

*Full-Length Article*

## Evaluation of the Effect of Indian Classical Music on the Blood Sugar Level of Type-2 Diabetic Mellitus Patients

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### Abstract

**Background:** Type-2 Diabetes Mellitus, being a major health care problem warrants holistic management. Stress has been identified as an important etiological factor that music therapy may help mitigate or alleviate. The present study has been conducted to assess the effect that Indian Classical Music may have on blood sugar level of Type-2 Diabetic Mellitus patients, vis-à-vis non-diabetic individuals.

**Methodology:** An interventional study was conducted on n= 59 Type-2 Diabetic Mellitus patients attending the Medicine outpatient department (OPD) and receiving oral anti diabetic agents with the same dosage regimen for two months. They were divided into a test and a control group. Similarly, n=41 non-diabetic healthy volunteers were recruited from the general population, with their informed consent, and a similar division into groups was carried out. Random blood sugar (RBS) was estimated with and without exposure to Raga Bageshree for 30 minutes in test and control group subjects respectively. **Result:** On applying relevant statistical tests to the data generated, significant reduction in blood sugar was found in all four groups. But, there was no statistical difference in the change in blood sugar level in the test groups as compared to the control groups in diabetic as well as non-diabetic patients. (p=0.789, p=0.379). **Conclusion:** No statistically significant improvement in blood sugar level was observed in diabetic as well as non-diabetic test subjects that was related to the music. Considering the small sample size and single exposure to music as limitations and also looking at it as the first study of its kind, long term studies involving a larger sample size and chronic exposure to music are recommended to reach a definite conclusion.

**Keywords:** *diabetes, chronic stress, raga bageshree, random blood sugar (RBS)*

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### Introduction

Diabetes is fast gaining the status of a potential epidemic in India with more than 62 million individuals currently diagnosed with the disease [1,2,3]. The prevalence of diabetes has been predicted to double globally by 2030 with a maximum increase in India, wherein the estimated number of patients by 2030 is 79.4 million [4,5]. Among different types of diabetes, Type-2 Diabetes Mellitus poses a significant healthcare problem because of the sizeable number of patients affected by it [6]. Because of its chronic progressive nature, associated co-morbidities, acute and long term complications, limitations of the current pharmacotherapeutic agents [7] and poor patient compliance [8], there occurs a significant increase in the health care burden of society in terms of quality of life, economic expenses and longevity of life [9].

Rigorous analysis of medical literature shows that stress plays a pivotal role in the genesis of Diabetes [10-13].

Chronic stress is also associated with raised plasma levels of hormones related to glucose metabolism, mainly epinephrine and cortisol. Stress also induces unhealthy changes in eating habits, thereby providing a bigger carbohydrate load for the body to tackle [12]. Chronic stress particularly leads to elevated plasma levels of cortisol by affecting the hypothalamus-hypophyseal-adrenal axis [14]. One of the physiological functions of cortisol, among others, is elevation of blood glucose level which aggravates the impaired blood glucose level in a diabetic patient. Hence even though the primary etiology leading to Type-2 Diabetes Mellitus is insulin resistance and eventual reduction in insulin secretion, stress also plays a key role (stress, being the etiology as well as the consequence, there by forming a vicious cycle). Considering this, diabetes can essentially be called a psychosomatic illness [12], and hence management of diabetic patients should also ideally incorporate measures which target the psychosomatic aspect of the disease in addition to established pharmacological and non-pharmacological measures like diet control, exercise etc.

A study recently concluded that listening to music and understanding it brings about an inevitable change in one's mindset. It brings about discipline in one's daily activities

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which also has been directly related to the compliance that patients maintain as far as their treatment is concerned [15]. Also, in ancient literature, it has been mentioned that music influences our mind and subsequently is transformed into thoughts and emotions [16-18]. It restores, maintains and improves emotional, physiological and psychological wellbeing. The articulation, pitch, tone and specific arrangement of “Swaras (notes)” in a particular raga stimulates one’s mind and also helps in alleviating and curing various ailments by inducing electromagnetic changes in the body [19-21]. In this context, music can help decrease stress levels.

In the music literature, there is constant mention of Raga Bageshree, as having a positive effect on blood sugar levels of diabetic patients. However there is a dearth of scientific work providing evidence to this same effect. Hence, the present study has been designed to scientifically evaluate the effect of Raga Bageshree on the blood sugar level of both Type-2 Diabetes Mellitus patients and non-diabetic individuals.

