

Investigating the effect of music on labor pain and progress in the active stage of first labor

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Abstract. – DESIGN AND PURPOSE: The purpose of this study is to investigate the effects of music-therapy on labor pain and progress in parturient primipara. Music-therapy during labor increases tolerance to pain; decreasing anxiety, it increases parturition and uterus activity and shorten labor duration.

SUBJECTS AND METHODS: The subjects of this research were 30 women, selected voluntarily and they have been put in two experimental and control group. This research has been conducted in the form of pre-test and post-test design. The experimental group listened to a relaxing music for 30 minutes in each hour for a two-hour period and the control group was not exposed to music during this period. For the purpose of gathering data in both groups, the pain scale (verbal, numeric and visual) was used to measure pain. The independent variable in this research is relaxing music and the dependent variables are the pain level and delivery progress.

FINDINGS: The independent t for sensations of pain in the experimental and control group before intervention has been ($p = 0.875$) 0.601 in numeric and visual pain and ($p < 0.01$) 2.92 in verbal pain, and one hour after intervention, it has been ($p < 0.0001$) 8.527 in visual and numeric pain and ($p < 0.0001$) 11.824 in verbal pain. Also, the equal value of independent t for the duration of delivery in control group before and after intervention shows that music has not had any effect on the rate of serotonin.

CONCLUSIONS: The results of statistical analysis show the effect of music on the decrease of sensation of pain in the experimental group as compared with the control group.

Key Words:

Music, Music-therapy, Pain, Delivery.

Introduction

Pain is one of the complex and challenging concept which is primordial. As defined by World Health Organization (WHO), pain is an

unpleasant sensation occurring as a consequence of tissue injury. However, rather than chronic pains which are mostly persistent and pathologic, delivery pain, as studied in the present research, is an alternative, acute and physiologic pain which involves severe uterine contractions. These contractions last 40-50 seconds in average and are repeated alternatively for 1-2 minutes which make the cervix opened. Pregnancy is a physiologic event which inevitably deeply affects the woman's mental and social life and in general changes the prospect of her future life, some of which are mental and some other are social aspects. Finally, this physiologic phenomenon is labor which is itself an important factor in decreasing woman's tolerance threshold, make her more incapable and sensitive than she is, as the result, when delivery time comes, her conditional reaction is to wait for pain and her mind interprets any contraction as pain which could bring stress for her. Stress produces a physiologic and biochemical response which is peculiar for the individuals with respect to its duration, intensity and overall effect and could cause hypertension and heart rate increase by activating the hypothalamic-pituitary-adrenal hormone axis and sympathetic nervous system, and by increasing cardiovascular system function and preventing the person's calmness, it could have a negative effect on the person's health and be a risk for her^{1,2}. Stress which is a prevalent disease among the hospitalized patients³ is an emotional state which is described by tension, anger, worry, fright, and the increase of activity of the autonomic nervous system, hypothalamic-pituitary-adrenal hormone axis, the increase of heart rate, hypertension and cardiac output with mental and physical effects⁴. Pre-operative anxiety is associated with the outbreak of severe post-operative pain, the increase of need to sedative and analgesic medicines and delay in recovery and hospital discharge which

might have reverse effect in providing unconsciousness and bringing the patient back to consciousness and finally decreases the patient's satisfaction from her experience of the time close to operation⁵.

Therefore, nurses' creative and supportive intervention in unpleasant or indefinite waiting time is useful and important in pain reduction and improving health efficiency⁶. The researches have shown that listening to favorite music affects the transfer of unpleasant feelings to limbic system of brain as emotions and feelings center by modifying the ability of neurotransmitters, and by increasing endorphin secretions intervenes behavior change and pain reduction⁷.

