- *Basic Research*

The Effect of Deep Breathing Exercise versus 4-7-8 Breathing Technique on Insomnia, Pain, and Anxiety Among Patients with Burn Injuries

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Abstract

Background: Pain, insomnia, and anxiety are critical challenges for patients with burn injuries, often prolonging recovery and impacting overall health outcomes. Deep breathing (DB) exercises and the 4-7-8 breathing technique have emerged as potential interventions to alleviate these issues. **Aim of the Study:** This study aimed to evaluate the effects of deep breathing exercise versus the 4-7-8 breathing technique on pain, insomnia, and anxiety among patients with burn injuries. **Subjects and methods:** The study involved a purposive sample of 120 adult patients diagnosed with burn injuries; they were randomly allocated into three groups: Study group A (n=40), Study group B (n = 40), and a Control group (n=40); a quasi-experimental design (three groups: one control and two study groups) was employed to implement the current study. **Setting:** the inpatient burn unit of Kafr El-Dwar Hospital, Egypt. **Tools:** Assessment tools included three tools; (I) The Insomnia Severity Index, (II) The Numeric Pain Rating Scale, and (III) Anxiety Self-Rating Scale, supplemented with demographic and clinical data. **Results:** Significant reductions were observed in both study groups as regards the levels of pain ($p < 0.001$), insomnia ($p < 0.001$), and anxiety as compared to those in control group. **Conclusion:** Deep breathing exercise and 4-7-8 breathing technique are effective for managing pain, insomnia and anxiety among patients with burn injuries, where deep breathing exercise showed superior effectiveness compared to the 4-7-8 breathing technique in the reduction of insomnia and pain among the current participants. Also, both techniques showed nearly similar effectiveness in anxiety reduction among participants compared to their controls. **Recommendations:** Healthcare providers including nurses should consider integrating deep breathing exercises and the 4-7-8 technique into comprehensive care plans for patients with burn injuries during their hospital stay. Future research should explore these techniques in larger samples to validate their effectiveness within this population. This study underscores the potential of non-pharmacological approaches, including deep breathing and the 4-7-8 techniques for enhancing health outcomes among patients with burn injuries.

Keywords: 4-7-8 Breathing Technique, Anxiety, Burn Injuries, Deep Breathing Exercises, Insomnia, Pain.

1. Introduction

Burn injury is a significant global health concern and one of the most critical traumas that needs hospitalization with substantial consequences in morbidity and mortality (Salajegheh et al., 2024). Burn survivors face a multitude of complications that encompass both physiological and psychological challenges; physiologically, they may experience pain, hypothermia, chronic inflammation, infections, contractures, and scarring. Psychologically, patients with burn injuries may experience post-traumatic stress disorder, phobias, depression, anxiety, and sleep disturbances (Miri et al., 2023).

Despite the use of pharmacological interventions, managing symptoms in patients with burn injuries remains a complex issue, with a notable gap in non-pharmacological approaches that could offer safe and effective alternatives to alleviate insomnia, pain, and anxiety in those patients (Stanton et al., 2024). Among these alternatives, breathing exercises have gained attention for their potential to alleviate symptoms and promote well-being in various populations (Rehan et al., 2024).

Burn injuries indeed provoke a complex interplay of physiological and psychological challenges for patients. The experience of pain is particularly acute, resulting not only from the burns themselves but also from essential therapeutic interventions such as wound care and surgeries. This pain can fluctuate dramatically during recovery, as patients may experience an evolution from acute, intense pain to potentially chronic discomfort, making effective pain management crucial (Mahmoud A., Mahmoud B., & Ammar, 2022).

The physical discomfort associated with burn injuries can contribute significantly to patients' anxiety levels. Concerns about ongoing pain, the process of healing, and potential disfigurement heighten emotional distress, leading to compromised sleep patterns and overall quality of life. The multifaceted nature of burn pain, compounded by the psychological stressors of both hospitalization and changing body image, underscores the importance of holistic approaches to care that integrate both physical and mental health strategies (Lerman et al., 2022; Chokshi et al., 2022).

Moreover, unmanaged pain can impact not only on physical sensations but also on sleep and rest patterns. Pain and anxiety often exacerbate sleep deprivation, leading to mental strain that can impede the recovery process. Addressing these symptoms through effective pain management techniques, psychological support, and the incorporation of complementary therapies may promote better outcomes for burn patients, enhancing their overall well-being and facilitating a more successful recovery trajectory (Salajegheh et al., 2024).

Anxiety, too, is a common result of burn injury, primarily stemming from fears about the painful nature of treatments, disfigurement, and adverse financial or occupational consequences. Patients with burn injury can manifest anxiety as fear, avoidance, concentration difficulties, and physiological reactions such as sweating, trembling, dizziness, and palpitations (Iyer et al., 2020). The interplay between anxiety and pain establishes a vicious cycle, where heightened anxiety can intensify pain, and in turn, discomfort aggravates anxiety, entrenching patients in both physical and emotional distress (Farzan et al., 2023).

Post-burn patients frequently face a range of sleep disturbances, such as insomnia, sleep deprivation, and fragmentation. Other factors such as pain, anxiety, and pruritus often intertwine with these issues. The use of opioid medications, while necessary for managing

acute pain, can complicate sleep further by disrupting normal sleep patterns (Lerman et al., 2022).

Research indicates a bidirectional relationship between anxiety and sleep quality, with increased anxiety leading to poorer sleep and sleep deprivation heightening anxiety levels. This cycle can create significant challenges for recovery, as poor sleep quality can impede overall healing and rehabilitation efforts (Mokhtari R., Ajorpaz N., & Golitaleb, 2023).

Evidence suggests that disruptions in sleep can affect pain perception, potentially intensifying chronic pain conditions. This bidirectional relationship highlights the importance of addressing both sleep disturbances and pain management concurrently in post-burn care to enhance patients' outcomes and overall quality of life (Lerman et al., 2022).

Addressing these issues holistically may involve a range of strategies, including effective pain management, psychological support, and possibly non-pharmacological interventions aimed at improving sleep quality. Non-pharmacological interventions, particularly breathing exercises, have garnered increasing recognition as effective adjuncts to traditional medical treatments in managing symptoms for patients with burn injuries. These techniques offer simple, cost-effective, and non-invasive strategies that can enhance patients' care. Deep breathing exercises, which entail inhaling deeply through the nose and exhaling slowly through the mouth, aim to increase oxygen intake and promote relaxation while reducing sympathetic nervous system activity (Gasteratos et al., 2022).

