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The Effect of the Dreamer Spiritual Therapies on Saliva Cortisol Hormone and Pain Score Patients in the Intensive Care Unit: A True-experimental Study

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Abstract

BACKGROUND: Patients' conditions can worsen if stress and pain are not appropriately managed. Conventional therapy ignores psychological and spiritual aspects. Both influence the body's response to various stimuli.

AIM: This study aimed to assess how Dreamer's spiritual therapy can affect the cortisol and pain in the intensive care unit (ICU) patients.

METHODS: It involved 86 ICU patients in a true-experimental study. Respondents were divided into the intervention and the control group randomly. The intervention group received Dreamer spiritual therapy (DST) for 30 min but not for the control group. Saliva samples and pain scores were taken from both groups before and after treatment. The comparison of two groups cortisol decreases using Wilcoxon test. Differences in pre- and post-pain scores in each group were analyzed using paired t-test.

RESULTS: According to Levene's test, the two groups were homogeneous ($p > 0.05$). The Wilcoxon test revealed a statistically significant difference in cortisol level reduction between the intervention (3.88 ng/mL) and control (3.82 ng/ml) groups ($p = 0.024$), with a large effect size (Cohen's d value = 59.5). The paired t-test revealed a statistically significant decrease in the intervention group's pain score from 2.6 to 1.95 ($p = 0.001$), with a moderate effect size (Cohen's d value = 0.49). The control group's pain score did not significantly decrease ($p = 0.75$).

CONCLUSIONS: A DST is effective in reducing salivary cortisol levels and pain scores of ICU patients.

Introduction

Stress and pain are the most often reported problems in patients admitted to the intensive care unit (ICU) [1]. This condition activates the sympathetic nervous system and results in release of stress hormones such as cortisol and aldosterone. Increased blood pressure, pulse rate, and blood vessel vasoconstriction can increase heart work and alter the patient's hemodynamics [2]. Unmanaged stress and pain impairs the healing process, exacerbates the complications, and prolongs the length of stay [3].

The management of stress and pain in ICU patients is not optimal yet. Until now, physical and psychological discomfort has persisted despite appropriate pain management in ICU patients [4]. It is hypothesized that managing stress and discomfort in ICU patients does not consider psychological or spiritual variables [2]. Psychological and spiritual factors impact pain in addition to nociceptive sensory sensations. Complementary and alternative medicine (CAM) includes all human qualities as holistic beings [1].

CAM is a valuable adjunct to conventional therapy in terms of addressing psychological and spiritual needs. When medical treatment is combined with CAM, synergy can occur, enhancing the effectiveness of the standard treatment [1], [2]. The difficulties associated with using CAM with the patients in the ICU are a lack of time and presence of therapists [2]. Nurses' motivation to provide spiritual assistance is limited due to their heavy workloads and time constraints [5]. As a result, a simple spiritual support model to the lower stress and discomfort in ICU patients is required.

Dreamer spiritual therapy (DST) is spiritual support in sound recordings of relaxing music, Koranic recitation (murottal), dhikr, and prayers. The term "Dreamer" is derived from various components, including dhikr, prayer, Al-Quran recitation, and music relaxation. DST is a form of sound therapy, as it uses sounds to produce a therapeutic effect. The use of sound therapy in the ICU is particularly ideal because it requires only a few simple tools (an MP3 player and headphones) and does not require any specific expertise staff [6], [7].

Comfort and self-transcendence are the two nursing theories underlying DST. The comfort theory focuses on the psychological, spiritual, and environmental components of well-being. Meanwhile, the concept of self-transcendence increases patients' internal qualities, such as transforming a negative perception into a positive one. Relaxing music and dhikr create a sense of tranquility, which can increases the levels of endorphin production. At the same time, prayer helps the limbic system turn negative thoughts into positive ones. This process is essential for limiting maladaptive stress responses that activates the stress hormones and sympathetic nervous system. Involvement of the limbic system in the therapeutic mechanism of DST is not found in conventional therapy [8], [9], [10], [11], [12], [13], [14].

