

EFFECTS OF MUSIC AND STRESS ON HEALING OF INDUCED WOUND IN THE SKIN OF ADULT MALE ALBINO RATS

By

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ABSTRACT

Background: Wound healing is a complex process involving intrinsic dermal and epidermal cells, and infiltrating macrophages and leukocytes. Noise and music exposure have long been used to investigate their effects on biological and biochemical responses.

Objectives: Studying the possible acceleration effect of the process of wound healing after exposure to music, and the stressor effect after exposure to noise.

Materials and Methods: Forty adult male albino rats of local strain were chosen as an animal model for this study. They were divided into four equal groups: Control group, wound group, stress-exposed group and music-exposed group. On the day of infection, superficial surgical wounds were produced on the shaved backs of anesthetized rats by making a longitudinal midline incision, 2.3 ± 0.2 cm in length and extending down to the panniculus carnosus. At the end of the experiment (30 days), blood samples were obtained for estimation of WBC, neutrophils, lymphocytes and platelets count. Immediately after the animals were killed, 5-mm punch biopsy specimens of excised skin were taken, and immediately fixed in phosphate-buffered (pH 7.4) formalin (4%).

Results: Stress-exposed group showed significant increase in both WBCs and neutrophils counts, and significant decrease in both lymphocytes and platelets counts. In music-exposed group, WBCs significantly increased and platelets significantly decreased. Histopathological examination revealed that the exposure to noise resulted in significantly slowed inflammatory process. This effect was demonstrated by increased infiltration of wounds with polymorphonuclear leucocytes (PMNL). The music exhibited significant acceleration of wound healing activity as compared to noise exposed group. The wound closure time was lesser, as well as the percentage of wound contraction was more. The epithelization of wound was found to be earlier as compared to noise exposed group.

Conclusion: Music has some antistressor effects and may accelerate wound healing.

Key words: Noise, music, wound healing.

INTRODUCTION

Music has been a part of human society at least for the past 40,000 years, and most likely much longer where people typically interact with music and value it for its

capacity to evoke and regulate emotions, provide enjoyment, comfort, relieve stress, alter mood and elicit relaxation responses. Such music induced emotions are often accompanied by physiological

reactions, such as changes in heart rate, respiration, skin temperature, conductance and hormone secretion e.g. cortisol, oxytocin and B-endorphin (*Juslin and Laukka, 2010*). On contrast, Stress can be defined as the psycho physiologic reaction of the organism to a variety of emotional or physical stimuli that threaten homeostasis, e.g. noise stress is implicated in various illness of human and it is responsible for increased morbidity associated with modern life style (*Mahmood et al., 2008*).

It has been shown that rhythm and tempo of music can be used to synchronize or entrain body rhythms such as heart rate. Music with a fluid and regular rhythm of less than 80 beats per minute can be used to promote relaxation by causing body rhythms to slow down or “entrain” with the slower beat and regular, repetitive rhythm. However, individual responses to music can be influenced by personal preferences, the environment, education, and cultural factors, People have different socio-cultural backgrounds and like different kinds of music (*Rentfrow et al., 2011*).

Wound healing and noise has thus far primarily been studied in animals. Although some potential effects on humans can be surmised, it is important to acknowledge that the response of humans to noise in general is more complex. One wound healing experiment exposed rats to 80 dB of rock music for a 22-hour time period and then measured changes of leukocyte function. The rock music was turned off periodically to prevent

habituation. Lymphocyte function remained unchanged in the presence of noise. However, short-term noise exposure did cause an alteration of the superoxide anion and interleukin-1 secretion of neutrophils and macrophages, thus decreasing wound healing (*McCarthy et al., 2010*).

The second phase of wound healing, the inflammatory phase, presents itself as erythema, swelling, and warmth, and is often associated with pain. The inflammatory response increases vascular permeability, resulting in migration of neutrophils and monocytes into the surrounding tissue. The neutrophils engulf debris and microorganisms, providing the first line of defense against infection. Neutrophil migration ceases after the first few days postinjury if the wound is not contaminated. If this acute inflammatory phase persists, due to wound hypoxia, infection, nutritional deficiencies, medication use, or other factors related to the patient’s immune response, it can interfere with the late inflammatory phase (*Brown, 2015*).

In the late inflammatory phase, monocytes converted in the tissue to macrophages, which digest and kill bacterial pathogens, scavenge tissue debris and destroy remaining neutrophils. Macrophages begin the transition from wound inflammation to wound repair by secreting a variety of chemotactic and growth factors that stimulate cell

migration, proliferation, and formation of the tissue matrix (Brown, 2015).

MATERIALS AND METHODS

Experimental animals: This study was done in the postgraduate laboratory of Medical Physiology Department, Faculty of Medicine, Al-Azhar University on 40 adult male albino rats of local strain obtained from Helwan animal house, used in the present work. Rats were weighing from 120 to 140 grams, kept for 10 days to adapt to conditions before the start of any experimental procedure. Each two rats were housed in a cage (30X42X30 cm). They were fed the standard balanced diet with water ad lib with normal dark/light cycle.

