

## A Comparative Study Regarding the Efficiency of Applying Hypnotherapeutic Techniques and Binaural Beats in Modifying the Level of Perceived Pain

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### **Abstract**

*The present study investigates the efficiency of applying hypnotherapeutic techniques and binaural beats in modifying the levels of pain perception in a sample of young adults. The participants (N=47), aged between 21 and 48 years old ( $M = 29.65$ ,  $SD = 8.45$ ) were exposed to three different conditions: experiencing hypnosis, listening to binaural beats and no intervention. The perceived level of discomfort has been analyzed after the painful stimulus was applied using a hemostat. The statistical results have shown that the independent variable had a significant effect on the level of perceived pain ( $H(2) = 14.48$ ,  $p < .01$ ), the participants from both the hypnosis and binaural beats group reporting lower levels of pain, compared to those from the control condition. Moreover, the two applied interventions (hypnosis and binaural beats) seemed to be similar with regard to their efficiency in diminishing the perceived level of pain ( $U = 99.50$ ,  $p > .05$ ).*

**Keywords:** *hypnotherapeutic techniques, binaural beats, level of perceived pain.*

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## I. INTRODUCTION

Theories regarding pain support the idea of a double physiological and psychological experience, fact which is still the subject of continuous research (Angelone, 2008).

Pain management, regarded from a psychological perspective, brings to discussion the fact that in order to define and understand pain as a sensorial phenomenon, it is necessary to take into consideration aspects such as motivation, affectivity and cognitions which are associated to the biomedical area (Choinière, Melzack, Girard, Rondeau, & Paquin, 1990).

A rather counter-intuitive conclusion related to pain mechanisms is mentioned by Patterson (2010) who explains how the injury, lesion or illness types do not play a role of prediction related to the way pain or suffering will be experienced by the patient, as previously believed. The further explanation offered by the author shows that the organic are affected by the pain is reported by the patient while the origin of the pain is found in the nervous system; such mapping and concept of pain might let us come to the conclusion that pain treatment has a rather general character from the point of view of the methodology chosen to manage it.

Although seemingly a medical issue, pain has caught the attention of psychologists because, as Jack (1999) points out, pain is part of a triangular model of distress (Hilgard & Hilgard, as cited in Jack, 1999). The model includes elements such as sensory pain, suffering and feelings of helplessness, which, as the author points out, can play the part of factors to depression. As we will further notice, depression is not the only possible psychological outcome for patients experiencing pain.

Any discussion related to pain should remind of the two main types in which it can manifest itself and be experienced by the affected patient. Thus, acute pain describes short and intense spikes of pain which bring great discomfort to the patient and signalize potential or real damage of the tissue; as Patterson (2010) further shows, pain, in acute emergence, is accompanied by anxiety. On the other hand, as the same author points out, chronic pain manifests itself as persistent and it passes the expected healing time and it is most of the times recognized because of the fact that it usually does not respond well to medical intervention; chronic pain is also accompanied by psychological issues such as states of depression, anxiety and tendencies of low activity (Patterson, 2010).

As we have already mentioned, pain management has not only caught the attention of medical staff but it is also a subject of interest for psychologists; one of the most used techniques which is generally prescribed in pain management is hypnotherapy.

The studies regarding the efficiency of applying hypnotherapeutic techniques in medical health issues, for diminishing pain levels have shown that hypnosis is highly efficient in the

treatment of chronic pain and have also emerged in identifying the neurophysiologic processes which support such effects (Dillworth, Mendoza, & Jensen, 2012).

Statistically, data is found to show that hypnosis is effective in reducing more than 50% of osteoarthritis pain within one month of training, results which are maintained during the following 6 months after the treatment (Gay, Philippot, Luminet, 2002). As for general results regarding pain management, according to Dillworth et al. (2012) around 70% of the individuals who confront chronic pain reach a direct response of pain reduction during hypnosis sessions while 20% to 30% of the patients benefit from permanent pain reductions.