The benefits of breathing exercises extend beyond relaxation; they are instrumental in managing pain, anxiety, and sleep disturbances in burn patients. Abo El Ata et al. (2021) and Iyer et al. (2020) concluded that these exercises play a crucial role in alleviating pain and anxiety during dressing changes for hospitalized burn patients. Their research revealed that the use of breathing techniques significantly reduced both the physical discomfort and psychological stress associated with the dressing procedure. This underscores the necessity of incorporating breathing exercises into care protocols for burn patients, aiming to enhance their overall well-being and effectiveness in pain management during treatment.

Among the various relaxation techniques, deep breathing exercises and the 4-7-8 breathing technique are particularly significant. Deep breathing enhances oxygenation and relaxation, while the 4-7-8 technique—a structured pattern of inhalation through the nose for four counts, breath-holding for seven counts, and exhaling through the mouth for eight counts—aims to calm the individual and regulate the body's stress response (Toussaint et al., 2021). This cyclical process can enhance relaxation, lower stress levels, and improve both sleep quality and overall well-being. The role of nurses in implementing these strategies is vital. Their interventions significantly influence the management of burn-related symptoms and patient satisfaction (Miri et al., 2023).

By integrating non-pharmacological approaches like breathing exercises with conventional treatments, nurses can provide comprehensive care that addresses both physical and psychological challenges faced by burn patients (Mahmoud A., Mahmoud B., & Ammar, 2022). Despite the established benefits of breathing techniques in various clinical contexts, there is a noticeable lack of research specifically examining their comparative efficacy in managing insomnia, pain, and anxiety among patients with burn injuries. This study aims to fill this research gap by evaluating the effect of two different breathing techniques, deep breathing exercise and the 4-7-8 technique, on alleviating these specific symptoms during the recovery process. By highlighting this comparative efficacy, we can enrich the evidence-based

practice of patients with burn injuries, especially holistic care, with interventions that ultimately promote better health outcomes and improve patient quality of life.

1.1. Significance of the study:

Therapeutic guidelines typically emphasize the use of potent analgesics to alleviate pain and sleep disturbances in patients with burn injuries. However, the reliance on high dosages of these medications raises significant concerns regarding the potential for undesirable side effects and the risk of addiction. As a result, there is an increasing interest in incorporating non-pharmacological interventions as viable alternatives or complements to pharmacological treatments. These interventions may help better management of insomnia, pain, and anxiety among patients suffering from burn injuries.

2. The Aim of the Study: This study aimed to:

- Evaluate the effectiveness of deep breathing and the 4-7-8 breathing techniques for managing insomnia, pain, and anxiety in patients with burn injuries.
- Compare the effectiveness of deep breathing exercises versus the 4-7-8 breathing technique in managing insomnia, pain, and anxiety in patients with burn injuries.

2.1. Research Hypotheses:

To achieve the aims of the study, the subsequent research hypotheses were formulated:

H0: Patients with burn injuries who receive either deep breathing exercise or 4-7-8 breathing technique will exhibit the same levels of insomnia severity, pain, and anxiety as those who do not.
H1: Patients with burn injuries who receive the deep breathing exercise will exhibit less insomnia severity, decreased pain and anxiety levels than those who don't receive it.
H2: Patients with burn injuries who receive the deep breathing exercise will exhibit the same levels of insomnia severity, pain, and anxiety as those who don't receive the 4-7-8 breathing technique.
H3: Patients with burn injuries who receive the deep breathing exercise will exhibit lesser levels of insomnia, pain, and anxiety than those who receive the 4-7-8 breathing technique.
H4: Patients with burn injuries who receive the 4-7-8 breathing technique will exhibit lesser levels of insomnia, pain, and anxiety than those who receive the deep breathing exercise.

3. Subject and Methods:

3.1. Research Design.

- The current study used a nonrandomized quasi-experimental design with a control group to achieve its goal.

3.2. Settings

This study was conducted at the burn injuries inpatient unit of Kafr El-Dawar Hospital, affiliated with the Ministry of Health and Population in El Beheira governorate, Egypt. The hospital features a specialized burn unit with an inpatient department dedicated exclusively to the treatment of burn injuries. This department is equipped with a total of 10 beds, with five designated for female patients and five for male patients, ensuring appropriate care and accommodation for both genders.

3.3. Subjects

A purposive sample of 120 adult patients who met the criteria was recruited from the burn unit at Kafr El-Dwar Hospital to participate in the current study. Participants were assigned to one of three groups: Group A (N = 40) received Deep Breathing Exercise, Group B (N = 40) received the 4-7-8 Breathing Technique, and a Control Group (N = 40) received routine hospital treatment alongside the routine nursing interventions.

3.4. Research Sampling

Sample size calculation was performed using the Epi Info 7 software; a sample size of 120 adults' patients admitted to the previously mentioned setting was determined.

Participants patients included in this study according to the following inclusion criteria:

1. Burn patients aged 18 ≥60 years, of both genders,
2. Patients with second and third-degree burns covering 3% to 18% Total Body Surface Area (TBSA).
3. Patients who were hemodynamically stable, admitted at least 3 days prior data collection.
4. Patients with a score of 2–8 on the Numeric Pain Rating Scale (NRS).
5. Patients who had a score of ≥ 8 on the insomnia severity index (ISI).
6. Patients who had a score of ≥ 8 on the Anxiety Self-Rating Scale (ASRS).
7. Interested in participating in the study.

The Exclusion Criteria Were Outlines as Follows:

1. Patients with inhalation injury.
2. Patients with psychiatric disorders.
3. Patients with neurological disturbances that may interfere with sleep.
4. Patients with a history of drug addiction.
5. Patients currently receiving anxiolytics, hypnotics, antihistamines, and narcotics medications.
6. Patients with a history of insomnia, pain, anxiety, or psychiatric illness (depression), those who are intoxicated or in an impaired state of consciousness, pregnant females, individuals already engaged in yoga, meditation, or relaxation therapy.

3.5. Tools of the Study:

Three tools were adopted by the researchers and were used to collect the necessary data for this study.