Experimental protocol: Animals were divided into 4 equal groups in this study as follows:

Group I (Control group): Each rat received regular diet and tap water for 21 days.

Group II (Wound group): Incisions were made on the backs of rats.

Group III (Stress exposed group): Incisions were made on the backs of rats, then exposed to 90 dB of prerecorded noise delivered via the highest volume setting stereo speaker placed one meter and half from the cages as described by McCarthy et al. (2010).

Group IV (Music exposed group): Incisions were made on the backs of rats, then exposed to prerecorded pieces of light music delivered via stereo speaker placed one meter and half from the cages, mild sound intensity levels at 60 dB. Rats were exposed to music for one hour daily

throughout the designed experimental period (Angelucci et al., 2008).

At the time of sacrifice, rats were anesthetized with isoflurane, and then blood samples were collected from the retro-orbital plexuses in day 30.

About 4 ml of blood was collected from each rat into a labelled clean sample bottle containing 1 mg of Na-EDTA powder, as an anticoagulant, for measuring WBCs, neutrophils, lymphocytes and platelets counts.

Histopathological examination of wound healing:

Excision wound was inflicted by cutting away a 300 mm² full thickness of skin from a predetermined area. The wound was left undressed to the open environment, and then calculated as percent reduction in wound area:

$$\% \text{ Wound contraction} = \frac{\text{healed area}}{\text{total area}} \times 100$$

The progressive changes in wound area were monitored planimetrically by tracing the wound margin on graph paper every alternate day. Epithelialisation time was noted as a number of days after wounding required for the scar to fall off leaving no raw wound behind. From the healed wound, a specimen sample of tissue is isolated from each group of rats for Histopathological examination (Gangopadhyay et al, 2014).

In order to characterize the histopathology of the model, biopsy specimens were taken after 30 days. Immediately after the animals were killed, 5-mm punch biopsy specimens of excised skin were taken and immediately fixed in phosphate-buffered (pH 7.4) formalin

(4%). The formalin-fixed biopsy specimens were embedded in paraffin and stained with hematoxylin and eosin.

Statistical analysis:

All the statistical analysis were processed using Statistical Program of Social Sciences (SPSS) for windows (version 17, SPSS Inc., Chicago, IL,

USA), Values of the measured parameters were expressed as mean value \pm standard deviation (SD), and the differences and significance were verified by one-way ANOVA, followed by the Fisher's least significant difference (Tukey post hoc test). P values \leq 0.05 were considered statistically significant.

RESULTS

Differences in WBCs count (Table 1):

In group I (control group), the mean \pm standard deviation (S.D) of WBCs count was 8.179 ± 0.328 ($\times 10^3/\text{mm}^3$).

In group II (wound group), the mean \pm S.D of WBCs count was 9.987 ± 0.387 ($\times 10^3/\text{mm}^3$). This level showed insignificant increase in WBCs counts as compared with the control group.

In group III (stress exposed group), the mean \pm S.D of WBCs count was 16.987 ± 0.528 ($\times 10^3/\text{mm}^3$). This level showed significant increase in WBCs count as compared with the control group.

In comparison to group II, WBCs count significantly increased.

In group IV (music exposed group), the mean \pm S.D of WBCs count was 10.230 ± 0.276 ($\times 10^3/\text{mm}^3$). This level showed insignificant increase in WBCs count as compared with the control group.

In comparison to group II, WBCs count insignificantly increased.

In comparison to group III, WBCs count significantly decreased.

Difference in neutrophil counts (Table 2):

In group I (Control group), the mean \pm standard deviation (S.D) of neutrophil count was 5.60 ± 0.50 mg%.

In group II (Wound group), the mean \pm S.D of neutrophil count was 6.9 ± 0.60 mg%. This level showed insignificant increase in neutrophil counts as compared with the control group.

In group III (stress exposed group), the mean \pm S.D of neutrophil count was 9.9 ± 0.62 mg%. This level showed significant increase in neutrophil count as compared with the control group.

In comparison to group II, neutrophil count significantly increased.

In group IV (music exposed group), the mean \pm S.D of neutrophil count was 8.4 ± 0.56 mg%. This level showed significant increase in neutrophil count as compared with the control group.

In comparison to group II, neutrophil count insignificantly increased.

In comparison to group III, neutrophil count significantly decreased.

Differences in lymphocytic counts (Table 3):

In group I (Control group), the mean \pm standard deviation (S.D) of lymphocyte count was 1.812 ± 0.40 mg%.

In group II (Wound group), the mean \pm S.D of lymphocyte count was 1.788 ± 0.50 mg%. This level showed insignificant decrease in lymphocyte count as compared with the control group.

In group III (Stress exposed group), the mean \pm S.D of lymphocyte count was 1.401 ± 0.40 mg%. This level showed significant decrease in lymphocyte counts as compared with the control group.

In comparison to group II, lymphocyte count was significantly decreased.

