3. **Montreal Cognitive Assessment Scale** - It is a widely used screening assessment for detecting cognitive impairment with 30-point test administered in approximately 10 minutes MoCA had a good internal consistency with a Cronbach's Alpha of 0.715 the curve was 0.761 for MoCA (95%CI 0.672-0.849) and a sensitivity of 97.8% and a specificity of 67.2 % and r =0.757.[11]

4. **Galvanic Skin Resistance Biofeedback** - It measures the conductance of the skin. Stress produce sweat and is been measure through copper electrodes. A passive test measures the current that is generated by the person's body itself. The feedback from this is the measured galvanic skin response.[12]

**III. Procedure**

After obtaining ethical clearance, people between 20-40 years were screened. All the participants were explained about the nature and process of the study. As per the inclusion criteria, a total of 50 participants were screened; 17 were excluded as 10 were above the age of 40 years, 2 ladies were pregnant, and 2 were suffering from type 1 Diabetes Mellitus and 3 individuals refused to participate in the study. Thus, 33 participants were finally recruited in the study. Demographic data of each participant were obtained. For the purpose of age group-wise and gender-wise comparison and analysis; data collected was segregated accordingly for age into two groups. Group 1 having <= 30 years of age, Group 2 having 31-35 years of age and Group 3 having 36-40 years of age.

**IV. Statistical Analysis**

The descriptive and quantitative data in the study did follow normal distribution. The test for normality for the data set was done using Kolmogorov-Smirnov test. The homogeneity of the data was checked using the Independent t- Test for the age, weight, height and BMI distribution in the present study. Dependent t-Test was administered for all the before and after outcome measures in terms of Serum cortisol levels, Perceived stress scale, Montreal cognitive assessment scale and galvanic skin resistance biofeedback were measured. Statistical significance was set at two-tailed p-value < 0.05. All statistical analyses were conducted with Statistical Package for Social Sciences (SPSS) software version 21.
V. Results

Subjects were recruited from April 2019 to March 2020. Evaluations and Interventions were carried out from April 2019. Figure 1 shows the flow chart and table 1 shows the sample characteristics. Table 1 describes the socio-demographic characteristics. The mean age was 35.21±5.22 years showing that there were more participants of age ranging between 30-40 years and 63.64% of the sample being women. The mean BMI of the participants were 25.88±3.94 which showed the study participants were falling in overweight category according to the Asian criteria based BMI. Table 2 shows the changes over 5 days of intervention in serum cortisol levels, perceived stress levels, cognition and autonomic response function. Changes in the assessed parameter were influenced by the 5 days of intervention as of the initial assessment value. Significant changes were noted in the serum cortisol levels which showed reduction with \( P = 0.001 \), perceived stress scale scores reduction was noted with \( p\text{-value}= 0.001 \), MoCA scores were improved suggesting improvement in cognition with \( p= 0.001 \) and autonomic response function assessed using GSR biofeedback showed improvements with \( p=0.001 \) which showed all the outcomes had statistical significance.

VI. Discussion

There is an existence of exponential variety of treatment techniques used for managing stress and type 2 dm. Numerous physiotherapeutic approaches are applicable in managing stress in return tackling type 2 dm. Two amongst those effective approaches are music therapy and Benson’s relaxation therapy. Hence the aim of the current experimental study was to assess the combined effect of music therapy and Benson’s relaxation therapy in type 2 diabetes mellitus patients on cognition, autonomic function, stress and cortisol levels. In the present study, the age taken into consideration was 20-40 years. Subjects having their PSS scores more than 13, diagnosed type 2 diabetes for 6 years, on medications and able to understand commands were enrolled in the study. As there was significant research done for prevalence of stress in type 2 diabetic patients aging upto 40 years, hence the age selected for the present study was 20-40 years. Sendhilkumar M and Tripathy TP reported prevalence of stress being 35% in 30-40 years aged type 2 diabetic patients.[2] Patel PA and Patel PP stated that high stress levels of 37% were noted in homemaker women then in males.[13] In this study, when statistical analysis was done for within group, it showed reduction in serum cortisol levels, perceived stress scale scores (PSS), improvement in the MoCA scores of cognition and GSR Biofeedback readings of autonomic response function with \( p=0.001^* \) showing statistical significance. According to a study done by Khoshkhou F and Bakhshipour A to assess the effectiveness of the combined music therapy and relaxation therapy on blood biochemical characters and blood pressure on type 2 diabetic patients. It had assessed the blood pressure, total cholesterol, triglyceride, HbA1c and fasting blood glucose levels before and after the study which concluded stating that combination of these therapies is a feasible and effective treatment on diabetes. [14]