Music is widely used to improve health status, decrease stress, making patients away from unpleasant symptoms and decreasing anxiety^{8,9}. The researches have shown that music is effective in decreasing pre-operative anxiety^{6,10,11}. Music-therapy causes decrease of mental tension and physiologic signs of anxiety such as heart rate and hypertension^{7,10,12}. It also reduces level of plasma cortisol hormone^{13,14}. The studies conducted to investigate physiologic and psychological effect of music on patients undergone cardiovascular surgery indicates that music reduces anxiety and pain^{15,16}. Some researches have shown that listening to music as pre-operative nursing intervention decreases the rate of anxiety and pain in patients undergone urologic surgery¹⁷. Light music may exert its calmness effect through interaction with autonomic nervous system^{18,19}. As all people are not inclined to prefer one music style due to the differences in age and culture²⁰, the selection of music by the patient would be very important in music-therapy^{15,21}.

Calm music without any fast beat and tempo, with slow rhythm and level tone is more proper for music-therapy²².

Researches have shown that listening to music during labor increases resistance to pain, reinforces mood and causes parturient to have regular and deep breathing, it could also have an effect on the personality of the new-born²³. Marolik and Charles' study in USA in 1996 has shown that women who have gone through music-therapy during labor and delivery, have reported less stress and pain²⁴. The studies have shown that calm music would cause the reduction of post-operative anxiety and pain²⁵⁻²⁷. The researches have shown that emotional tensions affects the duration of delivery by increasing cate-

cholamines and cortisol, and the high levels of plasma epinephrine could be seen in pregnant women who have the highest level of anxiety, these women suffer from the decrease of uterus activity and prolonged labor⁴. Based on Jeden et al²⁵, music-therapy during labor has led to pain reduction and decrease of heart rate and hypertension in parturient primipara compared with the group not go under music therapy.

Some researches have shown that music reduces anxiety level in patients undergone chemotherapy²⁸, it also reduces the pain and anxiety made for Extracorporeal Shock Wave Lithotripsy (ESWL)²⁹, some other researches indicate that music does not have remarkable effect on the quality of life and would not have any considerable effect on palpitation, hypertension, or oxygen saturation in patients before endoscopy^{30,31}.

Subjects and Methods

Having considered the nature, purpose, questions and the extent of executive facilities, the present research method is pseudo experimental and the statistical population is all parturient primipara, aged between 20 to 30, lived in urban dwellings, been in a complete physical and mental health status, and referred to Bentolhoda hospital of Bushehr city of Iran in the active stage of labor.

Among the member of the mentioned population, 30 parturient primiparas have been selected randomly and based on their tendency, 15 of whom have been put in experimental group and 15 in control group. In this research, Numerical Pain Rating Scale (NPRS)¹, Visual Analogue Scales (VAS)², and Verbal Pain Rating Scale have been applied to assess pain severity. The numerical pain rating scale is a straight line, at one end of which is zero and the other end is 10. In this scale under zero the phrase "lack of pain" and under 10 the phrase "the most possible severe pain", have been written and the mentioned line has been divided into 11 parts (0-10). When performing the test, the participant were asked to determine the severity of her pain by selecting a number from zero to ten. Consistency, validity and sensitivity of this tool to therapeutic effects have been approved. Visual analogue scale includes a straight line with the length of 10cm., at one end of which is the phrase "lack of pain" and at the other end, the phrase "the most possible se-

vere pain”, have been written and the participant were asked to put a mark on a line which indicates her pain severity. Then the distance between this marks from the starting point of line, ie the point in which the phrase “lack of pain” has been written, is measured with ruler. In this method, we obtain grades which could be analyzed based on the assumption that the distance between the grades is equal. The verbal pain rating scales includes 12 choices that are “non-significant”, “partly significant”, “very slight”, “weak-slight”, “average”, “strong”, “severe”, “very strong”, “intense”, “very severe”, “killing” in which the choice “non-significance” indicates the least level of pain and “killing” shows the most level of pain. In this research labor progress has been measured through physical examination of vagina.