In group IV (music exposed group), the mean \pm S.D of lymphocyte count was 1.732 ± 0.50 mg%. This level showed insignificant decrease in lymphocyte counts as compared with the control group.

In comparison to group II, lymphocyte count was insignificantly decreased.

In comparison to group III, lymphocyte count was significantly increased.

Differences in blood platelets count (Table 4):

In group I (control group), the mean \pm standard deviation (S.D) of blood platelets counts were 0.381 ± 0.01 ($\times 10^3/\text{mm}^3$).

In group II (wound group), the mean \pm S.D of blood platelets count was 0.352 ± 0.03 ($\times 10^3/\text{mm}^3$). This level showed insignificant decrease in blood platelets counts as compared with the control group.

In group III (stress exposed group), the mean \pm S.D of blood platelets count was 0.283 ± 0.05 ($\times 10^3/\text{mm}^3$). This level showed significant decrease in blood platelets counts as compared with the control group.

In comparison to group II, blood platelets count was significantly decreased.

In group IV (music exposed group), the mean \pm S.D of blood platelets count was 0.275 ± 0.02 ($\times 10^3/\text{mm}^3$). This level showed insignificant decrease in blood platelets count as compared with the control group.

In comparison to group II, blood platelets count was significantly decreased.

In comparison to group III, blood platelets count was insignificantly decreased.

Table (1): Differences in WBCs count in all studied groups

Groups WBCs	I	II	III	IV	P
Mean \pmSD	8.179 \pm 0.328	9.987 \pm 0.387	16.987 \pm0.528	10.230 \pm0.276	0.003
P1		0.91	<0.001	0.890	
P2	0.75		<0.001	0.811	
P3		<0.001		0.001	
P4		0.7.9	<0.001		

Test used: One way ANOVA followed by post-hoc tukey

P1: significance relative to G1 (Control)

P2: significance relative to G2 (Wound)

P3: significance relative to G3 (Noise)

P4: significance relative to G4 (Music)

Table (2): Differences in neutrophil counts in all studied groups

Groups Neutrophils	I	II	III	IV	P
Mean \pmSD	5.75 \pm0.4	6.9 \pm0.5	9.9 \pm0.4	8.4 \pm0.5	0.05
P1		0.29	<0.002	<0.001	
P2	0.43		<0.001	0.21	
P3		<0.001		0.001	
P4		0.35	<0.001		

Test used: One way ANOVA followed by post-hoc tukey

P1: significance relative to G1 (Control)

P2: significance relative to G2 (Wound)

P3: significance relative to G3 (Noise)

P4: significance relative to G4 (Music)

Table (3): Differences in lymphocyte counts in all studied groups

Groups Lymphocytes	I	II	III	IV	P
Mean \pmSD	1.812 \pm0.4	1.78 \pm0.5	1.401 \pm0.01	1.732 \pm0.3	0.003
P1		0.33	<0.001	0.27	
P2	0.39		<0.001	0.21	
P3		<0.001		0.001	
P4		0.41	<0.001		

Test used: One way ANOVA followed by post-hoc tukey

P1: significance relative to G1 (Control)

P2: significance relative to G2 (Wound)

P3: significance relative to G3 (Noise)

P4: significance relative to G4 (Music)

Table (4): Differences in platelets count in all studied groups

Groups	I	II	III	IV	P
Platelets					
Mean ±SD	0.381 ±0.01	0.352 ±0.03	0.283 ±0.005	0.275 ±0.02	0.001
P1		0.33	<0.005	<0.001	
P2	0.39		<0.003	<0.001	
P3		<0.002		0.19	
P4		<0.001	0.321		

Test used: One way ANOVA followed by post-hoc tukey

P1: significance relative to G1 (Control)

P2: significance relative to G2 (Wound)

P3: significance relative to G3 (Noise)

P4: significance relative to G4 (Music)

Histopathological Results:

(1) Gross findings of wound size (Figures 1&2):

Visual assessment of wound healing indicated that the wound tissue was in good condition in both group IV (music exposed group), no inflammation or other problems appeared during the healing period. In addition, a large amount of exudate and small amount of bleeding were observed one week after incision; both gradually decreased.

The wound closure time was lesser, as well as the percentage of wound contraction was more with group IV (music exposed group). The epithelization of wound was found to be significantly earlier as compared to group III(stress exposed group).The wounds were completely healed (epithelization period) in 16 ± 2 days, whereas in the Group III animals took more than 20 ± 2 days.

During early wound healing, no significant differences were observed between the two groups. However, wound healing seemed to accelerate at later stages in group IV (music- exposed

group). Significant difference in wound contraction rate and scar formation was oblivious in group III (stress-exposed group).

In the measurements of the percentage of wound healing, music exposure resulted in a statistically significant improvement by the final stages of healing .

On postoperative day 21, granulation tissue increased in the group III (stress-exposed group). In addition, scar formation in group III (stress-exposed group) significantly increased.