Tool I: The Insomnia Severity Index (ISI):

The researchers utilized the Insomnia Severity Index (ISI), which was validated in Arabic by Suleiman & Yates (2011), to evaluate the characteristics, intensity, and consequences of insomnia. The assessment comprises seven items that evaluate insomnia symptoms using a 5-point Likert scale, ranging from 0 (indicating no problem) to 4 (indicating a very serious problem). Higher scores on the scale indicate more severe symptoms of insomnia. The measure assesses the intensity of sleep-onset, sleep maintenance, early morning awakening insomnia, sleep satisfaction, and daytime impairments caused by sleep issues, distress, and concern. The total scores vary from 0 to 28 points and are divided into the following categories:

- 0–7 indicates the absence of clinically significant insomnia.
- 8–14 indicates subthreshold insomnia.
- 15–21 indicates clinical insomnia of moderate severity.
- 22–28 indicates clinical insomnia of severe severity.

Tool II: Numeric Pain Rating Scale (NRS):

The Numeric Pain Rating Scale (NRS), developed by Hawker., Mian., Kendzerska., & French. (2011) was adopted by the researchers to quantify the intensity of pain experienced by patients using a numerical score. The scale ranges from 0 (indicating no pain) to 10 (indicating extremely intense pain), and it is categorized into three levels: mild (1-3), moderate (4-6), and severe (7-10).

Tool III: Anxiety Self-Rating Scale (ASRS) **Interview Schedule:**

Zung Self-Rating Anxiety Scale, The Anxiety Self-Rating Scale (ASRS) Interview Schedule, developed by Dr. William Zung in 1971, was adopted by the researchers to assess the severity of anxiety symptoms. It consists of 10 items that measure the frequency and intensity of anxiety symptoms on a scale of 0 to 4, where higher scores indicate more severe symptoms.

Scoring system:

The total score ranges from 0 to 40, with higher scores correlating with greater levels of anxiety. Interpretation of scores is as follows:

- 8= Minimal level.
- 9-16= Mild level.
- 17-24= Moderate level.
- 25-32= Severe level.
- 33-40=Extreme level.

In addition, a bio-demographic and clinical data sheet was supplied and utilized to gather demographic information, including gender, age, marital status, education, and job status. It also collected data on the severity of the burn and the occurrence of concurrent injuries or comorbidities.

3.6. Ethical Consideration

Written approval for conducting the study was secured from the Ethical Committee of the Faculty of Nursing at Damanhour University, Egypt (No. 63-b, signed on October 20th, 2022). Official permission was also granted by the Dean of the Faculty of Nursing, who directed the researchers to obtain authorization from the relevant authorities at Kafr El-Dawar Hospital for data collection, following a detailed explanation of the study's purpose.

Each patient involved in the study was provided with comprehensive information regarding the study's nature, objectives, and potential benefits. Participation was voluntary, and patients were made aware of their right to refuse participation or withdraw at any time. The privacy and confidentiality of participant data were strictly maintained throughout the study. To ensure complete anonymity and confidentiality, each patient was assigned a unique numerical ID.

3.7. Pilot Study

A pilot study was conducted on 12 patients, comprising 10% of the total subjects, who were not included in the main study sample. This pilot aimed to assess the clarity, feasibility, and applicability of the study tools.

3.8. Validity and Reliability of The Tools

The three adopted tools demonstrated excellent construct validity. The Insomnia Severity Index (ISI) has been shown to be valid by being able to differentiate between

levels of severity and correlating well with other insomnia tests. It also has high internal consistency (Cronbach's alpha between 0.74 and 0.92) and strong test-retest reliability (correlation coefficients above 0.80). The Numeric Pain Rating Scale (NRS) has substantial construct validity, effectively correlating with other pain assessment tools and differentiating between various pain intensity levels, as well as strong reliability evidenced by high test-retest reliability (correlation coefficients greater than 0.85) and robust internal consistency. The Anxiety Self-Rating Scale (ASRS) has good construct validity because it measures anxiety well and correlates well with other anxiety tests. It also has high internal consistency (Cronbach's alpha of 0.85 or higher) and good test-retest reliability, which means that scores stay the same over time.

3.9. Data Collection

Data collection was conducted over the course of eight months, from December 16th, 2022, to August 28th, 2023.

Fieldwork:

Pretest Interviews (Baseline Assessment):

- Primarly, researchers conducted face-to-face interviews with each patient to gather demographic and clinical data including gender, age, %TBSA (Total Body Surface Area affected), presence of inhalation injury, and baseline assessments using three tools: (Tool I) for insomnia severity, (Tool II) for pain severity, and (Tool III) for anxiety levels. These interviews typically **lasted between 15 to 45 minutes** and were conducted **on the fourth day** of admission, prior to any interventions, **shortly after wound dressing**.
- Following pretest interviews, researchers explained the 4-7-8 and deep breathing exercises to the patients, providing educational materials for each technique and supervised practice sessions. Patients were instructed to perform one of the breathing techniques as part of their intervention.

- The control group began with **routine care,** which **included** immediate assessment and stabilization, wound care, analgesics for pain management, and nutritional support.

Intervention Procedures:

- The study groups (Groups A and B) began participating in the study from the fourth day after admission to the unit to the seventh day of admission.
- The deep breathing exercises and 4-7-8 breathing technique were administered three times daily: during morning, evening, and night shifts before sleeping, under the supervision of the principal investigator.

Group (A): Deep Breathing Exercise (DBE)

a. The participants received a brief verbal explanation of the breathing technique, followed by a demonstration. This process was repeated until the researcher ensured that each patient was correctly practicing the technique. The breathing exercises were conducted in sessions lasting 15 minutes, with participants practicing three times a day.

b. The patient was instructed to sit comfortably with relaxed shoulders and neck, placing their hand on their abdomen to monitor the depth of their breathing. They were guided to inhale slowly and deeply through their nose until the abdomen moves inward and then exhale in the same way until the abdomen moves outward. This cycle was repeated over the 15-minutes session, all under supervision. (Aktaş & İlgin, 2023; Mahmoud, Mahmoud, & Ammar, 2022; Iyer, Mitra, & Dabadghav, 2020).

Group (B): 4-7-8 Breathing Technique

a. The researcher explained the procedure in a calm environment while the patient sat comfortably. The researcher outlined the methods that the patient would practice.
b. Patients were instructed to close their eyes, completely exhale through their mouth, and then take a deep breath in through their nose for a duration of 4 seconds (count of 4). They were also guided to hold their breath for 7 seconds (count of 7) and then exhale fully over a span of 8 seconds (count of 8). This breathing cycle was to be repeated continuously for 5 to 10 minutes. (Aktaş & İlgin, 2023).