The perceived stress was mainly due to professional job demands, family issues, unhealthy dietary habits and physical inactivity.[2] The cognition in terms of memory, attention, executive functions are affected in relation to the duration and extent of type 2 diabetes occurring due to hippocampal affection and stress causing release of adrenal steroids and excitatory amino acids leading to neuronal loss.[15] According to a study done by Ciaco IE which stated that classical music helps in alteration of neuromediators i.e. epinephrine which in a way stimulates \( \beta \)-cells in organs and reverses the levels back to normal for a stipulated period.[16] Kellie Fowler stated that Benson’s relaxation therapy has a physiological response which runs in the opposite direction of flight – or fight response which reduces metabolism, heart rate, blood pressure, rate of breathing and produces slower brain waves inducing relaxation by releasing dopamine.[8]

In present study, outcomes measure for stress levels was serum cortisol levels, having a normal range from 6-23 micrograms per decilitre. [9] Perceived stress was measured by perceived stress scale with its reliability being 0.85. [10] Cognition was assessed using Montreal cognitive assessment (MoCA) which had a reliability of 0.757[11] and lastly, autonomic response function was measured using GSR biofeedback machine whose reliability couldn’t be commented upon due dearth in literature.
The above results have shown effective changes in serum cortisol levels, perceived stress scale, Montreal cognitive assessment and GSR biofeedback machine. Therefore, combination of Music therapy and Benson’s relaxation therapy had positive effect on stress, cortisol levels, perceived stress levels, cognition and autonomic function response.

The strength of the study was the novel notion wherein combination of Indian traditional classical music therapy (Raga Darbari) and Benson’s relaxation therapy was administered for only 5 days for 30 minutes in young 20-40 years aged Type 2 Diabetes Mellitus individuals. Assessment of Serum cortisol levels was the key indicator in the study for the better confirmation of results.

Limitations of the study were that the duration of medications and education profile of the patients was not considered in the study. There was difficulty in convincing the patients for the intervention protocol and managing timings as it was targeted in working age group population.

The clinical implication was that combination of music therapy with Benson’s relaxation therapy gave positive changes in coping up stress in young type 2 diabetic patients and aided in improving cognition and autonomic response function.

Future recommendation for the study: This study could be repeated with involvement of HbA1c levels, lesser duration of the disease, non-obese population and the dosage of medications which the patients are consuming which could be added in the combined intervention literature.

VII. Conclusion

It sums up that combined effect of this intervention had fruitful outcome in terms of reduction of stress levels, cortisol levels, improvement in cognition and autonomic response function in shorter duration of time.

VIII. Acknowledgement

I would like to thank my co-author for his help, the participants, and my colleagues for their support and Mr Prasad Daddikar for helping me out with the statistics of the study.

Conflict of interest: None.

References

1. Fink G. Stress: concepts, definition and history.

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**Figure 1**

**Total Number of Participants Screened**

N = 50

33 Participants were included in the study

Pre-intervention scores of serum Cortisol levels, PSS, MOCA and GSR Biofeedback were recorded

Combined Benson’s relaxation therapy and music therapy was given for 5 consecutive days

Post intervention scores of the outcomes were recorded

Data analysed for 33 patients

17 EXCLUDED

10 – Age above 40 years
2 – Pregnant Women
2 – Type 1 DM
3 – Refused to participate

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*Table 1 - Demographic characteristics

<table>
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<th>PARTICULAR</th>
<th>MEAN</th>
<th>SD</th>
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<td>AGE</td>
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<tr>
<td>WEIGHT</td>
<td>68.70</td>
<td>9.18</td>
</tr>
<tr>
<td>BMI</td>
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<td>3.94</td>
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</table>

*Table 2 - Comparison of pre-test and post-test of the outcome measures by Dependent t test

<table>
<thead>
<tr>
<th>Outcome measures</th>
<th>Treatment</th>
<th>Mean</th>
<th>SD</th>
<th>Mean Diff.</th>
<th>SD Diff.</th>
<th>% of effect</th>
<th>t-value</th>
<th>p-value</th>
</tr>
</thead>
</table>
| Serum cortisol   | Pre-test   | 101.72| 19.51| 25.33      | 12.92    | 24.90       | 11.265  | 0.001*  
|                  | Post-test  | 76.39 | 18.92|            |          |             |         |         |
| PSS              | Pre-test   | 23.52 | 4.69 | 9.33       | 4.56     | 39.67       | 11.758  | 0.001*  
|                  | Post-test  | 14.18 | 3.90 |            |          |             |         |         |
| MoCA             | Pre-test   | 20.61 | 3.44 | -5.64      | 3.15     | 27.36       | 10.277  | 0.001*  
|                  | Post-test  | 26.24 | 3.46 |            |          |             |         |         |
| GSR biofeedback  | Pre-test   | 209.30| 53.53|            | 111.74   | 168.87      | 18.171  | 0.001*  
|                  | Post-test  | 562.76| 113.85| 353.45     |          |             |         |         |