At the bottom of wounds, newly created granulation tissue (GT) was observed. The GT consisted from fibroblasts, endothelial cells, and newly synthesized non-organized collagen.

(2) Microscopic findings (Figures 3 &4):

Group II (wound group) showed that the epidermis was thickened at its cut edges. The dermis near the excision was rich in inflammatory cells (PMNL). Thus, the demarcation line was formed and

separated the necrosis from vital tissue. The number of fibroblasts slightly increased in the dermis near the wounded area. Beneath the dermis, it was possible to observe the beginning of neoangiogenesis, but presence of new collagen was not recorded.

Group III (stress-exposed group) showed that the exposure to stress resulted in significantly slowed inflammatory process. This effect was demonstrated by increased infiltration of wounds with PMNL.

Moreover, the epidermis regeneration significantly inhibited. In addition, the proliferation and migration of fibroblasts decelerated as well. The GT included a fewer amount of collagen as well as a significantly lower number of new vessels.

As compared to the Group IV (music-exposed group) the process of epidermis regeneration significantly decelerated and the inflammatory phase prolonged. Nevertheless, the general picture of healing delayed due to a slightly inhibited both fibroblast and endothelial cells proliferation which resulted in an altered formation of the GT.

Group IV (music-exposed group) exhibited significant wound healing activity as compared to group II. The wound closure time was lesser, as well as the percentage of wound contraction was more with music exposure than wound and stress groups. The epithelization of wound was found to be earlier as compared to III (stress-exposed group).

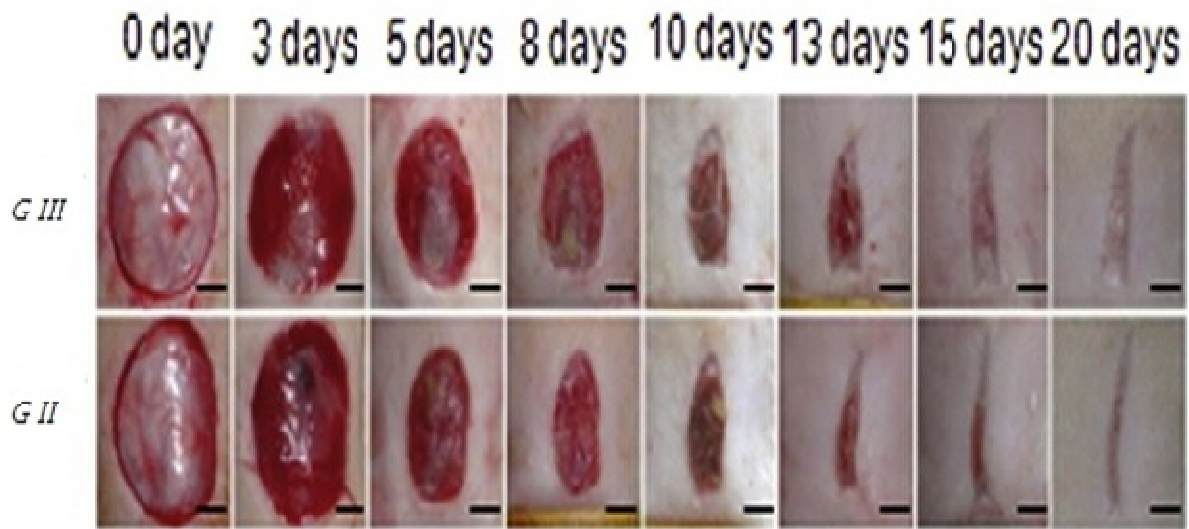


Figure (1): Gross representation of wound contraction rate on different days in group II (control group) and group III (stress-exposed group).