The constituent elements of DST, such as relaxation music, murottal, dhikr, and prayer, in previous studies, have been shown to have a calming effect. Some of the therapeutic effects produced includes increasing release of endorphins [15], alleviates the level of pain [16], [17], [18], [19], [20], [21], alleviate anxiety [17], [18], [20], [21], and improves the quality of sleep [16], [20]. There has never been a study that has integrated relaxing music, dhikr, murottal, and prayer in a spiritual healing approach to date, especially for ICU patients. The aim of this study was to determine the effect of DST on salivary cortisol levels and pain in ICU patients.

Methods

Ethical approval of this study was obtained from the Medical and Health Research Ethics Committee of Gadjah Mada University-Dr Sardjito General Hospital, Yogyakarta, Indonesia, (No. KE/FK/1110/EC/2020). Margono Soekarjo Hospital, Purwokerto, Central Java Region, Indonesia, also approved this research (IRB No. 480/03896/IV/2021). This study was conducted following the Helsinki Declaration.

It is a true experimental design with a pre-and post-test control group. Randomization was used to determine whether a respondent was in the control or intervention group. Data collection was carried out from April to May 2021 at the ICU of Prof. Hospital. Margono Seokarjo Purwokerto, Central Java Regency, Indonesia.

ICU patients who met the inclusion criteria were >15 years old, Muslim, 24 h post-operative, hemodynamically stable, responsive to sound stimulation, and received family approval. They were excluded if they were taking norepinephrine >0.1 mg/kg, dopamine >10 mg/kg, or dobutamine >10 mg. Sample calculations were performed using a sample calculation formula based on previous studies' mean and standard deviation the mean and standard deviation of cortisol in the control group (1.3 ± 0.1) and the treatment group (0.5 ± 0.9) [22], [23]. The calculation results show that 36 respondents are needed for each group and 72 for the total number of respondents, assuming a dropout rate of 10%. This study found 150 respondents who have the potential to become respondents. However, only 86 respondents met the inclusion and exclusion criteria, with 43 people in each group. The process of selecting patients as respondents is shown in Figure 1.

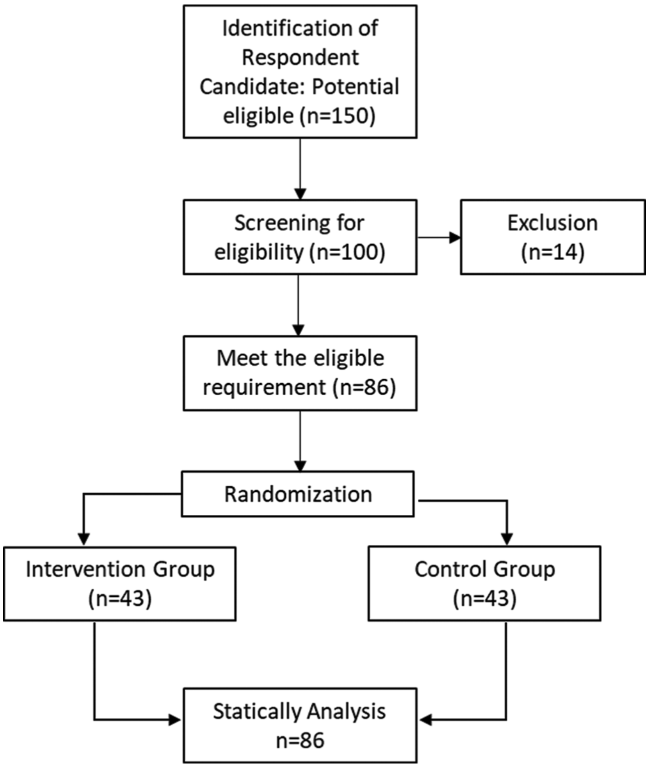

Figure 1: Respondent selection chart

Eligibility screening based on inclusion and exclusion criteria was performed for every patient admitted to the ICU. The informed consent process was carried out on patients eligible to obtain consent from the patient's family. If the family agrees, respondents get label numbers based on the order of arrival. The next stage of selecting respondents is a randomization to determine groups (intervention or control). Randomization was done using a table of random.

