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TYPE 2 DIABETES – PSYCHOSOMATIC DISEASE APPROACHABLE THROUGH MUSIC THERAPY

Ioana ELENA CIOCA[1]

[1]Department of Medical Psychology and Psychosomatics, University of Medicine and Pharmacy "Carol Davila" Bucharest
Corresponding author: Ioana Elena CIOCA, E-mail: ipsi200320002000@yahoo.com

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A rigorous analysis of medical literature shows that there are numerous aspects in which stress is linked to diabetes. Type 2 diabetes implies that the abnormalities in glucose levels as a result of stress, are associated, on one side, with hormones who are involved in the metabolism of glucose, and on the other side, with stress-induced changes in eating habits. The psychosomatic perspective on diabetes creates a new approach to the needs and burden of a diabetic patient, offers the chance to find the most efficient treatment and improves the doctor-patient relationship based exactly on the understanding of the complex implications of this disease. Music therapy is an important way of treating psychological disorders as well as psychosomatic diseases because it creates psychological wellness, increases the ability to concentrate and make plans, helps to express emotions and to clarify thoughts. .Music helps patients to relax and reduces depression and anxiety. In diabetes, some aspects of this therapy help treating the disease and its possible complications. The results of our personal study prove the obvious hypoglycemic role of classic music for type 2 diabetic patients. This beneficial effect preserves itself no matter what type of music the subject is listening to (joyful or relaxing). There is no doubt that besides psychological parameters improved through music, the improvement of somatic markers (glycemia) stands by the idea of using music in therapeutic purposes, for type 2 diabetic patients.

Key words: type 2 diabetes, psychosomatic, glyceamia, music threrapy.

INTRODUCTION

Psychosomatic aspects of type 2 diabetes

Psychosomatic approach to type 2 diabetes implies taking into consideration psychological factors as disease triggers. There are many possible ways in which these factors can be referred to, such as the influence of depressive symptoms on the behavior, on the hypothalamus-hypophysis-adrenal axis but also on the sympathetic nervous system. This disease implies the existence of a truly vicious circle mental stress-diabetes-mental stress. At the same time, through a psycho-somatic kick, this condition determines the development of depressive symptoms that have notable consequences in what regards therapeutic compliance and quality of life. The evaluation of every psychosomatic aspect of type 2 diabetes also highlights the efficiency of psychotherapy and musical therapy in the process of treatment.

A rigorous analysis of medical literature shows that there are numerous aspects in which stress is linked to diabetes:

– it can favor the development of diabetes

– can be a consequence of symptoms and complications of diabetes (psycho-somatic kick)

– can be a threat in what regards glucose levels

– can be a challenge for auto-management.

Type 2 diabetes implies that the abnormalities in glucose levels as a result of stress, are associated, on one side, with hormones who are involved in the metabolism of glucose, and on the

other side, with stress-induced changes in eating habits[1]. In other words, the stress caused by modern life can take part in the development of obesity, due to the high levels of cortisol and leptine. Other studies show that stress (especially linked to working places characterized by overload) and low coherence are associated with type II diabetes[2].

A 1994 study[3] shows that the glucose level is higher on stressful or solicitant days than on a normal uneventful day – subjects are less active in stressful days and have a lower compliancy in what regards eating restrictions. Common depressive symptoms among diabetic patients are: fatigue, sleep disorders, lack of hope and decrease of libido.

A relatively recent study[4] shows that depression is more likely to appear among middle aged people who suffer from chronic diseases such as diabetes. Chances for a diabetic patient to develop depression are higher than for other patients. Research has shown that approximately 30% of the people suffering from diabetes are depressed, and 10% are in major depression. Both diabetes and depression are important factors that have contributed to the functional incapacity of middle aged people.

Moving on, we are going to present some of the outcomes of recent studies about the connection between depression and diabetes. Among diabetic patients, both minor and major forms of depression are associated with the increase of mortality. Women that live alone are more prone to develop diabetes as a result of embracing a risky behavior (smoking, alcohol, inobservance of diet)[6]. Is more likely for diabetic patients to have depressive symptoms than control groups and they have experienced many more psycho traumatic events over a period of 6 months before they developed the disease[7]. Depression in diabetic patients is associated with low metabolic control, faulty self-management and higher risks of complications. Female diabetic patients are more exposed to depression than male patients and consequently, more exposed to potential complications. Their life partners experiment the same levels of distress, or even higher levels than the actual patients (especially when there is a female life partner who tends to be more involved emotionally and more sensitive to the psychosocial aspects of the marriage than men)[9].