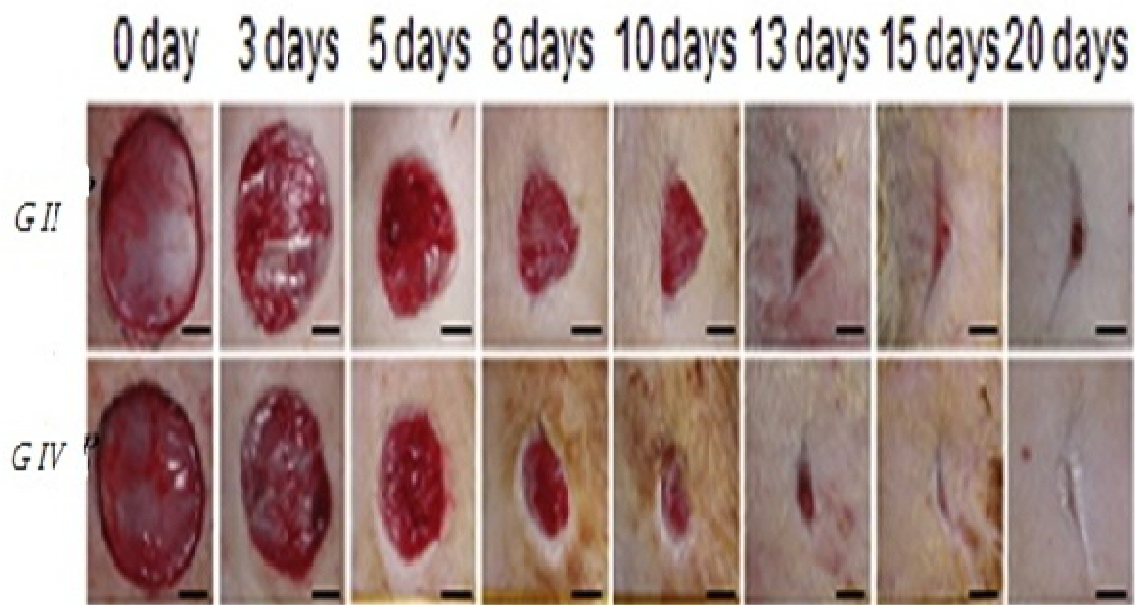


Figure (2): Gross representation of wound contraction rate on different days in group II (control group) and group IV (music-exposed group).

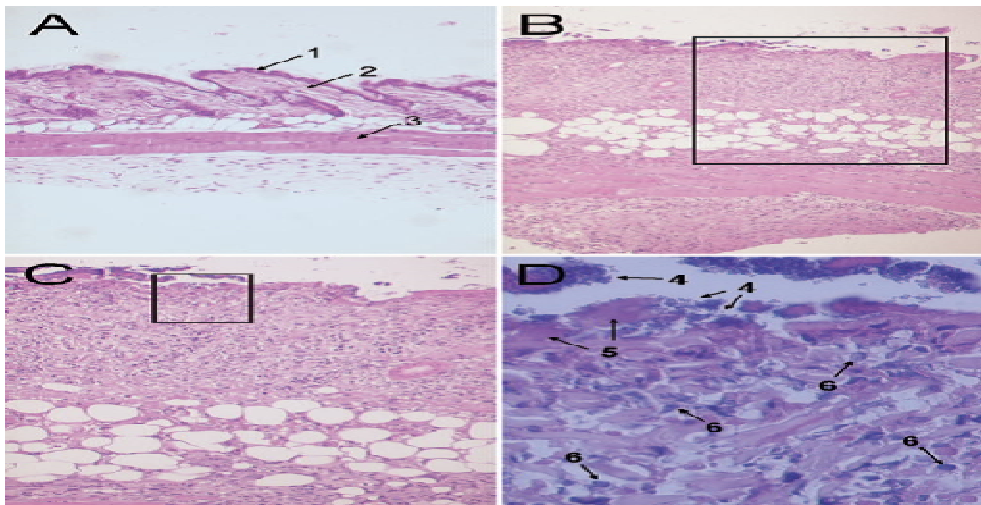


Figure (3): Histological appearance of skin of rats in group II (Hx&E x 100).The inflammatory cell infiltrate consisted of mononuclear cells, including lymphocytes, histiocytes, and, to lesser extent, neutrophils. The inflammatory response was associated with marked fibrosis, edema (B), and fibrin deposition (D). The epidermal layer was absent in the infected lesions. Numbered arrows indicated the following: 1, epidermis; 2, dermis; 3, muscular layer; 4, collagen fibers; 5, fibrin deposition; 6, inflammatory cell infiltrate.