Data collection was carried out every 08.00 pm until 11.00 pm because the body's cortisol levels are relatively stable [23], and many treatment procedures have been reduced. 10 min before treatment, respondents' gums and teeth were cleaned with an oral sponge moistened with distilled water. Saliva sampling as a pre-cortisol was carried out between 1 and 3 min before treatment. For 30 min, the intervention group received DST through an MP3 player and earphones. The control group continued to receive standard therapy. 10, 20, and 30 min after treatment, critical-care pain observation tool (CPOT) measurements were taken. 30 min after treatment, saliva samples as a post-cortisol were collected.

For 30 s, saliva was absorbed using paper points inserted between the teeth and gums. Paper points that have been filled with saliva were inserted into a 1.5 ml Eppendorf vacuum containing phosphate buffer saline solution. Each tube was labeled according to the patient code. The saliva samples were frozen for later use. Cortisol levels in saliva were analyzed using an enzyme-linked immunosorbent assay (ELISA) technique. The machine used to analyze cortisol levels is the ELISA Reader Labotron LB-6200 made in Germany. The reagent used was Human Cortisol ELISA, which was produced by the Bioassay Technology Laboratory in China.

Table 1: Respondents clinical data

Characteristics	Intervention group		Control group		p-value*)
	f	%	f	%	
Age					
Teenagers (11–19 years old)	1	2	4	9	0.41
Adult (20–60 years old)	28	65	29	67	
Elderly (>60 years old)	14	33	10	23	
Gender					
Male	17	39.5	24	55.8	0.43
Female	26	60.5	19	44.2	
Ethnic group					
Java	39	90.7	41	95.3	
Sundanese	4	9.3	1	2.3	0.48
Sumatra	0	0	1	2.3	
Use of Mechanical Ventilators					
Yes	31	72.1	33	76.7	0.33
No	12	27.9	10	23.3	
Anesthesia type					
General anesthesia	39	90.7	40	93	0.69
Regional anesthesia	4	9.3	3	7	
Analgesic drug type					
Opioid	32	74.4	31	72.1	0.69
Non-opioid	11	25.6	12	27.9	
Giving analgesics					
Continuous	27	63	22	51	0.19
Intermittent	2	5	2	5	
Bolus	14	33	19	44	
Anti-inflammatory drug use					
Yes	7	16.3	9	20.9	0.523
No	36	83.7	34	79.1	

*)=Levene Test, f=Frequency.

Statistical analysis

Continuous data were presented as mean or median, while categorical data were displayed as frequency. The Shapiro-Wilk test was used to check the normality of data. The significance of the differences in pre- and post-cortisol levels in each group was identified using the Mann–Whitney Test. At the same time, the Wilcoxon test was used to determine the difference in the decrease in cortisol levels between the intervention group and the control group. Paired t-test was used to determine differences in pain scores pre and post in intervention groups. Because the control group's pain score, data were not normally distributed, the difference between pre and post pain scores was done using the Mann–Whitney test. Cohen's d test was used to measure the effect size of DST on pain and cortisol levels. All statistical analyzes were performed using IBM SPSS version 20.

Results

Age, gender, use of mechanical ventilators, type of surgery, drug use (anesthesia, analgesics, and anti-inflammatory), and nutrition were all collected from the respondents. Table 1 contains a description of the respondents' clinical data.

According to Levene's test, both groups were homogeneous in terms of age, gender, mechanical ventilation use, type of anesthesia, analgesic, and anti-inflammatory medication. $p > 0.05$ indicates this. Table 2 describes the duration of the operation, the time interval between study's conduct and the surgery/anesthesia and administration of drugs.

Table 2 shows that the duration of surgery and the distance between surgery and the conduct of the study were homogeneous in both groups. The distance between the administration of analgesics, anesthetics, anti-inflammatory drugs, and nutrition and the conduct of the study was also homogeneous. This is indicated by $p > 0.05$ in the Levene test. The Levene test revealed that the two groups were homogeneous in terms of medical diagnosis ($p = 0.342$). In both groups, the most common medical diagnosis was a brain tumor. It is seen in Figure 2.

Table 2: The interval time between surgery and medication to research conduct

Interval time	Intervention Median (range)	Control Median (range)	p-value*)
Surgical duration (hour)	2 (1–7)	2 (0.5–8)	0.287
Surgical – study (hour)	9 (2–45)	8.5 (3.5–11.5)	0.08
Anesthesia drug – study (hour)	11.5 (3.5–46.5)	11 (3.5–13)	0.106
Analgesic drug – study (hour)	0.00 (0.0–5)	0.00 (0.0–5.5)	0.189
Nutrition – study (hour)	0.00 (0.0–3)	0.00 (0.0–3.5)	0.523

*) = Levene test.