There are some hypotheses worth considering which may explain the high rate of depression among diabetic patients in comparison to average people: the intensity and repetition of the treatment overloads patients and invades their daily life, playing an important role in the development of major behavior changes. The duration of the disease and the perspective of possible complications over time, considerably affects the life of these patients; diabetes and depression are both involved in metabolic disorders.

In numerous cases, diabetes is linked to an eating habit disorder. This is more common to diabetic patients, than to average people and can be as well a symptom as a consequence at the same time. Due to the fact that diabetes and eating disorders equally determine the management of weight, the control over food and the attention one pays to his body, there are people who use diabetes in order to conceal or justify an eating disorder. Psycho-somatic kick in diabetes is enlarged by the existence of numerous disorders, characteristic for diabetes such as: cognitive disorders, sexual disorders and common sleeping disorders.

In order to fully understand the nature of cognitive disorders in diabetes, we need to start by analyzing the metabolic, morphological and behavioral consequences of the action of stressing agents. Unlike responses to acute stressful events, which are most of the time for protection and adjustment, in nature, chronic stress leads to neurochemical, neuroanatomical and cellular changes, which can have unfavourable consequences for the functioning of the brain. For example, while acute exposure to stress favors development and consolidation of memory, chronic stress, or chronic exposure to high levels of cortisol deteriorates cognitive performance. Chronic stress or exposure to high levels of cortisol and dysfunctions of hypothalamus-adrenal – hypophysis axis are thought to be a part of the etiology and progress of neurological disorders and psychiatric disorders such as depression diseases, anxiety and post-traumatic stress disorders. Dysfunctions of hypothalamus-adrenal-hypophysis axis, high levels of cortisol, responses to stress are characteristic as well for type 1 and 2 diabetes as for low glucose control. These consequences suggest that common mechanisms can take part in the developing of neurological complications associated with anxiety, depression diseases and diabetes.

Acute exposure to stress leads to the activation of hypothalamus-adrenal-hypothesis axis which determines the secretion of epinephrine and cortisol by the suprarenal gland[10]. Once they are

secreted, these hormones can induce a variety of peripheral effects: from an increase in cardio-vascular activities to a decrease of gastro-intestinal activity and immune system, increasing the disuse of energy. Stress hormones have an important role in the functioning of the central nervous system, facilitating and strengthening emotional memories, which implies the activation of cortisol in some regions of the limbic system, hippocampus and amygdaline nucleus[11]. Unlike these physiologic outcomes to acute stress events, chronic stress, exposure to constant and elevated stress levels and an increased level of cortisol in addition to dysfunctions of hypothalamus-adrenal-hypothesis axis are important mediators in peripheral nervous system (PNS) and central nervous system (CNS) diseases. For example, chronic stress is an etiologic factor in cardio-vascular diseases, cancer, and other types of dysfunctions (linked to the immune system). Deteriorations of the hypothalamus-adrenal- hypophisys axis and increasing levels of cortisol are involved in peripheral complications of type 1 and 2 diabetes. The interesting fact is that, many of the neurological consequences observed in type 1 and 2 diabetes, are very similar to consequences of chronic stress, in this way suggesting that cortisol can create common mechanisms for diabetes and stress determined dysfunctions.

The insulin receiver is not easily found in the CNS, including the cerebellum, hypothalamus and hippocampus. The insulin receiver takes part in numerous functional activities of the CNS, including the cognitive area. For example, insulin improves the human cognitive performances, in a variety of ways, as well for the healthy subjects, elderly subjects as for patients suffering from Alzheimer's.

Moreover, patients who have a low control over glucose levels, show an increased level of plasma cortisol; neuroendocrine dysfunctions including increased sensibility to acute and chronic stress are observed in experimental diabetes examples[12–14]. One of the most important metabolic effect of a chronic increase in cortisol levels is the resistance to insulin, a disease caused by an increase of glucose in the serum[15,16]. In normal physiological conditions, the increase in plasmatic insulin levels stimulates the translocation of the glucose transporter, that is sensitive to insulin, GLUT4 from intracellular deposits from the plasma membrane, to organs, muscles, adipose tissue increasing the absorption and usage of glucose[16,17]. High levels of circulating cortisol leads to a decrease in the function of GLUT4, which can contribute to the resistance to peripheral insulin[18].