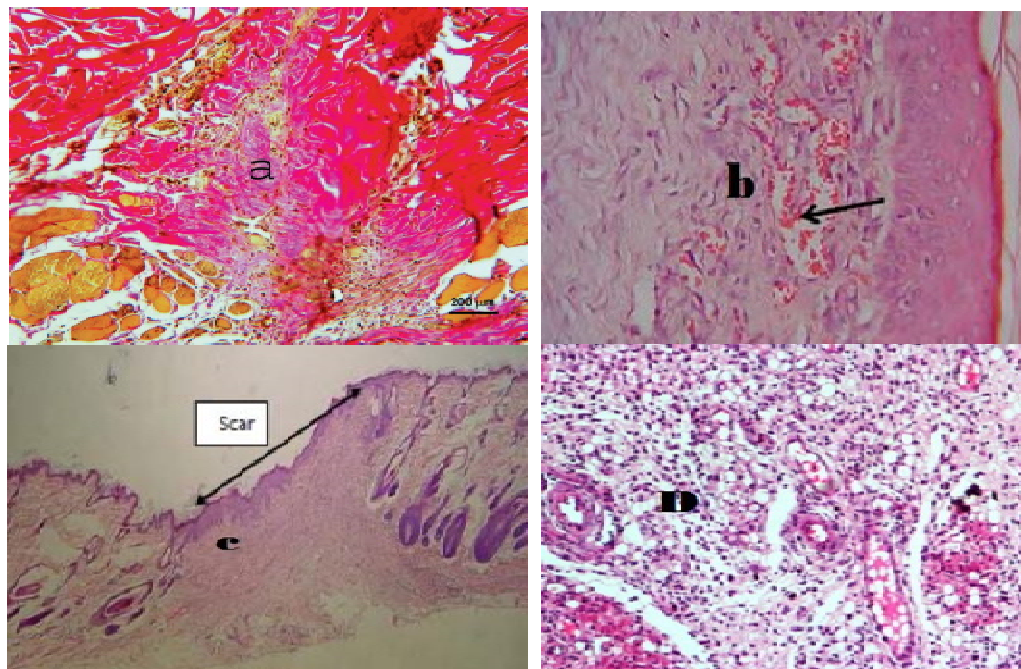


Figure (4):Microscopic sections at day 30 showed: (a) Normal skin architecture (control group), (b) normal healing process with vascular proliferation and fibroblasts(wound-group), (c) Dermal edema with poor collagen infiltration after noise exposure and scar formation(stress-exposed

group)and (d) Accelerated healing with dense collagenation on after music exposure with minimal scar(music-exposed group).(Hx&E x 100).

DISCUSSION

Several drugs such as thiazolidinediones, analogues of GLP-1, sulfonylurea and insulin are available to control diabetes mellitus (*Jeong et al., 2018*). It is mandatory to deal with DM by polytherapy regimens which include diet control, regular physical activity and new line of drugs to improve symptoms, reduce complications and decrease side effects of ordinary drugs (*Pearson, 2016*). Much attention has focused on thiazolidinediones and glucagon-like peptide-1 agonists (*Weiss et al., 2014*).

Music is one of a small set of human cultural universals evoking a wide range of emotions from exhilaration to relaxation, joy to sadness, fear to comfort and even combinations of these. Many people use music to regulate mood and arousal, much as they use caffeine or alcohol. Neurosurgeons use it to enhance concentration, Armies to coordinate movements and increase cooperation, workers to improve attention and vigilance and athletes to increase stamina and motivation (*Soto et al., 2009*).

Careful selection of music that incorporates patient's own preferences may yield positive results, whereas contrary effects may result from use of the wrong type of music. Selection of "wrong" music can intensify depressive syndromes, aggressiveness and anxiety. In addition, feelings toward music may change during different phases of life and may lead to different effects (*Brotons and Marti, 2008*).

In recent years, music no doubt plays a pivotal role in the lives of human beings as a therapeutic tool in the treatment of different diseases. It has been shown that music therapy not only reduced blood pressure, heart rate and patient anxiety but had a significant effect on future events, including re-infarction and death, in acute coronary syndrome patients who underwent revascularization. More recently, several reports have indicated the usefulness of music therapy in managing psychiatric disorders as psychosis and neurosis and now is being used in addressing organic disorders such as dementia (*Sarkamo et al., 2008*).

Music may not only be an important mood inducing factor as a successful marketing tool for restaurants but also a possible influencing factor on meal duration and meal size (*Nanette et al., 2010*).

Humans may be needs both relaxed and sad music in some times for satisfaction of pleasure and unpleased centers in limbic system. So we noticed in restaurants relaxed music always played while in bad situations sad music could be required.

On the other hand, stress is states of threatened balance induced by external stressor and appear as the display of somatic and psychic reactions, struggling to regain homeostasis. Among stressful stimuli, noise which is the most prevalent and insidious natural pollutant causing hearing impairment, behavioral, mental and widespread disturbances at several levels in human organs and apparatus due

to chemical and physiological modifications of endocrine, cardiovascular and nervous systems. Also, noise is partially responsible for reduced reproductively and decrease in the number of fetuses of pregnant rats and had a lethal effect in mice embryos that were exposed to high frequencies of noise (Cyr, 2009 and Enk *et al.*, 2010).

Noise exposure has long been used as a stressor to investigate its effect on biological and biochemical responses.

This study was investigated the effect of listening to music and noise on wound healing. It was considered as a pilot study and as such certainly raises more questions than answers.

The results of this study showed that group III (stress-exposed group), show significant increase in WBCs count in comparison to all studied groups but in (music-exposed group) showed insignificant increase in WBCs count in comparison to group I and II.

This result may be explained by *Agbagwa (2009)* who reported that WBCs counts and differential leukocyte counts (DLC) reflect the systemic status of an animal in relation to its response and adjustment to stress; the indices are of value in confirming or eliminating a tentative diagnosis, in making a prognosis and guiding therapy.

Group III (Stress-exposed group), showed significant increase in neutrophil count in comparison to group I and II but in group IV (music-exposed group), there was significant increase in neutrophil count in comparison to group I and significant decrease in comparison to group III.

Group III (Stress-exposed group), showed significant decrease in lymphocyte count in comparison to group I and II but in group IV (music-exposed group), there was insignificant decrease in lymphocyte count in comparison to group I, II. There was significant decrease in comparison to group III.

Doreen et al. (2016) showed significant difference on lymphocyte and neutrophil count was shown between the experimental rats and to the rats in the control cages. Such findings confirmed previous related physiological findings on the effect of various stressors on the WBCs of rats.