To conduct the research, the parturient who had referred to maternity hospital and were interested in participating in the research were divided into experimental and control groups based on their willingness and then the research samples were hospitalized in an isolated room allocated to painless labor in order to minimize peripheral stresses including noise and extra travels. Afterwards, the personal particulars of the samples were recorded and the concept of each of the numbers on the scale ruler in numerical rating scale and visual rating scale as well as the concept of options 1 to 12 in verbal pain rating scale were taught to the subjects, and during reception of the subjects, the severity of their pain was measured and recorded separately by the above-mentioned three scales, and the cervix was measured by vaginal examination and the first criterion for reception of the parturient was that they should be primipara, the second was that they should have 3-4 cm dilatation (which indicates the starting of active stage of labor and is measurable through vaginal examination), and the

third was that they should have at least 2 to 3 uterine contractions at the time of reception. Directed imagination with music was taught to the experimental group (when there was no uterine contraction) and then the light music of “Barane Eshgh” (Love Rain) composed by Manouchehr Cheshmazar was played by headphone for 30 minutes for subjects of the experimental group, and after removing the headphones and in case there was no uterine contraction, the parturient were asked to explain the severity of their pain based on the three numerical, visual and verbal scales while listening to the music and their statements were recorded. Then, the music was played again to the parturient after half an hour and it was continued for two hours after hospitalization. At the end of the second hour, labor progress and severity of pain were again measured and recorded. In regard to the control group, measurement of pain severity and labor progress at the end of the second hour after hospitalization was done like in the experimental group and the only difference was that music was not played for the control group. Finally, the data obtained by independent *t* test was used for comparing the control group and the experiment group and comparing the post-test and pre-test of a group using dependent *t* statistic and average scores.

Findings

Results of independent *t* test between feeling numeric, verbal and visual pain in the experimental and control groups before intervention of music-therapy indicated that there is no significant difference between feeling of visual and numeric pain in the experimental and control groups and there is a significant difference ($p \leq 0.01$) in the experimental and control groups only in regard to feeling verbal pain before intervention of music-therapy (Table I).

Table I. Results of independent *t* test between feeling numerical pain, verbal pain and visual pain in the experimental and control groups before intervention of music-therapy.

Significance level	T value	Degree of freedom	Standard deviation	Mean	Frequency	Group/statistical index	
$p = 0.875$	0.601	28	1.162 1.265	3.93 4.20	15 15	Experimental Control	Visual pain
$p < 0.01$	2.92	28	1.345 1.279	5.67 7.07	15 15	Experimental Control	Verbal pain
$p = 0.875$	0.601	28	1.163 1.265	3.93 4.20	15 15	Experimental Control	Numeric pain

Besides, the results of the present research indicated that there is a significant difference at the level of $p \leq 0.0001$ between the experimental and control groups in regard to feeling visual, verbal and numeric pain one hour after intervention of music-therapy (Table II), so that the group who had undergone music-therapy felt less pain.

Furthermore, the results indicates that there is a significant difference at the level of $p \leq 0.0001$ between the experimental and control groups in regard to feeling visual, verbal and numeric pain two hours after intervention of music-therapy (Table III). Moreover, the results indicate that there is a significant difference at the level of $p \leq 0.0001$ between the experimental and control groups in regard to labor progress one and two hours after intervention of music-therapy in favor of the group which had undergone music-therapy, while the difference was not significant before intervention of music-therapy (Table IV).

Discussion

Results achieved from statistical analysis of the findings confirm the fact that music has a positive effect in decreasing pain in the active stage of labor. Labor pains, unlike other pains, does not have a stable intensity and is gradually intensified in order to reach labor progress. In the present experiment, feeling pain in the both control and music-therapy groups had a significant increase for two hours but it had a significant decrease in the music-therapy group in comparison with the control group. In this regard, the research findings accord with the results of the researches conducted by Simkin and Bolding (2004) in one of the hospitals in the Netherlands³².