Procedure Technique and Patients' Instructions:

- The guidelines were designed considering the educational level and medical status of the participants to ensure participant adherence to the assigned technique according to his/her group.
- The intervention and patient training were done by the same researcher to ensure consistency in patients' performance, while the other researchers were assigned for measuring and interpreting the results, to avoid bias in the study.

Posttest Interviews (Assessments) (Evaluation Phase):

- The entire sample (interventions & control groups) was evaluated twice (post intervention) during study period:
- **First posttest interviews (second assessment): performed** on day 5 of patients' admission, to assess their pain levels, insomnia severity, and anxiety levels.
- **Second posttest interviews (third assessment): performed** on day 7 of patients' admission, to assess their pain levels, insomnia severity, and anxiety levels.

3.10. Data, Statistical Analysis, and Processing:

After data collection, the data was coded and transformed into specially designed forms suitable for computer input. All entered data underwent verification to detect and correct any errors. Descriptive data analysis was conducted using percentages, means, and standard deviations. Statistical analysis was performed using the Statistical Package for the Social Sciences version 28 (SPSS-v28) at a confidence level of 95%, with a significance level (probability of error) set at 0.05.

The following statistical methods were employed

- Mean
- Standard Deviation
- ANOVA test for comparing the three groups and Pairwise comparison between each 2 groups using Post Hoc Test (Tukey), (ANOVA) with repeated measures for comparing between the three periods in each group
- Kruskal Wallis test for pairwise comparison between each 2 groups using Post Hoc Test (Dunn's for multiple comparisons test)
- Effect size (Eta Squared); <0.5 = small effect, 0.5-<0.8 = medium effect, >0.8 = large effect

4. Results

Table (1) shows the characteristics of the studied patients; as noticed, the age of the higher percentage (47.5%, 50%, 55%) of the control group, study groups A & B, respectively ranged from 30 <45 years with mean age and SD of (37.23± 9.872, 35.90±9.797, 35.80± 9.714), respectively. As regards gender, males represented the highest percentage (65%, 52.5%, 62.5%) among the controls, study groups A & B, respectively. As for the educational level, it can be noticed that 30% of the control group, 32.5% of study group A, and 25% of study group

B had primary education. In relation to marital status 92.5%, 77.5%, and 65% of the control group, study groups A & B, respectively were married. Concerning occupation, the highest percents (42.5%, 50%, and 35%) of the control group, study groups A & B, respectively had manual work, while (62.5%, 52.5%, 50%) of the control group, study groups A & B, respectively lived in rural areas.

Regarding the clinical data, it was clear that superficial second-degree burns were dominant among (62.5%, 72.5%, 62.5%) of the controls, study groups A & B, respectively. Furthermore, the majority hadn't any concomitant injuries nor chronic diseases with percentages (77.5%, 82.5%, 87.5%) among the controls, study groups A & B. It was evident that no statistically significant difference could be traced between the controls and the study groups A&B as regards their demographic characteristics and clinical data.

From table (2), it can be seen that the mean scores in the second and third assessment of insomnia severity demonstrated statistically significant difference between the control group, both study groups A & B where p1, p2 <0.001; while there was no statistically significant difference between the two study groups in the second and third assessment where p3= (0.788, 0.580) respectively. On the other hand, the three groups demonstrated highly significant reduction p <0.001 in their insomnia scores after 1 day and at the follow up assessment at day 7 where η2= 0.439, 0.970, 0.967 for control group, study group & study group B, respectively: with the largest effect size for study group A. In addition, percents of improvement for first and second post intervention assessments were significant compared to controls (H = 77.499, p<0.001), and (H = 79.199, p<0.001) respectively.

Table (3) reveals that there was no statistically significant difference found among the studied patients at the beginning of the study in their pain scores; p= 0.686 .While the study results showed that deep breathing exercises and 4-7-8 breathing technique were highly significant in pain reduction among both study groups A and B respectively η2=(0.912, 0.814) respectively as compared to the control group (0.200). While percents of improvement for first and second post intervention assessments were significant compared to controls (H = 40.173, p<0.001), and (H = 39.217, p<0.001) respectively.

Table (4) demonstrates the comparison of the anxiety mean scores of the three groups at day 4 with no statistically significant differences p = 0.311. Significant improvements were noticed among the three groups for first and second post intervention assessment on day 5 and day 7, with no statistically significant differences between both study groups in both of the first and second assessment p3= 0.082, 0.676 respectively. Although significant differences were noticed compared to controls (H = 77.711, p<0.001), and (H = 79.404, p<0.001) respectively..

Figure (1): Mean percent of improvement at first and second assessment after intervention in both study groups

Figure (1) illustrates the mean percentage of improvement in insomnia severity, pain, and anxiety assessments across two study groups (A and B) and a control group. Both study groups demonstrate significant improvements from the first to the second assessment, indicating the effectiveness of the interventions. In the insomnia severity assessment, study group A shows an increase from 41.4% to 43.7%, while study group B improves from 38.5% to 40.6%. The control group, however, exhibits minimal improvement, rising from 5.9% to 9.3%. In the pain assessment, study group A experiences a notable increase from 28.6% to 41.3%, and study group B shows a rise from 36.4% to 40.6%, while the control group shows an improvement that still remains low from 1% to 11.8%. The anxiety assessment reveals even more pronounced improvements, with study group A increasing from 60.6%to 94.0% and study group B from 66.3% to 94.2%. The control group shows a very notable improvement from 4.2% to 82.7%., however, it is lesser than both of the two study groups, further emphasizing the interventions' effectiveness.

Table (1): Percentage distribution of the demographic and clinical characteristics of the studied patients.