In conclusion, researchers suggest that CNS shortages of structure and function among diabetic patients are subtle and do not represent a significant cognitive burden in comparison to the rest of the population. Nevertheless, by not taking into consideration the importance of cognitive deficiencies among diabetics, the complications of hyperglycemia can put patients in danger of developing another neuro psychic diseases such as recurrent depression, insanity or Alzheimer's. It is true that long term consequences of diabetes that affect the CNS are to become an important issue in the upcoming decade, as a result of the increase in the number of diabetic patients. As a result, diabetic encephalopathy could exceed kidney problems, heart diseases and retinopathy, as well as other major diabetes complications.

Sexual disorders are common for diabetes. Diabetes causes numerous metabolic diseases, dysfunction of multiple organs, including erectile dysfunction. Erectile dysfunction has without doubt an organic basis (neurologic, endocrine) but also a psychological one[19]. One study[20] shows that 34% of the diabetic patients have frequently complained of erectile problems. These patients have suffered a decrease in the quality of life, especially in what regards physic functionality but also an increase in depressive symptoms and of course, a considerable deterioration of the quality of their sex life.

Sleep disorders are common among diabetic patients – 33,7% *versus* 8,2% in groups of control[21]. On the other hand, there are significant associations between sleep disorders and symptoms like: coughing, dyspnoea, night cramps, paraesthesia, sole burns with consequences on the psychic and quality of the life of the patient that are not to be neglected. Sleep disorders can be caused by: physic discomfort, psychosocial factors, variations of the metabolic control and low quantities of insulin.

One frequently used concept in literature of specialty is that of diabetes management. Most of diabetics have numerous psychological problems that affect their self-management; they do not have enough resources to face these problems[22]. A study reveals us what diabetics perceive as concerning and which are their therapeutic purposes[22]. In approaching a diabetic patient, one must undoubtedly take into consideration what makes a

patient feel anxious: loss of freedom, eating restrictions, the need to constantly measure the glucose levels and the perspective of complications. This is why, therapeutic purposes of diabetics might imply: maintaining or decreasing the levels of glucose, although, according to patients, doctors tend to overrate the importance of glycemic control, prevention against possible complications, ensuring and keeping a good quality of life.

Cognitive-behavioral therapy has proven to be efficient in treating diabetic patients from depression. But favorable effects have been also noticed in areas such as: stress and weight management, eating and sexual disorders, auto destructive or in health endangering behaviors. Numerous studies have proven that different behavioral interventions can be efficient in changing the quality of life for diabetic patients[25, 25]. Nonetheless, there has not been clarified yet which form of therapy is more efficient[26].

A recent study[27] intends to investigate the efficiency of cognitive behavioral therapy in producing changes in what regards cardiovascular risks when it is used for controlled treatment of diabetes and for changing the lifestyle. The study shows that a combined behavioral intervention is needed, consisting of a motivational stage and solving techniques for problems related to lifestyle factors.

In addition to this, bearing in mind the implications of the disease on family life, family therapy has proven to be useful in solving family conflicts but also in solving some of the problems of life partners. Relaxing, which leads to a significant stress decrease and produces important and useful changes in physiological parameters is not to be neglected[28]. Bio-feedback is associated with significant glycemic and muscular stretching decrease, but also with depression and anxiety lowering[29].

Understanding type 2 diabetes from a psychosomatic perspective has three implications from a clinical point of view:

– enlarges the perspective of approaching the patient from an orientation exclusively on the disease to a general perspective on the lifestyle of the patient – it is as important as approaching family, economic, work related, distress aspects caused by the disease itself.

– Extends the approaching of the subjective experience of the patient, from depression to general psychic distress which can induce anxiety, quality of life and general well-being of the patient deterioration.

– Increases the number of purposes of interventions that include not only diminishing the symptoms of diabetes but also solving work, finance, family related problems. In this way disease management could be improved and could be less stressful for the patient, if family and work place related stress or economic issues of the patient were avoided.

In this way, treating the patient from this perspective becomes more oriented on the patient rather than exclusively oriented on the disease and offers the doctor the possibility of a more complex understanding of every psychic and behavioral consequence of diabetes.

Taking all the above mentioned into consideration, the psychosomatic perspective creates a new approach to the needs and burden of a diabetic patient, offers the chance to find the most efficient treatment and improves the doctor-patient relationship based exactly on the understanding of the complex implications of this disease.