Endorphins and enkephalins are opioids which have a significant role in killing pain, making a pleasant feeling, decreasing stress and helping

relaxation³³. Listening to a classic music evokes pleasant emotions and feelings^{34,35}, and these effects are stopped by naloxone which is an opioid antagonist³⁶. Therefore, music is effective on pain relief and the entire mood probably by increasing the production of nervous endorphins³⁶. Besides, music is probably accompanied with stimulating the secretion of opioids and transferring it to nucleus accumbens (NAc) in central nervous system (NAC) and releasing dopamine in the ventral tegmental area (VTA) both of which are from among the brain structures involved in reward³⁷.

New studies on animals as well as the recent functional imaging studies on human brain have indicated that listening to happy music activates the communication system of cortical and sub-cortical regions of brain including ventral striatum, amygdala, NAC, insula, hippocampus, hypothalamus, VTA, anterior cingulate, orbitofrontal cortex and middle-ventral areas of the prefrontal cortex³⁸⁻⁴¹. VTA is the major producer of dopamine in brain and has direct relationships with Nucleus locus coeruleus (LC), accumbens, amygdala, hippocampus, insula, hypothalamus, anterior cingulate, orbitofrontal cortex and prefrontal cortex^{42,43}. Studies have indicated that responses of VTA-NAC are related to disgusting stimuli and pain which are likely to be effective on regulation of brain responses to award and concepts of music^{41,44} and it indicates the effect of music on coping with stresses. Animal experiences indicate that listening to music causes increase of dopamine production in brain by stimulating VTA⁴⁵⁻⁴⁸. Therefore, stimulation of the neural pathways of VTA to LC probably leads to balancing the activity of this nucleus (LC) and decreasing stress. Studies have indicated that there are many interactions between VTA, NAC, hypothalamus, insula and orbitofrontal cortex of brain which are all involved in emotional, body and autonomous functions and music probably

Table II. Results of independent t test between feeling numerical pain, verbal pain and visual pain in the experimental and control groups one hour after intervention of music-therapy.

Significance level	T value	Degree of freedom	Standard deviation	Mean	Frequency	Group/statistical index	
$p < 0.0001$	4.18	28	1.397	5.67	15	Experimental	Visual pain
			1.121	7.60	15	Control	
$p < 0.0001$	5.47	28	0.883	6.93	15	Experimental	Verbal pain
			1.222	9.07	15	Control	
$p < 0.0001$	4.18	28	1.397	5.67	15	Experimental	Numeric pain
			1.121	7.60	15	Control	

Table III. Results of independent t test between feeling numerical pain, verbal pain and visual pain in the experimental and control groups two hours after intervention of music-therapy.

Significance level	T value	Degree of freedom	Standard deviation	Mean	Frequency	Group/statistical index	
$p < 0.0001$	8.527	28	1.207 0.487	6.80 9.67	15 15	Experimental Control	Visual pain
$p < 0.0001$	11.824	28	0.915 0.743	7.53 11.13	15 15	Experimental Control	Verbal pain
$p < 0.0001$	8.527	28	1.207 0.487	6.80 9.67	15 15	Experimental Control	Numeric pain

activates these nervous structures^{49,50}. Studies have also indicated that activation of auditory nerve pathways have a role in central inhibition of transfer of painful stimulations⁵¹. Therefore, music decreases pain and unpleasant feelings probably by activating the network of cortical and subcortical regions of brain especially dopaminergic system in brain. Studies of Halihichen et al (2010) indicated that music-therapy is effective in reducing stress and malaise⁵² and music probably increases the sensitivity of brain cells to gaba and as a result, neuron activity is decreased effectively for creating a relaxing response³³. Some studies^{52,53} have indicated that light music increases the level of serotonin and this may justify the results of different researches which indicate that music-therapy has a significant effect on pain relief, depression and stress in patients afflicted with physical disorders⁵⁵⁻⁵⁷. Listening to light and happy music enhances the retrieval of respiratory and cardiovascular operations and decreases the value of cortisol after stress⁵⁸⁻⁶². These findings indicate that music has analgesic (painkiller) effects which accords with results of the present research and is effective in reducing stress and banishing negative thoughts and as a result, it helps coping with emotional stress⁶³. Experiences of other scholars also have indicated that music-therapy is useful for controlling pain, decreasing stress,