Study cases have been conducted (Jack, 1999) concluding that hypnosis is successful in diminishing pain levels to levels that are more easily accepted by the patient and also in offering the patient the instruments needed to better cope with additional stress caused by pain.

In 2012 Dillworth, Mendoza and Jensen (2012) take into consideration the fact that chronic pain is generally viewed as being biologically determined and therefore it is largely treated through medication and physical cure: medication might include anti-inflammatory drugs, opioid analgesics (which might lead to opioid tolerance as the authors note) or surgery and physical therapy.

As we may notice, pain might be approached according to the conception of each specialist who comes in contact with it with the purpose of lowering its intensity. While medical specialists tend to use medication, surgery and physical therapy as noted before, psychologists come to add another dimension to the issue (Holdevici, 2010). From this point of view, we will recall the social – cognitive theories which include elements of expectancies, motivation and environment in explaining the patient's responsiveness to hypnotic suggestions and also the possibility of reaching significant changes related to pain (Dillworth, Mendoza, & Jensen, 2012). Also, according to Patterson (2010), hypnotic suggestions applied should reflect the neurophysiology of analgesia; in other words, describe an analogical process of it.

Among recently developed brainwave manipulation techniques that include breathing exercises, guided relaxation, visualizations, there is also binaural beat stimulation. When two slightly different sounds are presented in stereophonic earphones to each ear the brain produces the sensation of a third beat frequency that represents the difference between the two auditory inputs (Oster, 1973). In 1996, Foster (as cited in Kennel, Taylor, Lyon & Bourguignon, 2010) suggests that binaural beats influence the subject's state of consciousness and that individuals exposed to such auditive effects experience higher alpha production on a cortical level.

Vernon, Peryer, Louch and Shaw (2012) quote several research studies conducted in order to test the effects of binaural beats but point out the fact that such studies have not succeeded in offering consistent results. In other words, it seems that binaural beats correlate to increased vigilance, memory performance, reduced anxiety and tinnitus levels, but contradictory

results have been obtained regarding hypnotic susceptibility. According to the same authors, binaural beats possible effects have also been tested in relation to blood pressure, heart rate and attention deficit hyperactivity disorder, but showing no significant differences in these matters.

The novelty and diversity of results in applying binaural beats techniques has caught our attention and raised several questions and hypothesis regarding their usefulness in pain management. Therefore, the purpose of this study is to evaluate the efficiency of applying hypnotherapeutic techniques and binaural beats in modifying the levels of pain perception in a sample of young adults.

## II. METHOD

### 1. Participants

The present study involved 47 participants, 20 male and 27 female, aged between 21 and 48 ( $M = 29.65$ ,  $SD = 8.45$ ). Most of them were psychology students at a university from Bucharest and were living in the urban environment. The sample was heterogeneous with regard to employment status: 28 participants were employed (most of them in part time jobs, in domains such as human resources, call-center units and sales), while 19 were unemployed.

After announcing their availability to be part of the study, all participants received details regarding the procedure that was about to take place, such as the fact that some of them would experience a brief relaxation session, while others would be asked to listen to a series of sounds using a pair of headphones, and were explained that the experiment did not imply any risks or negative consequences, and that they were free to leave the study at any time, their participation being voluntary.

Subsequently to this informing phase, they were randomly divided into three groups - two experimental and one control group. Each experimental group included 16 participants, and was defined by the type of intervention the participants were about to be exposed to, namely either hypnosis ( $M_{age} = 24.33$ ,  $SD = 2.12$ ) or binaural beats ( $M_{age} = 43$ ,  $SD = 7.01$ ). The third group contained 15 participants ( $M_{age} = 30.68$ ,  $SD = 2.12$ ) who did not receive any treatment.

### 2. Research design

The present study implied a one-factor design and a one between-group measurement.