The effects of musical therapy on diabetic patients

Music influences our mind before it is transformed into thoughts and emotions. It stimulates the superior and inferior cerebral centers so that music therapy helps one discover personal harmony. Music therapy is an important way of treating psychological disorders as well as psychosomatic diseases because it creates psychological wellness, increases the ability to concentrate and make plans, helps to express emotions and to clarify thoughts.

Stress leads to physiological disorders and can determine functional disorders of multiple organs, temporarily or permanently. For example, the hepatic carbohydrates resources of diabetic patients are low as a consequence of insulin deficiency. This shortage does not allow sugar to pass from blood to the liver or to other cells that need it, and this is why, the blood sugar level remains elevated. Sugar is a form of a complex carbohydrate called glycogen, which is put into the circulation of the blood on demand, through epinephrine. Classic music stimulates the activity of Beta cells in the organs and ensures normality for a given period of time. In emotional situations, the blood sugar level is affected. Classic music helps to gently alter the activity of the neurotransmitter epinephrine.

Metabolic changes have been poorly studied and have been put in connection with neuro-vegetal changes produced by music. The most studied indicator was the level of glycemia. A study[30] has revealed elevated glycemic levels when listening to an intense type of music, which have been interpreted as markers of catecholamines increase, whereas a slow and discrete music lowers glycemic levels.

Music therapy represents a creative and experimental form of therapy that seems to have magical powers. It can be used in alternative medicine in order to restore the psychic and physic wellness of a person. Music helps patients to relax and reduces depression and anxiety. In diabetes, some aspects of this therapy help treating the disease and its possible complications. Musical therapy means performing (active musical therapy) as well as listening to different types of music (receptive musical therapy).

Pain is a serious issue among diabetic patients. Some of them are persistent and resistant to any type of medication, and musical therapy can help in this way by distracting them or by stimulating endorphin secretions. Music can also make the patient believe he is in control and thus relax him by regulating his heart beats and respiration. Diabetes is different from other conditions, due to the fact that its treatment requires self management. This self management implies keeping a strict diet, regular physical exercise and precise checking of glucose levels. All these cause considerable stress that can be replaced by the eustress (positive stress) created by listening to music, due to the fact that research has proved that music improves respiration, decreases arterial pressure, reduces the cardiac rhythm. In other words, music therapy improves almost every physiologic indicators of stress. A study[31] proves actual benefits for diabetic patients involved in music therapy with medical purposes:

1. Faster steadiness of insulin in diabetic children. 60 children (30 of them formed an experimental group and 30 of them a control group) aged 7 to 12 years old took part in the experiment. In addition to the conventional treatment consisting of diet and administrating insulin the experimental group listened to music daily, from 13 pm to 14 pm, for 10 days, using headphones. 64% have experienced a faster steadiness of insulin than the children in the control group.

2. Decreasing irritation and improving mood in the same experimental group (80% of them have experienced a decrease in irritation and a peaceful mood while in the control group no significant change has been noticed).

3. Decreasing thirst sensation among diabetic children from the experimental group (80% of them have experienced a considerable decrease in thirst sensation while the children in the control group have only noticed a slight decrease in thirst).

4. Decreasing of migraines among diabetic children (80% of them have experienced a decrease in headaches while children in the control group have not experienced notable changes)

5. Significant decrease of vertigo among diabetic patients (81% of the female patients with type I insulin dependent diabetes have experienced a notable decrease in dizziness after listening to music for 40 minutes a day over a period of 12 days.

6. Decreasing irritation, improving emotional stability (81% of the female diabetic patients have experienced a significant decrease in irritation, an improvement in emotional stability and an obvious peaceful mood).

7. Decreasing sleep disorders – the same study showed that 81% of the women who listened to 40 minutes of music, over a period of 12 days experienced a decrease in sleep disorders.

8. Decreasing headaches – the same study showed that the same 81% of the women suffering from type 1 diabetes who listened to music have experienced a decrease in the intensity and frequency of headaches.

Therefore, the real beneficial action of musical therapy on both somatic and psychic levels for patients who suffer from diabetes has been scientifically proven.

MATERIALS AND METHODS

Personal study regarding variations of glycaemia after listening to music, on patients suffering from type 2 diabetes

Taking into consideration the existing information concerning favorable effects of music on diabetic patients, we have decided to study the variations of glycaemia after listening to music, on type 2 diabetic patients (experimental group) in comparison to healthy people (control group) and to diabetic patients who have not listened to music (control group).