The studied patients' data	Control group n = 40		Study group (A) DBE n = 40		Study group (B) 4-7-8 technique n = 40		Statistical test	p-value
	No	**%**	**No**	**%**	**No**	**%**		
Demographic data								
Age:								
18 <30 years	9	22.5%	12	30%	11	27.5%		
30 <45 years	19	47.5%	20	50%	22	55%	$\chi^2 = 2.223$	0.695
45 ≤ 60 years	12	30%	8	20%	7	17.5%		
Mean ± SD	37.23± 9.872		35.90±9.797		35.80± 9.714		F = 0.792	0.455
Gender:								
Male	26	65%	21	52.5%	25	62.5%		
Female	14	35%	19	47.5%	15	37.5%	$\chi^2 = 0.482$	1.458
Education:								
Can't read & write	6	15%	3	7.5%	3	15%		
Read and write	9	22.5%	5	12.5%	3	15%		
Primary	12	30%	13	32.5%	10	25%	$\chi^2 = 9.248$	0.322
Secondary	6	15%	12	30%	13	32.5%		
University	7	17.5%	7	17.5%	11	27.5%		
Marital status:								
Single	2	5%	7	17.5%	11	27.5%		
Married	37	92.5%	31	77.5%	26	65%	$\chi^2 = 9.036$	0.060
Widower	1	2.5%	2	5%	3	7.5%		
Employment status:								
Manual work	17	42.5%	20	50%	14	35%		
Office work	11	27.5%	6	15%	12	30%		
Housewife	10	25%	14	35%	12	30%	$\chi^2 = 5.863$	0.439
Retired	2	5%	0	0	2	5%		
Residence:								
Rural	25	62.5%	21	52.5%	20	50%		
Urban	15	37.5%	19	47.5%	20	50%	$\chi^2 = 1.414$	0.493
Clinical data:								
Degree of burn:								
Superficial second-degree burns	25	62.5%	29	72.5%	25	62.5%	$\chi^2 = 1.186$	0.553
Third degree burns	15	37.5%	11	27.5%	15	37.5%		
Presence of other injuries or illnesses								
None	31	77.5%	33	82.5%	35	87.5%		
Diabetes mellitus	4	10%	3	7.5%	4	10%		
Hypertension	4	10%	2	5%	1	2.5%	$\chi^2 = 4.424$	0.619
Cardiac disease	1	2.5%	2	5%	0	0		

χ^2: Chi square test for comparing the three group F: F for ANOVA test for comparing the three groups

Table (2): The studied patients' mean scores regarding insomnia severity assessments before and after intervention.

Insomnia Severity Assessments	Control group n = 40	Study group (A) n = 40	Study group (B) n = 40	F_1	p-value
	Mean ± SD	Mean ± SD	Mean ± SD		
First assessment (day 4 of admission) before intervention for groups A&B	25.03± 1.747	25.28± 1.339	24.48±1.601	2.816	0.064
Second assessment Insomnia scores 1 (day 5 of admission) after intervention for groups A&B	23.15± 2.107	14.85± 2.167	15.17±2.241	151.679*	<0.001*
Sig. between groups	**p1<0.001*, p2<0.001*, p3= 0.788**				
Third assessment Insomnia scores 2 (day 7 of admission) after intervention for groups A&B	22.1250± 2.114	14.4750±1.880	14.5250±1.907	225.212*	<0.001*
Sig. between groups	**p1<0.001*, p2<0.001*, p3= 0.580**				
F_2 between periods (p)	**13.103*(0.001*)**	**415.18*(<0.001*)**	**390.03*(<0.001*)**		
Effect size (η^2)	**0.439**	**0.970**	**0.967**		
% improvement for First assessment					
Mean ± SD	-5.88±10.7	-41.36±10.24	-38.48±11.33		
Median	-7.87	-39.2	-36.59	**H = 77.499***	<0.001*
Sig. between groups	**p1<0.001* , p2<0.001*, p3= 0.461**				
% improvement for Second assessment					
Mean ± SD	-9.31±11.55	-43.67±7.73	-40.57±6.75		
Median	-9.88	-44.84	-42.4	**H = 79.199***	<0.001*
Sig. between groups	**p1<0.001* , p2<0.001*, p3= 0.203**				

F_1: ANOVA test H: Kruskal Wallis test
P1: p value for comparing between control group and study group (A)
P2: p value for comparing between control group and study group (B)
P1: p value for comparing between study group (A) and study group (B)
F_2: ANOVA test with repeated measures
η2: Eta-squared *: Statistically significant at $p \leq 0.05$

Table (3): Comparison of the studied the patients' pain scores before and after intervention

Pain assessment	**Control group n = 40**	**Study group (A) n = 40**	**Study group (B) n = 40**	**F_1**	**p-value**
	Mean ± SD	**Mean ± SD**	**Mean ± SD**		
First pain assessment (day 4 of admission)	8.25±1.296	8.35±1.331	8.20±1.224	0.142	0.686
Second pain assessment (day 5 of admission)	8.03±1.405	5.35±1.312	5.20±1.363	38.788*	<0.001*
Sig. between groups	**p1<0.001*, p2<0.001*, p3= 0.143**				
Third pain assessment (day 7 of admission)	7.15±2.131	4.60±1.105	4.68±.656	42.104*	<0.001*
Sig. between groups	**p1<0.001* , p2<0.001*, p3= 0.994**				
F_2 between periods (p)	**5.278*(0.012*)**	**102.12*(<0.001*)**	**92.978*(<0.001*)**		
Effect size (η^2)	**0.200**	**0.912**	**0.814**		
% improvement for First assessment					
Mean ± SD	-0.96±22.72	-28.58±17.56	-36.37±26.40		
Median	-3.92	-31.02	-39.57	**H = 40.173***	<0.001*
Sig. between groups	**p1<0.001*, p2<0.001*, p3= 0.519**				
% improvement for Second assessment					
Mean ± SD	-11.84±28.29	-41.33±17.29	-40.61±11.24		
Median	-21.12	-42.46	-41.26	**H = 39.217***	<0.001*
Sig. between groups	**p1<0.001*, p2<0.001*, p3= 0.512**				

F_1: ANOVA test H: Kruskal Wallis test
P1: p value for comparing between control group and study group (A)
P2: p value for comparing between control group and study group (B)
P1: p value for comparing between study group (A) and study group (B)
F_2: ANOVA test with repeated measures
η2: Eta-squared *: Statistically significant at $p \leq 0.05$

Table (4): Comparison of studied patients' anxiety scores before and after intervention