The independent variable comprised three levels defined by the following experimental conditions: 1) hypnotherapeutic techniques; 2) binaural beats; 3) no intervention.

The dependent variable consisted in participants' evaluations with regard to the level of perceived discomfort caused by a painful stimulus that was produced with a hemostat. The surgical clamp was used to squeeze the ring finger with the same pressure for all participants,

irrespective of the group they were part of. More precisely, it was used the first closing level of the hemostat for all participants.

The painful stimulus followed by the participants' evaluation of perceived discomfort was applied only one time over the course of the experiment. We opted for not introducing a within-subjects variable, namely a pretest–posttest measurement, in order to avoid the possibility of the second score to be somehow contaminated by the impressions and expectations potentially created at the first contact with the painful stimulus.

### **3. Procedure**

The experiment consisted in applying a painful stimulus with a hemostat across two experimental and one control condition, in order to estimate the efficiency of using hypnosis on one hand, and binaural beats on the other hand, in reducing the level of perceived pain.

In the case of the first experimental group it was used a hypnotherapeutic technique applied by a licensed psychotherapist. The scenario which the participants were invited to follow after the phase of trance induction, involved the technique of guided imagery along with direct and indirect suggestions for maintaining a state of physical and psychological comfort no matter of the body sensations they were experiencing, or the stimuli they were receiving from the environment.

The painful stimulus, namely squeezing the ring finger with a hemostat, was applied during the exercise, while the participants remained in a state of deep relaxation, having their eyes closed. Subsequently, after being de-hypnotized, they were asked to evaluate the level of perceived pain by indicating on a Likert scale divided into 10 points, where 1 = absent and 10 = very high, the intensity of the discomfort they had felt in their finger.

The participants included in the second experimental group had to use a set of headphones in order to listen to a high quality track with binaural beats for pain relief. The session lasted 5 minutes and consisted of a combination of tones within delta, theta and alpha spectrum, with frequencies of 0.5Hz, 1.5.Hz, 2.5Hz, 4.0Hz, 10.0Hz and 11.0Hz. The sounds were extracted out of a 60-minute track downloaded from [www.free-binaural-beats.com](http://www.free-binaural-beats.com). The participants were asked to focus on the beats, making themselves as comfortable as possible, having their eyes closed. Moreover they were instructed that at a certain moment they will receive a signal (touch of hand) to open their eyes, while still listening to the sounds and trying to maintain a relaxed state. The signal was applied during the 4th minute of playing the binaural beats and was immediately followed by the painful stimulus for inducing the experimental pain. Then, the participants were asked to evaluate the level of perceived pain using a 10-point Likert scale.

The participants from the control group were not exposed to any kind of intervention that could have altered the intensity of their perceived pain. The procedure implied a short instructing in which they were informed that a stimulus was going to be applied safely on their finger. They were told no information regarding having their eyes closed or open. Thus, it was noticed that all participants from this condition preferred to stay all the time with their eyes open, as opposed to the ones from the two experimental groups who were instructed precisely with regard to this aspect. However, the experimenter assured that the participants would see the hemostat only just before the moment when it was used, and not in advance. The painful stimulus was applied very quickly after the instructing was ended, considering that all participants declared that they were prepared for the procedure. After this step, the participants used the same 10-point Likert scale method to evaluate the level of the pain they had experienced.

### III. RESULTS

Considering the small sizes of our research samples we opted for using two non-parametric statistical tests in order to compare the perceived level of pain reported by the participants, depending on the three research conditions.

Thus, we applied a Kruskal-Wallis test for the differences between the three investigated groups, followed by a post hoc analysis consisted of a series of Mann-Whitney tests. In order to diminish the cumulative Type I error, we used a Bonferroni correction.