tension, anger, malaise and improving psychological condition⁶⁴⁻⁶⁷. Studies have indicated that listening to music increases plasma levels of oxytocin hormone⁶⁸. Oxytocin is a 9-amino-acid neuropeptide produced in magnocellular neurons, super optic regions, as well as paraventricular nucleus of the hypothalamus and is secreted into blood from the posterior side of the pituitary and in other parts of brain by paraventricular nucleus. Oxytocin operates through G protein-coupled receptors and phosphatidylinositol-calcium second messenger system⁶⁸⁻⁷⁰ in order to enable neuropeptides to directly affect behaviors such as copulation and mothers' attachment to their children in mammals^{43,71-77}.

In addition, oxytocin reduces the pain by stimulating the opioidergic systems⁷⁸. This neuromodulatory hormone released in hypothalamus in addition to its cerebral effects, has environmental effects such as stimulating the womb during labor, facilitating the process of delivery by resonance of contractions of uterine wall and increasing the level of milk secretion during breastfeeding. Oxytocin is a hormone whose secretion will be increased in response to sensory and tactile stimulations, sucking milk, and caring the children. It also simplifies the physiological processes related to the maternal compromises happening after delivery and plays a role in productive behavior in mammals^{77,79,80}. In

Table IV. Results of independent t test between labor progress in the experimental and control groups before intervention, one hour and two hours after intervention of music-therapy.

Significance level	T value	Degree of freedom	Standard deviation	Mean	Frequency	Group/statistical index	
$p = 0.133$	0.529	28	0.676 0.703	3.80 3.93	15 15	Experimental Control	Before intervention
$p < 0.0001$	4.361	28	1.032 0.976	7.27 5.67	15 15	Experimental Control	1 hour after intervention
$p < 0.0001$	7.483	28	0.639 0.899	9.47 7.33	15 15	Experimental Control	2 hours after intervention

accumbens nucleus there is a high density of oxytocin receptors which have been proved by researchers to have important effects in formation of maternal behaviors by stimulating the NAC⁸¹⁻⁸⁸. The discretion of oxytocin is also increased under the effect of dopamine in hypothalamus⁸⁹ and with regard to the numerous relations in dopaminergic systems with limbic frequencies, including NAC, the maternal behaviors will be improved, the activity of HPA hormone axis and the sympathetic system induced in stress conditions^{43,90-94}. Therefore, music probably increases the production and discretion level of oxytocin hormone, by raising the level of dopamine in near ventricular nucleus and supraoptic, which finally shorten the labor time. Along with abdominal pain and cramps in children, the decrease in the level of oxytocin is seen. Base on the findings of this research, there is a strong relationship between the level of oxytocin and pain and anxiety⁶⁹, and so the tranquilizing music increases the level of oxytocin discretion and lessens pain and anxiety and shortens the duration of delivery. Khodakarami et al⁹⁵ have done a research in one of the hospitals in Tehran which proves that music and messages significantly decreases the pain of delivery and shorten its time.

Conclusions

The researches have shown that the patients, who suffer from higher level of depression and anxiety before surgery, would have more sever pain after surgery and so need more analgesic factors. Music-therapy can considerably reduces the pain after surgery^{67,98,99}. The researches have shown that music stimulates the NAC and VTA areas which are important cerebral regions dealing with the process of reward and pleasant feelings^{47,48,100,101}. Music changes the activities and a network of nervous systems which play role in the reward process and includes VTA, NAC, hypothalamus and insula. These parts totally control the physiologic and autonomous responses of reward and excitement stimulations. The responses in VTA & NAC regions have a strong dependency on dopamine secretion and the response of NAC to music.

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Conflict of Interest

None to declare.

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