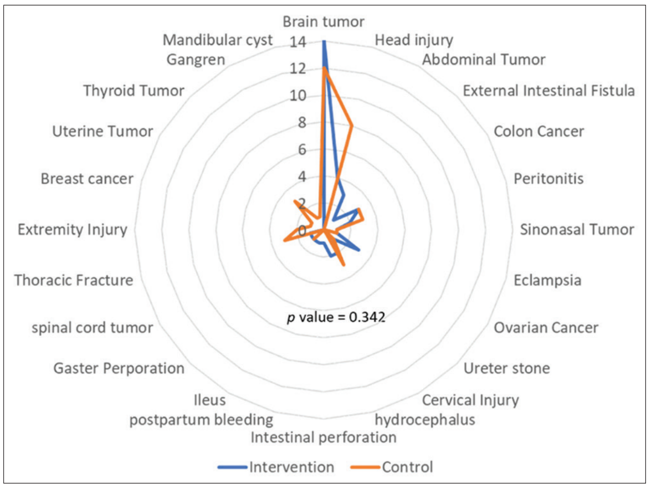

Figure 2: The respondent's medical diagnostic

With a high prevalence of brain tumors and head injuries, craniotomy is the most frequently performed type of surgery, as shown in Figure 3. Levene's test revealed that both groups were homogeneous in surgical type ($p = 0.33$).

Two statistical tests, Wilcoxon and Mann–Whitney, were used to determine the effect of DST on cortisol levels. Wilcoxon test was used to determine differences in pre and post salivary cortisol levels in each group. The Cohens one-group test was used to determine the effect size of the treatment in each group on cortisol levels. It is illustrated in Table 3.

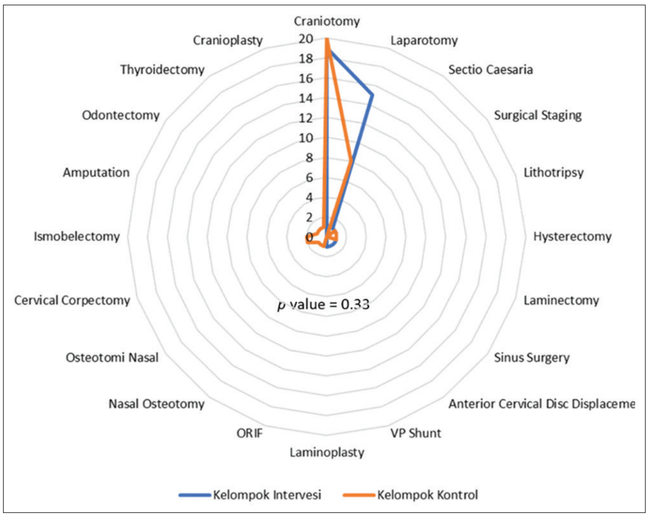

Figure 3: The respondent's surgical type

Table 3: Cortisol differences before and after treatment

Group	x̄ (SD)	Δx̄	Median (Range)	Δm	p-value	d-value
Intervention group						
Cortisol-Pre (n = 43)	16.2 (10.2)	7.4	12.5 (9.09–49.41)	3.6	<0.001[a)]	0.77[b)]
Cortisol-Post (n = 43)	8.8 (2.4)		8.9 (3.17–15.79)			
Control group						
Cortisol-Pre (n = 43)	12.1 (2.4)	8.8	12.1 (7.56–18.74)	9.3	<0.001[a)]	2.07[b)]
Cortisol-Post (n = 43)	3.3 (1.8)		2.8 (0.23–8.42)			

SD: Standard deviation, a): Wilcoxon test, x̄: Mean, Δx̄: Mean difference, Δm: Median difference, d: Size effect, b): Cohen's d one-group test.

The Wilcoxon test indicates that both groups have a significant decrease in cortisol levels (p < 0.001). The d-value suggests that both DST and conventional therapy have a big size effect on cortisol levels reduction. The Mann–Whitney test was conducted to determine the difference in the magnitude of the decrease in cortisol levels between the two groups. The results of the Mann–Whitney test are presented in Table 4.