The results of the Kruskal-Wallis test have shown that the independent variable had a significant effect on the level of perceived pain ( $H(2) = 14.48, p < .01.$ )

Table 1. Differences regarding the perceived level of pain, depending on the applied treatment – Mann-Whitney test

	Group	<i>U</i>	<i>z</i>	<i>p</i>	<i>r</i>	<i>Mdn</i>	<i>M<sub>rank</sub></i>
<b>Pair 1</b>	Binaural beats	47.00*	-3.15	.001	-.55	5	11.44
	Control					7	21.56
<b>Pair 2</b>	Hypnosis	37.00*	-3.37	.000	-.60	4	10.47
	Control					7	21.19
<b>Pair 3</b>	Binaural beats	99.50	-.82	.430	-.14	5	17.28
	Hypnosis					4	14.63

*Note.*  $N_{control} = 16, N_{binaural\ beats} = 16, N_{hypnosis} = 15$ ; all *p* values are exact significance values (two-tailed); \*  $p < .0166$

The post-hoc analysis was consistent with our hypotheses revealing that the three groups were significantly different one from another in the way we had expected them to be.

Thus, the participants exposed to binaural beats, reported lower levels of perceived pain, compared to those who did not receive any treatment. Similarly, it was noticed that the perceived pain was evaluated as being less intense in the experimental condition of applying hypnotherapeutic techniques, than in the control condition (no intervention). Moreover, as we expected, there were not registered statistically significant differences between the participants who listened to binaural beats, and those tested during hypnotic trance.

The level of statistical significance for Mann-Whitney test results was interpreted after applying a Bonferroni correction. Thus, we considered to be statistically significant all differences with  $p$  critical values  $< .0166$ . The effect sizes were large for both types of intervention (binaural beats and hypnosis).

#### **IV. DISCUSSIONS**

Consistent with the previous work of various authors, this study may provide further potential evidence regarding the efficiency of hypnotherapeutic techniques in diminishing the level of perceived pain. The fact that the participants who were exposed to the brief session of hypnosis reported a less intense discomfort caused by the experimental pain, compared to the ones that received no intervention, may suggest once again the importance of psychological mechanisms in pain perception, as well as the idea that medication or other procedures specific to traditional medicine, may not be the only treatment for alleviating pain.

Moreover, this statement may also be sustained by the fact that the obtained results have revealed a lower level of perceived pain when the binaural beats were used, than in the control condition. These findings may be further important because they stand as a possible argument for conducting more studies regarding the usefulness of binaural beats in pain control, considering especially the fact that we could not find any previous research to test for this hypothesis. One possible explanation for obtaining these results may stand in the sound itself which was considered by the majority of the participants to be monotonous, pleasant and relaxing. Thus, the way participants have described their experience, may represent a clue for the fact that binaural tones might induce a relaxing state which, as in the case of hypnosis, could play an important role in pain perception. Besides, in support of this assumption, it is important to mention both the fact that the association between relaxation and listening to binaural beats has also been highlighted by other authors (e.g., Owens & Atwater, as cited in Brady & Stevens), as well as the fact that our results did not reveal any significant differences between hypnosis group and binaural beats group with regard to level of perceived pain, suggesting that these two interventions could be produce similar effects on pain perception.

However, this study has a series of limitations that must be taken into account. Firstly the number of participants was very low, leading to additional statistical shortcomings. Secondly, we highlight the limited procedure for testing participants' level of perceived pain, as well as the fact that we did not test for any variables that could have affected our results. Thirdly, the very short session of listening to binaural beats (5 minutes) may also be an important shortcoming considering that the recommended length of one session is one hour. Moreover, another limitation may be represented by the fact that the visual impact of the administration of pain stimulus differed from one group to another (those from the hypnosis group had their eyes closed all the time, the ones from the binaural beats group opened their eyes at the experimenter's signal, just before the painful stimulus was applied, while the control group had their eyes opened all the time during the research procedure).

In conclusion, this study presents some evidence for the efficiency of hypnosis and binaural beats in diminishing the level of perceived pain and advances the necessity of conducting more research regarding this issue.

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