Anxiety assessment	**Control group n = 40**	**Study group (A) n = 40**	**Study group (B) n = 40**	**F_1**	**p-value**
	Mean ± SD	**Mean ± SD**	**Mean ± SD**		
First anxiety assessment (Day 4 Of Admission)	35.08±2.223	28.88±4.675	28.95±5.084	1.179	0.311
Second anxiety assessment (Day 5 Of Admission)	27.18±5.382	11.10±3.095	8.90±2.881	263.247*	<0.001*
Sig. between groups	**p1<0.001*, p2<0.001*, p3= 0.082**				
Third anxiety assessment (Day 7 Of Admission)	5.00±.000	1.73±.554	1.60±.545	708.722*	<0.001*
Sig. between groups	**p1<0.001*, p2<0.001*, p3= 0.676**				
F_2 between periods (p)	**694.82*(<0.001*)**	**623.94*(<0.001*)**	**611.85*(<0.001*)**		
Effect size (η2)	**0.947**	**0.975**	**0.973**		
% improvement for First assessment					
Mean ± SD	-4.24±19.6	-60.56±14.29	-66.25±14.14		
Median	-1.72	-60.0	-68.58	**H = 77.711***	<0.001*
Sig. between groups	**p1<0.001*, p2<0.001*, p3= 0.182**				
% improvement for Second assessment					
Mean ± SD	-82.74±1.17	-93.97±2.48	-94.23±2.20		
Median	-82.8	-93.97	-94.66	**H = 79.404***	<0.001*
Sig. between groups	**p1<0.001*, p2<0.001*, p3= 0.800**				

F_1: ANOVA test H: Kruskal Wallis test η2: Eta-squared *: Statistically significant at $p \leq 0.05$
P1: p value for comparing between control group and study group (A)
P2: p value for comparing between control group and study group (B)
P1: p value for comparing between study group (A) and study group (B)
F_2: ANOVA test with repeated measures

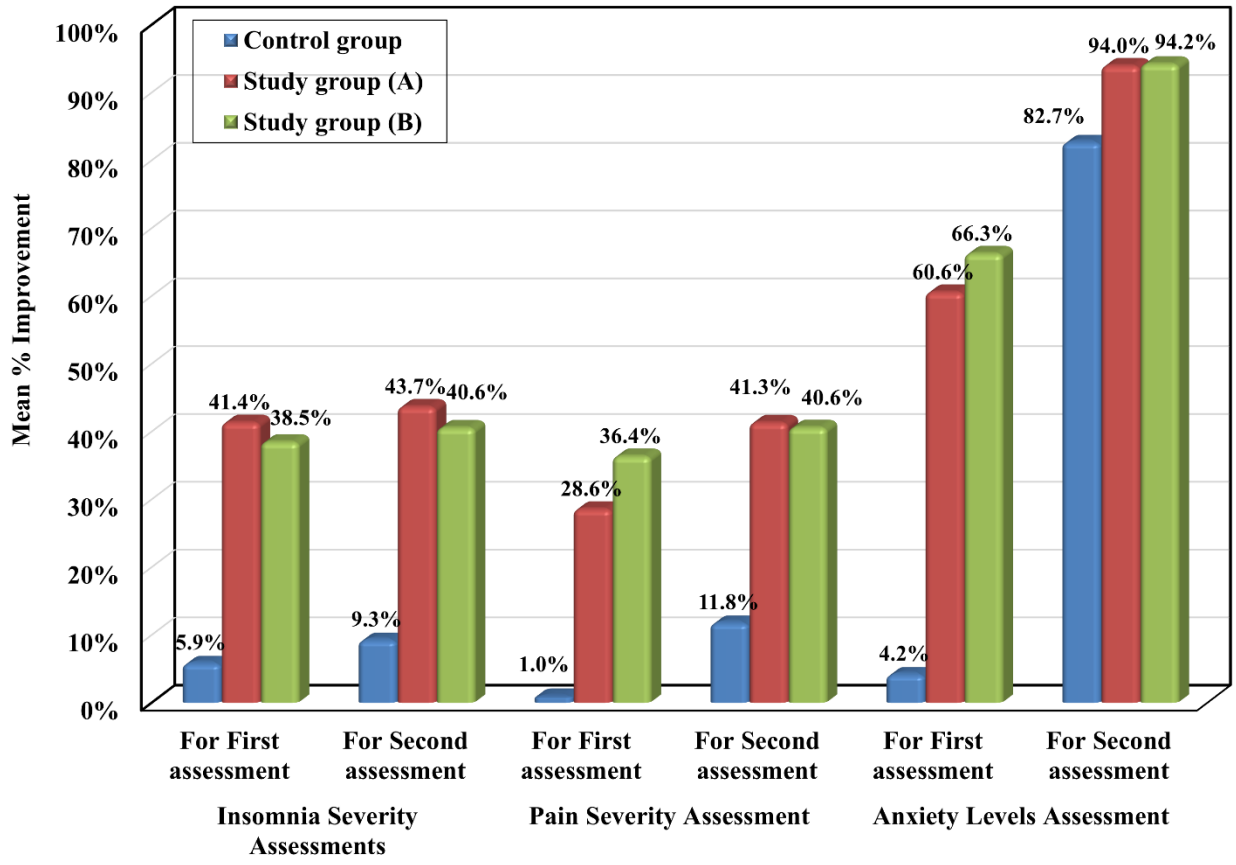

Figure (1): mean percent of improvement at first and second assessment after intervention in both study groups and in control group

Discussion

Burn is among the worst tragedies in modern society that people may experience, and it can occur in all age groups and social or economic classes. High frequency of severe burns and injuries results in mortality, morbidity, and socioeconomic costs to society which are good reasons to pay special attention to burn victims by health experts, and the community as well. (Mason et al., 2023)

The influence of pain due to burn injury, as a physical stressor that affects mental health, will affect the sleep and anxiety of patients suffering from burn injury. Deep breathing exercise is effective and is recommended for patients who are breathing fast and shallow. Active use of breathing is also recommended to prevent the repercussion effects of long-term traumatization and chronic hyperventilation syndrome. The 4-7-8 breathing technique is reported to act as a natural tranquilizer for the nervous system that improves anxiety and insomnia. Some evidence suggests the 4-7-8 breathing technique due to its relaxation effects. (Miri et al.2023; Fardin et al.2020)

As there is a lack of research comparing the effects of deep breathing exercises and the 4-7-8 breathing technique on pain, insomnia, and anxiety among patients with burn injuries. The present study was conducted to determine and compare the effects of deep breathing exercises versus the 4-7-8 breathing technique on pain, insomnia, and anxiety among patients with burn injuries.