## Methods

A prospective controlled interventional study was conducted in the Medicine out-patient department of a tertiary care teaching hospital. Before starting the study, prior permission was obtained from the local Institutional Ethics Committee. The method of convenient sampling was adopted. Both Type-2 Diabetic patients and non-diabetic individuals were included in the study and the same procedure was used for both groups independently. Patients diagnosed as having Type-2 Diabetes Mellitus receiving oral anti-diabetic agents with the same dosage regimen for last 2 months and belonging to age group of 30-60 years, were included in the study. Since the recruitment of the patients was done in the OPD, only the patients who had consumed an adequate breakfast and their morning dose of oral anti-diabetic agent were allowed to participate, to minimize the confounding effect of diet and anti-diabetic medication on blood sugar levels. While, those patients having other systemic illness, psychiatric history, diabetic complications, pregnancies or patients not willing to consent were excluded from the study. Regarding the selection of non-diabetic subjects, individuals having other systemic illness, psychiatric history, pregnancies or being aged less than 30 years or more than 60 years were excluded.

The study participants were instructed to sit in a quiet room for a while. After a baseline Random Blood Sugar (RBS) estimation, they were asked to sit idle for a half an hour as controls. Then, again their Random blood sugar was estimated. Later the same patients were made to listen to an audio recording of the Raga Bageshree by Dr. (Mrs.) N.

Rajam on the violin for 30 minutes. This audio file was preselected by the investigator. Portable speakers and a laptop were used to perform this exercise. The participants were allowed to decide the volume of the music being played. Thereafter, their RBS was again estimated. A similar procedure was followed for non-diabetic individuals as well.

As the blood sugar was estimated around two hours after breakfast, some fall in blood sugar was expected physiologically. Hence to eliminate the confounding effect of this physiological reduction, control subjects were assigned in both diabetic and non-diabetic groups and results were analyzed accordingly.

In total, 100 subjects were recruited for the entire study (59 Type-2 Diabetic patients and 41 non-diabetic persons).

The data so collected was entered in MS Excel 2007 and EpiInfo™ 2007 and was analyzed by applying Student t-test, Mann Whitney U test and Wilcoxon sign rank test.

## Results:

Demographic characteristics of study participants are mentioned in Table 1. Among the Type-2 Diabetic study participants, a majority of them (45, 76.27%) were on two oral anti-diabetic agents (metformin and glipizide). A few of them (6, 10.16%) were on metformin alone. While the remaining were on two or more oral anti-diabetic agents out of metformin, glimepiride, glibenclamide, pioglitazone, sitagliptin and voglibose.

Table 1: Demographic Characteristics

Demographic group		Diabetic individuals (59)	Non-diabetic Individuals (41)
Age (years)	30-40	5	13
	40-50	19	16
	50-60	21	6
	60-70	14	6
Gender	Male	24	18
	Female	35	23
Duration of diabetes (years)	1-5	28	Not applicable
	5-10	22	
	10-15	7	
	>15	2	

**Table 2:** Comparison of RBS (before and after) in control and test group in Diabetic

Group	Parameter	Mean (mg/dl)	Standard Deviation (SD)	p-value
Test	Baseline RBS	225.925	78.2587	0.01
	RBS after 30 min of listening to preselected audio recording	216.025	73.2360	
Control	Baseline RBS	238.175	75.9085	0.001
	RBS after 30 min (no music)	223.375	80.3705	

**Test Group:** A statistically significant difference in mean RBS before and after listening to raga music ( $p < 0.05$ ) was noticed. Hence, it was inferred that RBS decreases upon exposure to the music, as shown from the decrease noted in the mean score.

**Control Group:** A statistically significant difference in mean RBS was noted after 30 minutes without music ( $p < 0.01$ ). So, RBS decreases even without listening to music as shown from decrease in mean score.

**Table 3:** Comparison of RBS of test and control group in diabetic patients

Group	Mean change of RBS value	Std. Deviation	p-value
Test group	9.900	23.2818	0.379
Control group	14.800	26.1448	

There was no statistically significant difference in change in RBS value before and after exposure to music between the test and control groups ( $p = 0.37$ ). Leading to the inference that music has no effect on RBS in diabetic group.