The impact of music on glucose levels has been investigated using to types of music:

– Active, joyful music:

- **Richard Wagner – "Lohengrin" 3 min 32 s**
- **Șostakovici – 3 min**

- **Bela Bartok – 1 min 27 s**
- **Sibelius – "Karelia" 3 min 2 s**

– Relaxing, melancholic music:

- **Mendelssohn op. 30 2 min 41 s**
- **Şostakovici – "Melody" 2 min 59 s**
- **Faurè – "Apre un reve" 2 min 49 s**
- **Delius – "La Kalinda" 4 min 37 s**

We have measured glycaemia before and after listening to music (for both quick and relaxing music). Glycaemia has been measured similarly for all diabetic patients (control or experimental group) standard conditions and avoiding measuring after treatment. For diabetic patients – control group, levels have been measured in an interval of time equal to the listening one (in the experimental group – approximately 15 minutes) in a relaxed mood.

Investigated groups	Number of subjects	Types of investigation	Average age
Healthy subjects (control group)	40	Glycaemia before and after the audition (40 subjects) Listening to active music (20 subjects) and relaxed music (20 subjects)	56
Diabetic patients (experimental group)	40	Glycaemia before and after the audition (40 subjects) Listeningg to active music (20 subjects) and relaxing music (20 subjects)	59
Diabetic patients (control group)	40	Glycaemia initially and after 25 minutes	57

Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper			
Pair 1	glicemie 1 - glicemie 2	38.825	37.289	5.896	26.899	50.751	6.585	39	.000

Statistics

Type of music		Glycemia initial control	Glycemia after music
Relaxed	N Valid	20	20
	Mean	103.85	101.95
	Std. Deviation	14.561	16.516
Joyfull	N Valid	20	20
	Mean	107.50	105.50
	Std. Deviation	11.227	15.473

Paired Samples Test

		Paired Differences					T	Df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper			
Pair 1	Glicemia control initial – glicemia control after audition	1.950	10.377	1.641	-1.369	5.269	1.188	39	.242

Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper			
Pair 1	Glicemia diabetic control 1 – glicemia diabetic control 2	3.000	23.770	3.758	-4.602	10.602	.798	39	.430

Hypothesis of the study

1. The level of glycaemia after listening to music is significantly decreased in comparison to the levels measured before that, among diabetic patients.
2. The level of glycaemia after listening to music is significantly decreased in comparison to the levels measured before that, among healthy patients.
3. The level of glycaemia after listening to music is significantly decreased than the levels measured before among diabetic patients in comparison to healthy patients and diabetic patients who have not listened to music.

RESULTS

Statistic analysis of the results

For starters, we have used **t test** in order to evaluate the statistic significance of the difference between **average levels of glycaemia measured before and after listening to music** for the diabetic patients in the experimental group.

The results show a very important statistic difference (t=6.585, DF=39, p<0.001) between glucose levels before listening to music (M=197.75, SD=61.05) and after listeningg to music (M=158.93, SD=52.80).

In what concerns separate effects of the two types of music (joyful and relaxing), relaxing music has determined a decrease in glucose levels from an average of M=169.76 to M=148.10, with a statistically significant difference (t=2.887, DF=20, p<0.05). Joyful music has determined a statistically significant difference from M=197.53 to M=172.84 (12.49%) (t=2.296, DF=18, p<0.05).

Furthermore, we have calculated the average representing the level of glucose before and after healthy patients listened to music, considering the type of music they listened to (joyful versus relaxing).

Data indicates there is a decrease in the level of glucose in both subgroups (relaxing – 1.82% and joyful – 1.86%), so the type of music does not matter. Afterwards, a thing that we considered of importance was whether the decrease is statistically significant or not. This is why we have used the t test for correlated number patterns.

The difference between the average level of glucose before listening to music (M=105.68, SD=21.96) and afterwards is of 1.95, among healthy subjects (M=103.73, SD=15.89). 95% confidence interval for this difference is from -1.36 to 5.29. Because the confidence interval passes through 0.000 the difference is not statistically significant at a two tailed 5% level of significance.

A control group of diabetic patients has been investigated in order to test the natural variation of glucose levels in comparison to the variation induced by music. For this group of control consisting of diabetic patients who have not listened to music we have also used the t test in order to compare two correlated number patterns.

The analysis of the results reveals the fact that there is not a statistically significant difference (the difference between the average numbers was 3 with a percentage of 1.68%) between average glucose levels measured before (M=177.80, SD=45.78) and after approximately 25 minutes (M=174.80,SD=39.24) for diabetic patients in relaxed conditions but without listening to music.