- **Sociodemographic data and clinical data of the subjects of the study.**

Understanding the sociodemographic characteristics of the study participants is crucial as it provides context for interpreting the findings. Several socioeconomic factors have been associated with burn risk; in this respect, the current study results indicated that a significant portion of the patients were male, married, engaged in manual labor, had completed primary education, and lived in rural areas. The average age of patients in the different groups showed a pattern of middle-aged individuals. This finding aligns with the work of Youssef & Eldeen (2018) as they noted that most participants belonged to a younger age. Additionally, a majority of their participants were male, married, and employed, with a substantial proportion having a low to medium level of education.

The predominance of male participants in this study suggests a higher incidence of burn injuries among males, which is consistent with existing research that attributes this trend to occupational hazards and behaviors that expose men to burns more frequently. The significant proportion of married individuals highlights the role of marital status in influencing social support networks, which are crucial for burn recovery. Additionally, the prevalence of participants engaged in manual labor reinforces the idea that occupational hazards are significant contributors to burn injuries, emphasizing the urgent need for targeted workplace safety measures.

Lower levels of education among participants indicate potential disparities in knowledge related to burn prevention, underscoring the importance of educational outreach. Lastly, participants living in rural areas face unique challenges, such as limited access to healthcare and increased exposure to environmental hazards, necessitating tailored public health interventions. These sociodemographic insights underscore the need for comprehensive strategies that address specific risk factors to effectively reduce the incidence and impact of burn injuries across diverse population groups.

These findings are consistent with the reports of Davodabady et al. (2021), Alinia-Najjar et al. (2020), and Rafiei et al. (2018) in that the mean age of their study participants was approximately 36 years, with more than half being male, married, and from rural areas. This may be attributed to the fact that burns primarily occur in home and workplace settings, where men are more likely to experience fire, scald, chemical, and electrical burns. Furthermore, the living conditions and lifestyle typical of rural areas tend to be less safe than those in urban areas; patients in rural regions often tend to be younger, less educated, and have lower economic status compared to their urban counterparts.

According to Gautam et al. (2022) the demographic characteristics (such as age and gender) and socioeconomic factors (including low literacy, economic status, and occupation) significantly affect burn injury risk. They supported those with lower socioeconomic backgrounds, those living in crowded housing, and those with lower education levels are more susceptible to burn injuries.

Clinically, the current study clinical data indicated that superficial second-degree burns predominated among the studied patients, consistent with findings by Peck (2012) as the highest percent of their study group had second-degree injuries. Superficial second-degree burns often result in symptoms such as pain, discomfort, redness, and blistering. The findings suggest that the majority of the studied patients had severe pain at the first assessment. This clinical profile implies including non-pharmacologic pain management techniques into routine nursing intervention.

- **Effect Of Deep Breathing Exercises Vs 4-7-8 Breathing Technique on Insomnia, Pain, and Anxiety Among Patients with Burn Injuries.**

Hospitalized burn patients often experience pain, insomnia, and anxiety, which can negatively impact their recovery. While pharmacological therapies are commonly employed to manage these symptoms, non-pharmacological interventions—such as deep breathing exercises, the 4-7-8 breathing technique, relaxation techniques, and music therapy—have also proven effective. These interventions can be used alongside medications for pain management in burn patients (Fardin, Rezaei, & Maslakpak, 2020).

Pain, insomnia, and anxiety are common issues among patients with burn injuries. Poor sleep can exacerbate pain, slow wound healing, and lead to restlessness, irritability, anxiety, and behavioral changes. The findings of this study demonstrated that patients in both the study and control groups experienced severe pain, moderate to severe anxiety levels, and severe clinical insomnia. Moreover, both deep breathing exercises and the 4-7-8 breathing technique were effective in reducing insomnia, pain, and anxiety levels among the participants. However, there was a notable improvement in study group A regarding the reduction of insomnia and pain from the first to the second assessment, indicating that the percentage of improvement increased over time.

In the present study, nearly similar anxiety reduction than controls might be interpreted as the majority of the participants had superficial second degree burn that can heal with dressings and topical applicants than surgical procedure which may provoke anxiety. Another factor may be that control group had the routine treatment and pharmacologic agents that may decrease pain and inflammatory reaction which accordingly can decrease anxiety..

These findings are consistent with those of Fardin, Rezaei, & Maslakpak (2020), who noted that hospitalized burn patients suffer not only from the physical and psychological distress of the burn incident but also from the stressful medical procedures such as wound cleansing, dressing, physiotherapy, and surgery. This can lead to heightened pain, insomnia, and anxiety. Their study highlighted that pain and anxiety often interact in a vicious cycle, where pain exacerbates anxiety, and anxiety increases pain perception, making it more intolerable.

Furthermore, these results are congruent, even with similar anxiety results with controls, with Bozorg-Nejad et al. (2018), who evaluated the effect of relaxation breathing on burn pain and found that breathing techniques significantly impacted the overall anxiety experienced by burn patients. Additionally, Miri et al. (2022) concluded that non-pharmacological techniques, such as breathing exercises combined with prescribed therapies, effectively reduced pain and anxiety in burn patients. In a similar context, Youssef & Eldeen (2018) reported that deep breathing exercises effectively improved insomnia and reduced pain among these patients.

In this regards, Bozorg-Nejad et al. (2018) emphasized that deep breathing exercises, including rhythmic breathing and the 4-7-8 technique, are effective in reducing pain intensity during dressing changes for burn patients. Accordingly, it was interesting to investigate these different techniques on insomnia and anxiety also.

Comparing the Effectiveness of Deep Breathing (DB) versus 4-7-8 Breathing Technique on Sleep, Pain, and Anxiety:

Based on the current study results, both deep breathing techniques are effective in reducing pain scores when compared to the control group. However, the deep breathing (DB) technique showed superior effectiveness compared to the 4-7-8 breathing technique in improving sleep quality and reducing pain among the current participants. Specifically, the DB group exhibited significantly larger improvements in reducing insomnia scores, with mean scores decreasing from severe to mild after both the first and second evaluations. In contrast, the 4-7-8 group experienced less pronounced improvement, with scores decreasing from severe to moderate initially and then to mild subsequently.