Taylor et al. (2008) first proposed the idea of a unique female stress response which they termed "tend-and-befriend." The tend-and-befriend response is characterized as an oxytocin mediated stress response cascade. Estrogen has been found to increase the effects of oxytocin already in excess in females as compared with males. Testosterone and vasopressin, the counterparts of estrogen and oxytocin, present during the male stress response, "fight-or-flight," have been found to exhibit the opposite effects of oxytocin.

Hence, despite the difference in mechanism, comparable results were controlled on the basis of hormonal secretions for both male and female mice as to the differential WBC count is concerned.

Group III (Stress-exposed group), showed significant decrease in blood platelets count in comparison to group I and II.

Group IV (Music-exposed group), showed significant decrease in blood

platelets count in comparison to group II only .

Qureshi et al. (2009) reported that stress produces changes in blood cell parameters and reported increased Blood Platelets counts. Noise exposure has long been used as a stressor to investigate its effect on biological and biochemical responses .

Rohini et al. (2017) showed that stress induced changes in hematological parameters clearly decrease in platelet count. The treatment of fusidic acid decreased the stress induced effect on hematological values and also showed a protective role in thrombocytopenia.

One of the limitations of the present study was the lack of bacteriological data to possibly correlate biochemical findings with those involved in the histopathologic process of tissue repair. Nevertheless, the method of wound contraction is a good reference in the study of factors that influence tissue repair, and other authors have used very similar methods (*Semenoff-Segundo et al., 2008*). Calculation of the contraction of the wound based on the initial area, which avoids a bias of the wound due to the mobility of the tissues in the area treated. Considering the importance of treating the skin wounds, finding more beneficial agents to enhance and improve the wound healing process have always been a concern for the researchers.

Group II (wound-group) showed that the epidermis was thickened at its cut edges .The dermis near the excision was rich on inflammatory cells (PMNL), thus the demarcation line was formed and separated the necrosis from vital tissue. The number of fibroblasts slightly

increased in the dermis near the wounded area. Beneath the dermis was possible to observe the beginning of neoangiogenesis, but presence of new collagen was not recorded.

Group III (Stress-exposed group) demonstrated that the exposure to stress resulted in significantly slowed inflammatory process. This effect was demonstrated by increased infiltration of wounds with PMNL.

Moreover, the epidermis regeneration was significantly inhibited. In addition, the proliferation and migration of fibroblasts was decelerated as well. The GT included a fewer amount of collagen as well as a significantly lower number of new vessels.

These results were explained by that stress can lead to raised levels of the hormone cortisol which, if prolonged, affects immunity and inflammatory responses in the body. Sustained cortisol release can lead to myopathy, weakness, fatigue and a suppressed immune system. A reduction in the levels of inflammatory cytokines and enzymes involved in tissue repair will inhibit the regeneration of endothelial cells, resulting in delayed wound healing. Furthermore, prolonged immune suppression might progressively decrease, giving way to the opposite effect: an excessive immune response in which the immune system attacks its own body, which could potentially result in further damage to the healing process .

Similarly, in a study by *Broadbent et al. (2008)*, wound fluid was collected over the first 20-hour postoperative period. Wound healing was assessed by levels of interleukin-1, interleukin-6 and matrix metalloproteinase-9 in the fluid. It was

found that greater preoperative stress significantly predicted lower levels of interleukin-1 in the wound fluid .

As compared to the Group IV (Music exposed group) the process of epidermis regeneration was significantly decelerated and the inflammatory phase was prolonged. Nevertheless, the general picture of healing was delayed due to a slightly inhibited both fibroblast and endothelial cells proliferation which resulted in an altered formation of the GT .

Rafi et al. (2009) showed that loud noise stress affects the cells (macrophages) involved in the healing of the wound. Therefore it is expected to have impact on the stages of wound healing. This study was also compatible with *Alex Semenoff et al. (2014)* who conclude that rats subjected to chronic stress have delayed wound contraction.

The present study also matched with (*Jean-Phillibe et al., 2012*) who showed that acute and chronic stressors can disrupt the healing process. Furthermore, the impact of stress on wound repair has been observed across different methodologies and with different healing outcomes and most results have replicated in at least two independent laboratories .

Group IV (music-exposed group) exhibited significant wound healing activity as compared to Group II .

This study has shown that stress can delay the healing of an experimentally created wound. Another study looked into the influence of natural stressful emotional conditions such as anxiety and conditions like depression, which can also impact the inflammatory system and wound healing. Delayed healing of a

punch biopsy wound was correlated with a higher score on the hospital anxiety and depression Scale .

An association between psychological stress and delayed wound healing has been demonstrated in studies of biopsy wounds. For example, a study by *Kiecolt-Glaser et al. (2008)* looked at the impact of hostile marital interactions on pro-inflammatory cytokine production and the healing of experimentally induced blister wounds .