**Table 4:** Comparison of RBS (before and after) in control and test group in non-diabetic

**Individuals (Wilcoxon signed rank test)**

	Parameter	Median (mg/dl)	IQR (Q3-Q1)	(Q3-Z value)	p-value
Test Group	RBS before music	105	24	2.75	0.006
	RBS after 30 min of listening to preselected audio recording	102	12		
Control Group	RBS baseline	113	32	2.87	0.004
	RBS after 30 minutes	105	24		

**Test Group:** There is a statistically significant difference in median RBS before and after exposure to music ( $p < 0.05$ ). After exposure to music, RBS decreases as shown from a decrease in median score.

**Control Group:** There is a statistically significant difference in median RBS before and after 30 minutes of exposure ( $p < 0.05$ ). Leading to the inference that after exposure to music, RBS decreases as shown from decrease in median score.

**Table 5:** Comparison of change in RBS value in Test Vs Control group in non-diabetic individuals

Group	Median change of RBS value	IQR (Q3-Q1)	Z value	p-value
Test	4	14	0.44	0.65
Control	6	19		

There is no statistically significant difference in change in RBS value between test and control group ( $p = 0.65$ ). Leading to the inference that music has no effect on RBS in non-diabetic group.

**Discussion**

Rigorous exploration of the music literature suggests the possible use of music as a cure or to address the symptoms of many diseases [16-18]. As such, use of one particular raga (which is made of a fixed set of “swaras” or frequencies and

permutations and combinations of those frequencies alone), seemed to have a beneficial effect on one particular ailment [20].

The results of a prospective interventional study conducted by Ioana Elena Cioca showed a statistically significant reduction in blood sugar level of Type-2 Diabetes Mellitus patients after listening to Western classical music [12].

Similarly, music therapists across India suggest that listening to Raga Bageshree (belonging to the genre of Hindustani classical music) has a positive effect on patients of Type-2 Diabetes Mellitus and helps in reduction of blood sugar [20,21].

But, medical literature has very less to offer regarding this aspect of alternative medicine i.e music therapy for Diabetes Mellitus. Further, the effect of listening to Ragas on Blood sugar level or any other physiological parameter has not been documented in Indian medical literature to the best of the knowledge of the author. Hence, a similar study was conducted in the Indian set up using Indian classical music, particularly Raga Bageshree, because of its constant mention in various music related works [17,20].

In the control groups (i.e. non-diabetic volunteers and Diabetic patients without exposure to music) RBS reduction was seen in 65% and 70% subjects respectively. While reduction in blood sugar in the test groups (i.e. non-diabetic volunteers and Diabetic patients with exposure to music) was seen in 72.5% and 70% subjects, respectively.

On statistical analysis of the data collected, it was determined that there was a significant reduction in blood sugar level of control and test groups of both Diabetic and non-diabetic subjects. However, upon comparison of difference in blood sugar of test and control groups of Diabetic and non-diabetic subjects, there was no statistically significant reduction in blood sugar in the test groups of either set of subjects.

Some plausible explanations for the statistically insignificant results obtained have been made. Firstly, the procedure took place in the hospital setup (Medicine OPD) where, as such, the patient is tensed and in a hurry. The resulting sympathetic stimulation could also have increased the plasma glucose level.

Secondly, this methodology was designed to assess the acute effect of music on blood sugar level of the recruited patients, which as mentioned, was proven to be statistically insignificant. But this does not rule out the possibility of music, on long term exposure, affecting plasma glucose levels. Hence, a planned and organized study need to be designed to assess effect of music on long term exposure using better blood sugar estimation parameters like Glycosylated Hemoglobin.

Thirdly, Hindustani Classical music classifies its diverse variety of ragas according to the time of the day during which they should be heard or sung. It further suggests that listening to a raga during that particular time period maximizes the benefit of listening to the said raga. Raga Bageshree, according to this classification, is a **madhya raatri** raga and has its best effect when heard or sung around midnight (9pm to 12am) [23]. But, this study was conducted in the morning hours (9am to 10.30am).

Lastly, since a small sample size was used, generalization of the result or coming to a definite conclusion is not possible.

## Conclusion

The analysis of data collected using the above study did show a statistically significant reduction of blood sugar in both- the control and the test groups- however, a comparison between the two groups revealed that that the fall in blood sugar levels may not have been because of the intervention under consideration.

Probable reasons for this outcome could be a lack of a homely, peaceful environment in which the patient would be relaxed, the time period during and for which the music was heard and also the method used to assess plasma glucose levels. Hence further study is required in this area, accounting for the above mentioned factors, to assess the effect of long term exposure of music on blood sugar level of Type-2 diabetic patients.

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