Regarding pain reduction, the DB group demonstrated a more substantial decrease in mean pain scores compared to the 4-7-8 group. The superior effectiveness of DB may be attributed to its effectiveness in improving symptoms of pain and insomnia among adults. Although the study did not reveal statistically significant differences between the two techniques in treating insomnia, pain, and anxiety among burn patients, both deep breathing exercises (DBE) and the 4-7-8 breathing technique provided significant therapeutic benefits (Ali & Mahmoud, 2024).

Despite their confirmed efficacy, the study found that neither technique demonstrated significant variations in their ability to reduce the severity of anxiety among this study participants as compared to controls. However, the randomized controlled trial underscored the potential of deep breathing exercises, particularly in alleviating pain, insomnia, and anxiety levels among the studied patients. This reinforces the efficacy of DBE as a valuable adjunct to daily hospital care routines, noted for its ease of implementation and lack of adverse drug interactions. These findings consolidate previous research supporting the therapeutic benefits of DBE (Miri et al., 2023; Iyer et al., 2020; Mahmoud, A, Mahmoud, B & Ammar, 2022; Hosseinzadeh-Karimkoshteh et al., 2021; Hamasaki, 2020).

The findings from this study highlight the significant therapeutic benefits of deep breathing exercises, particularly the deep breathing technique in managing insomnia, pain, and anxiety among adult burn patients. While both deep breathing and the 4-7-8 technique offer valuable interventions, the evidence suggests that the DB method may provide enhanced outcomes, underscoring its potential as an effective adjunct to conventional hospital care. As healthcare professionals continue to explore non-pharmacological approaches for improving patient well-being, integrating deep breathing exercises into clinical practice could serve as a cost-effective, easily implemented strategy to enhance patients' emotional and physical recovery.

5. Strengths of the study:

This study is the first to compare the efficacy of deep breathing (DB) and the 4-7-8 breathing technique specifically in patients with burn injuries. Both techniques were effective in reducing insomnia, pain, and anxiety, but the results indicate that the DB group showed significantly greater improvements compared to the 4-7-8 technique. Notably, the DB group demonstrated more substantial reductions in insomnia and pain scores during the intervention. While the 4-7-8 breathing technique also contributed to reductions in insomnia, and pain, anxiety, its repetitive practice may be impractical for some. In contrast, the DB technique was more consciously controlled, making it easier for patients to incorporate into their daily routines for long-term benefits.

6. Limitation of the study

Further research with larger sample sizes is needed to confirm the effectiveness of both deep breathing exercises and the 4-7-8 technique, ideally using objective stress markers such as cortisol levels.

7. Conclusion

Deep breathing exercise and 4-7-8 breathing technique used in the current study are helpful for managing pain, insomnia and anxiety among patients with burn injuries, where deep breathing exercise showed superior effectiveness compared to the 4-7-8 breathing technique in the reduction of insomnia and pain among the current participants. Also, both techniques showed nearly similar but significant effectiveness in anxiety reduction among participants compared to controls.

8. Recommendations

Based on the study's findings, the following recommendations are suggested:

8.1. For Health professionals and policymakers:

- Incorporate deep breathing exercises and the 4-7-8 breathing technique into routine care plans for patients with burn injuries
- Provide comprehensive education to patients on how to properly perform both breathing techniques. Instructional materials, such as videos or pamphlets, may enhance understanding and compliance.
- Encourage patients to practice these techniques regularly. Establish a structured schedule or reminders that patients can follow to promote consistency.
- Implement a system for monitoring patient adherence to the techniques and solicit feedback on their effectiveness. This could involve regular check-ins or journaling their experiences.
- Consider creating support groups where patients can practice these techniques together, fostering a sense of community and shared learning.

8.2. Future Research:

- Future studies should include larger, diverse patient populations and the use of objective measurements to validate the findings regarding the effectiveness of these techniques.

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Informed consent: After the study's objective was explained, informed consent was obtained from patients who participated in this study.

Peer-review: Externally conducted**.**

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الملخص العربي

تأثير تمرين التنفس العميق مقابل تمرين التنفس 4-7-8 على الألم والأرق والقلق بين المرضى المصابين بالحروق.

مقدمه: يعتبر الألم والأرق والقلق من التحديات الحرجة التي تواجه المرضى المصابين بالحروق، حيث تؤدي هذه المشكلات إلى إطالة فترة التعافي وتؤثر سلبًا على النتائج الصحية العامة. تمثل تمارين التنفس العميق وتقنية التنفس 4-7-8 تدخلات محتملة لتخفيف هذه المشاكل.

الهدف: هدفت هذه الدراسة إلى تقييم تأثير تمرين التنفس العميق مقابل تقنية التنفس 4-7-8 على الألم والأرق والقلق بين المرضى المصابين بالحروق.

التصميم: تم استخدام تصميم شبه تجريبي مع عينة عمدية من 120 مريضًا بالغًا مصابًا بالحروق، تم توزيعهم عشوائيًا إلى ثلاث مجموعات: مجموعة الدراسة أ ($n=40$)، مجموعة الدراسة ب ($n=40$)، ومجموعة التحكم ($n=40$). كما شملت أدوات التقييم ثلاثة أدوات كالتالي **مؤشر شدة الأرق*(Insomnia Severity Index)*** ، **مقياس تقييم الألم العددي *(Numeric (Pain Rating Scale)*** **ومقياس تقدير الذات للقلق*(Anxiety Self-Rating Scale)*** . تم تعزيز هذه الأدوات بالبيانات الديموغرافية والسريرية.

النتائج: أظهرت الدراسة انخفاضات ملحوظة في مستويات الألم ($p < 0.001$) والأرق ($p < 0.001$) والقلق مقارنةً بالمجموعة الضابطة في كلا مجموعتي الدراسة. وأظهر تمرين التنفس العميق فعالية تفوق تقنية التنفس 4-7-8 في تقليل الأرق والألم.

الخلاصة والتوصيات : تعتبر تمارين التنفس العميق وتقنية التنفس 4-7-8 فعالة في إدارة الألم والأرق والقلق بين المرضى المصابين بالحروق. يُوصى بدمج هذه التقنيات في خطط الرعاية الشاملة للمرضى خلال فترة إقامتهم في المستشفى. ينبغي على مقدمي الرعاية الصحية، بما في ذلك الممرضين، النظر في دمج تمارين التنفس العميق وتقنية 4-7-8 في روتين الرعاية. يجب على الأبحاث المستقبلية استكشاف هذه التقنيات في عينات أكبر للتحقق من فعاليتها في هذه الفئة من المرضى.