A study by *Juslinand Lukka. (2010)* found that, after being given a blister wound, rats who had reported higher levels of stress produced significantly lower cytokine levels and a higher number of adverse life events compared with rats who had high cytokine levels. Furthermore, rats with low cytokine levels also had higher levels of salivary cortisol than those with high cytokine levels. These findings suggest that stress can delay the appearance of pro-inflammatory cytokines early in the wound-healing process, which could have a detrimental effect on wound repair.

In contrast to previous biopsy wound healing studies, *Kiecolt-Glaser et al. (2008)* investigated the effect of long-term, naturally occurring, psychological stress caused by caring for a relative with Alzheimer's disease on healing. Thirteen women caring for relatives with Alzheimer's disease and a control group were given a punch biopsy wound on the non-dominant forearm. Wounds were assessed using photography and hydrogen peroxide, and were defined as completely healed when the site no longer foamed after peroxide application. Caregivers reported significantly more stress than the

controls, and wound healing took an average of nine days longer in the caregivers than controls.

Cole-King and Harding (2008) also examined the relationship between the healing of chronic wounds and anxiety and depression. A sample of 53 male and female participants was included in the study. Psychological and clinical wound assessments were conducted, with the investigators and participants blinded to the results of the other assessments. The relationship between the healing of chronic wounds and anxiety and depression was statistically significant delayed healing demonstrating that symptoms of both depression and anxiety were associated with chronic wound healing. It should be acknowledged, however, that a causal relationship between stress and delayed wound healing cannot be inferred from these findings as other factors, such as physical or social limitations resulting from the wound, may play a role in this relationship.

The findings of these studies showed that methods of assessing stress during wound treatment would benefit the healing process by enabling the practitioner to understand the patient's individual needs for minimizing stress .

Practitioners should pay particular attention to both physiological and psychological aspects when delivering wound care. For some patients, psychological treatments, such as emotional disclosure, in addition to wound treatment, may help improve quality of life, relieve subjective distress and potentially also promote wound healing. It would be beneficial for patients if practitioners were to take account of the

role that stress plays in wound healing, particularly in leg ulceration, where stress may increase the incidence of wound recurrence.

CONCLUSION

Listening to light music has some antistressor effect and may accelerate wound healing. The music exhibited significant wound healing activity as compared to noise. The wound closure time was lesser, as well as the percentage of wound contraction was more. The epithelization of wound was found to be earlier as compared to noise.

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تأثير الموسيقى والضغط العصبي علي علاج جروح الجلد المحدثة تجريبيا في ذكور الجرذان البيضاء البالغة

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خلفية البحث : تعتبر الضوضاء من أهم العوامل التي تؤثر سلبا على صحة الإنسان ، وتعد واحدة من أكثر مشكلاتالصحة العامةفي القرن الحادي والعشرين خطورة حيث تشهد إنتشارا متزايدا فى كل مجالات الحياة المختلفة على مستوى العالم . ومن جانب آخر، نجد أن الموسيقى الهادئة تحظى بالتفاعل والتناغم مع الكثير من الناس لقدرتها على التأثير على الوظائف العاطفية وتوفير التمتع والراحة وتخفيف التوتر بما يؤدي إلى الإسترخاء وتغيير المزاج البشرى وكذلك على سائر المملكة الحيوانية،فالبعض منا يستخدم الموسيقى كمنبه،والآخر بمثابة مهدئ، وآخر لجمالها وآخر بمثابة العلاج البديل، والبعض يهتم بها من وجهة النظر العلمية.

الهدف من البحث: دراسةالتأثير العلاجي المحتمل علي إنتنام الجروح المحدثة تجريبيا في ذكور الجرذان البيضاء.

مواد وطرق البحث: إستخدم في هذا البحث اربعون جرذا أبيضاً بالغاً من فصيلة محلية ، وقد تم إحداث الجرح تجريبيا في أعلي الظهر. وفي نهاية التجربة تم أخذ عينات من الدم لقياس بعض مكونات صورة الدم، وكذلك تم أخذ عينات من نسيج الجلد لفحصها مجهريا ولعمل بعض القياسات الخاصة بحدوث عملية الالتئام داخل هذه الأنسجة.

النتائج: أحدثت الضوضاء تغيرا ذا دلالة إحصائية في معظم مكونات صورة الدم، وهذا ما أكدته نتائج فحص النسيج الجلدي والتي أظهرت تأخيرا ملحوظا في فترة الإلتئام، بينما لم تحدث الموسيقى اي تغيرات ذات دلالة إحصائية إلا في بعض المراحل المتأخرة من إلتئام الجروح .

الاستنتاج: مازالت الضوضاء إلي الآن تؤثر بطريقة أكثر واقعية علي البيئة الداخلية والعوامل البيولوجية، وربما مستقبلا تكون هناك محاولات للإستعانة بالموسيقى لمقاومة الضغط العصبي الذي تحدثه الضوضاء و لكن يحتاج الأمر إلي دراسات أخرى تدرج فيها العوامل الدينية والاخلاقية والتاريخية، الأمر الذي قد يزيد من إستخدام الموسيقى علاجيا.