DISCUSSIONS

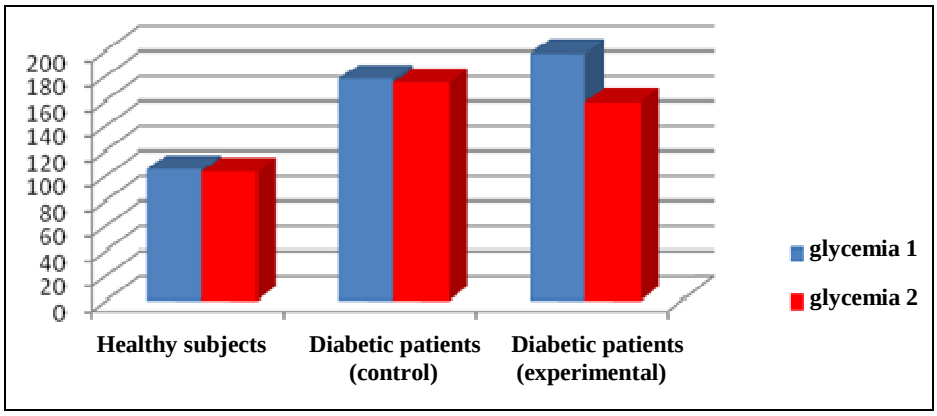
Statistic results offer a statistically significant difference (t=6.585, DF=39, p<0.001) between average glucose levels before listening to music (M=197.75, SD=61.05) and afterwards (M=158.93, SD=52.80), for the experimental group.

In what concerns the separate effects of the two types of music (relaxing and joyful). relaxed music has determined a decrease in glucose levels from an average of M=169.76 to M=148.10, with a statistically significant difference of 12.75% (t=2.887, DF=20, p<0.05). Joyful music has determined statistically significant decrease from M=197.53 to M=172.84 (12.49%) (t=2.296, DF=18, p<0.05). In conclusion, our hypothesis is confirmed for both types of music, because the level of glucose after listening to music is significantly decreased in comparison to the glucose level that diabetic patients had before.

Regarding the third hypothesis about the level of glucose after listening to music, for diabetic patients, being significantly decreased than the one before, in comparison to the healthy patients and the diabetic patients who have not listened to music, the data obtained can be analysed in the Table and graphic below:

Healthy subjects		Diabetic patients (without music)		Diabetic patients (with music)	
Glycemia 1	Glycemia 2	Glycemia 1	Glycemia 2	Glycemia 1	Glycemia 2
105.68	103.73	177.80	174.80	197.75	158.93

Average glucose levels before and after listening to music on the three types of patients:



Their analysis shows us that the level of glycemia has decreased with almost 20% among the diabetic patients who have listened to relaxed or quick music. In what concerns control groups, the healthy patients who have listened to music and the diabetic patients who have not listened to music the decrease was approximately similar of 1.85% and 1.7%. Therefore, the level of glycemia decreases significantly more among diabetic patients who have listened to music than among control groups, so, in this in way, the third hypothesis proves to be true. This is why, the higher the level of glucose is, the more obvious the effects of music on this parameter are. This change implies a regaltory music capacity, possibly by mobilizing other neuromediators which lead to other favorable changes, besides the "mechanical" decrease of glucose. In conclusion, music can contribute to more complex metabolic regulation, apart from adjusting the levels of glucose.

CONCLUSIONS

The results of our study prove the obvious hypoglycemic role of classic music for type 2 diabetic patients, not taking into consideration the natural variations of glycemia. Hypoglycemic effect is less emphasized and statistically insignifcant among healthy patients, which highlightens the favorable role of symphonic music among diabetic patients. This beneficial effect preserves itself no matter what type of music the subject is listening to(joyful or relaxing), thus non-confirming the fact that joyful music leads to elevated glycemia whereas relaxing music decreases the level of glucose.

There is no doubt that besides psychological parameters altered through music, the improvement of somatic markers (glycemia) stands by the idea of using music in therapeutic purposes, for type 2 diabetic patients. In addition to other psychoterapeutic useful interventions, music therapy can help the diabetic patient up to a somatic level. Certainly, music therapy has an important role in treating diabetes through its relaxing effects and obvious ways of intervention in symptoms such as depression, anxiety etc. Nonetheless, we share the opinion that it would be useful to extend studies regarding the effects of music on glycemia among type I diabetic patients.

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