Table 4: Cortisol level reduction differences between intervention and control groups

Group	x̄ (SD)	Δx̄	Median (Range)	Δm	p-value	d-value
Cortisol reduction in the intervention group (ng/ml) (n = 43)	7.3 (9.1)	5.00	3.88 (1.64–38.18)	1.06	0.024[a)]	59.5[b)]
Cortisol reduction in the control group (ng/ml) (n = 43)	3.3 (1.8)		2.82 (0.23–8.42)			

SD: Standard deviation; b): Mann–Whitney test, x̄: Mean, Δ x̄: Mean difference, Δm: Median difference, b): Cohen's d two-group test.

The Mann–Whitney test results in Table 4 indicate a statistically significant difference in the decrease in cortisol levels between the two groups (p = 0.024). Cortisol levels decreased significantly more in the intervention group than in the control group. Cohen's d test indicated that DST had a large effect size on cortisol reduction (d = 59.5).

DST's effects on pain score

Paired t-test was used to compare pain scores before and after therapy in the two groups.

Paired t-test results in the intervention group showed that the mean CPOT score decreased significantly (p = 0.001) from 2.60 ng/ml (pre) to 1.95 ng/ml (post), with a moderate effect size (value of d = 0.49). The Wilcoxon test showed no significant difference between the median pain values of the control group before (3 ng/ml) and post (2.6 ng/ml). Based on this, DST has been shown to significantly reduce pain scores.

Discussion

The demographic characteristics of respondents, such as ethnic origin [24], age [25], and gender [26], [27], have an influence on stress, anxiety, and pain. Levene's test shows that the two groups of respondents (control and intervention) have homogeneous demographic characteristics (p > 0.05. Thus, the possibility of bias in the research results due to differences in age, gender, and ethnicity can be prevented. Various medical procedures, such as surgery, mechanical ventilation, and side effects of drugs, can cause discomfort and stress to patients in the ICU [28], [29]. The effect of disease diagnosis on anxiety is related to disease severity [30].

The time interval between various procedures or drug administration to data collection can affect cortisol levels and pain scores. The larger the time interval, the less the effect on pain and cortisol levels [31], [32]. Cortisol, for example, will begin to decrease within 24–48 h after surgery [29]. Levene's test on all respondents' clinical data showed p > 0.05. It showed that both groups of respondents have homogeneous clinical data. Thus, the bias in the results due to differences in clinical data in the two groups can be overcome.

Statistical analysis revealed that DST had a significant effect on cortisol levels and pain scores. Cortisol levels in both groups decreased significantly, as shown in Table 3. However, as shown in Table 4, the decrease in cortisol in the intervention group was more significant than in the control group with a large effect size. Likewise, a significant decrease in CPOT scores only occurred in the intervention group with moderate effect size, as shown in Table 5.

The decrease in cortisol levels in the control group was due to various drugs such as anesthetics, analgesics, and anti-inflammatory drugs [33], [34], [35]. It occurs due to the inhibitory mechanisms of central nervous system stressors, which reduce the stress response. Decreased cortisol levels are indicative of stress reduction through endocrine mechanisms [33]. However, lowering cortisol as a stress biomarker is not optimal because drugs only prevent brain stimulation by stressors. For example, general anesthesia can

Table 5: Pre- and post-treatment differences in the pain score

Group	(SD)	$\Delta\bar{x}$	Median (Range)	Δm	p-value	d-value
Intervention group						
Pre-pain score	2.60 (0.65)	0.65	3 (1–5)	1	<0.001[a)]	0.49[c)]
Post-pain score	1.95 (0.67)		2 (1–4)			
Control Group						
Pre-pain score	2.7 (0.8)	0.16	3 (1–5)	0.4	0.75[b)]	0.11[c)]
Post-pain score	2.5 (0.96)		2.6 (1–6)			

SD: Standard deviation, a): Paired t-test, b): Wilcoxon test, $\bar{x}$: Mean, $\Delta\bar{x}$: Mean difference, Δm: Median difference, c): Cohen's done-group test

reduce the pain sensation associated with surgery but does not relieve the stress response. The hypothalamus continuously responds to unpleasant stimuli by releasing stress hormones. Even at more profound levels of anesthesia, this mechanism persists [36]. The large number of patients in the ICU who complain of discomfort despite receiving standard therapy is an example of this argument [4]. This mechanism also causes a decrease in pain scores in the intervention group are more significant than the control group.

Drugs can inhibit pain stimuli that enter the sensory center in the cerebral cortex. However, if an event creates a negative perception, then the discomfort is still there. Perceived threats stimulate the hypothalamus to release the hormone corticotropin-releasing factor (CRF). The CRF hormone then stimulates the anterior pituitary to secrete adrenocorticotropic hormone (ACTH). ACTH stimulates the adrenal cortex to generate cortisol [2]. Adverse psychological states such as anxiety and stress and elevated cortisol levels affect how a person perceives pain. In stressful situations and worry, a person's pain threshold decreases, making them more sensitive to pain [37], [38].

The decrease in cortisol levels and pain scores in the intervention group was due to DST and influenced by standard therapy. As a CAM, DST acts as a complement to standard therapy [38]. DST produces a synergistic effect with standard therapy through strengthening psychological and spiritual aspects. It causes a decrease in cortisol levels, and pain scores in the intervention group are more significant than the control group.

The DST mechanism in lowering cortisol and pain scores is based on two nursing theories: the theory of comfort and the theory of self-transcendence. The first theory highlights the critical role of calm and comfort in the healing process. The second theory emphasizes the importance of positive perceptions in the face of unpleasant stimuli [9]. The previous research has reinforced this theory. Listening to music can reduce the anxiety and cortisol levels of patients undergoing dental treatment [39].

Calmness and comfort both contribute significantly to the reduction of stress and pain. This condition triggers the hypothalamus to stimulate the anterior hypophysis to produce endorphins. This hormone, which has a morphine-like structure, inhibits pain perception, provides strength and confidence, and promotes feelings of well-being and happiness [39]. DST consists of several elements such as relaxation music, murottal, dhikr, and prayer. The constituent elements of DST in several previous studies can provide a pleasant effect and reduce pain in various cases and conditions. Several cases and conditions that have been studied include cancer pain [18], [40], [41], childbirth [42], hypertension [43], and hemodialysis [40]. Murottal, as one of the elements of DST, has also been shown to increase endorphin levels [15] during labor and decrease the need for opioids in post section caesarian [43].

The second mechanism of DST in dealing with stress and pain is through spiritual content that provides motivation and positive perception. It refers to how the amygdala responds to various incoming stimuli. Negative perceptions trigger maladaptive reactions, which include releasing stress hormones and activation of the sympathetic nervous system. Meanwhile, a positive perception of the incoming stimulus produces an adaptive response that induces a state of relaxation and increases the production of endorphins [29], [44], [45].

DST is involved in the process by which the incoming stimulus is perceived. Spiritual content elicits memories about the meaning of every event he encounters, including his current illness, from the hippocampus. This therapy assists patients in transforming negative perceptions about the pain and illness they are experiencing into positive ones. When accepted with sincerity, a Muslim believes that every illness, sadness, or suffering will wash away his sins. In addition, this therapy can help respondents improve their perceptions of their illness. Prayer is a critical component of DST because it enables him to develop the confidence necessary to confront life's difficulties [45].

Positive perceptions created in the prefrontal cortex activate the adaptive reactions in the amygdala and avoid maladaptive reactions. The adaptive response of the amygdala occurs when the incoming input from the prefrontal cortex is positive and deemed innocuous. This adaptive reaction is characterized by a relaxed state of mind and a sense of well-being. This condition may lead to a decrease in stress hormones such as adrenaline, noradrenaline, glucocorticoids, and cortisol. The hypothalamus will then direct the anterior pituitary to release endorphins, promoting happiness and blocking unpleasant stimuli [45]. Listening to murottal and prayer can reduce anxiety in hemodialysis patients [44] and increase levels of the hormone endorphins in women giving birth [15].

Conclusions

The intervention group receiving DST shows significant reduction in the cortisol levels and CPOT scores than the control group. DST does not harm ICU patients, so it is safe to use as a complementary and alternative therapy in the ICU.

Acknowledgments

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