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Reducing Blood Pressure and SRAS Scores in Preoperative CDL Patients Through Alternate Nostril Breathing Exercise (ANBE)

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Abstract

Patients diagnosed with CKD often experience changes in both physiological and psychological responses. Alternate Nostril Breathing Exercise (ANBE) has been reported to influence cardiorespiratory and autonomic functions, as well as to reduce anxiety and stress scores. The objective of the study was to analyze the effectiveness of ANBE on the stability of physiological and psychological responses in preoperative patients undergoing CDL insertion at Ratu Zalecha Hospital, Martapura. The study employed a quasi-experimental design with a Pretest-Posttest Control Group Design. The total sample size was 30. The instruments used included an observation sheet and the Zung Self-Rating Anxiety Scale questionnaire. The tool required to measure blood pressure is the Omron HEM-7120 digital sphygmomanometer. The data were analyzed univariately with frequency distribution and bivariately with paired t-test and independent t-test. Data were analyzed using univariate and bivariate methods. The result revealed a significant difference in systolic blood pressure between the control group and the intervention group, with a mean ± SD of 179.6±28.45 in the intervention group and 154 ±15.96 in the control group. Similarly, there was a significant difference in diastolic blood pressure between the two groups, with a mean ± SD of 102.47 ± 10.41 in the intervention group and 91.40 ± 7.82 in the control group. In conclusion, ANBE has the potential to serve as a method for managing preoperative stress and physiological responses (such as blood pressure).It is recommended that nurses in inpatient or pre-operative rooms are encouraged to provide brief training and assistance in performing Alternate Nostril Breathing Exercise to pre-operative patients.

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INTRODUCTION

Chronic kidney disease (CKD) has a high morbidity and mortality rate, placing a significant economic burden on healthcare systems each year (Acheampong, 2023). CKD affects populations across different regions of the world unevenly, likely due to variations in demographic characteristics, comorbidities, and access to healthcare resources (Yu et al., 2019). CKD, commonly referred to as chronic renal failure, involves the gradual loss of all kidney functions (Saunders et al., 2020). and is classified into five stages. It is characterized by a progressive decline in kidney function, leading to disturbances in fluid balance, waste elimination, and electrolyte regulation (Hecking et al., 2022). CKD occurs when the kidneys are damaged for more than three months and the condition becomes irreversible. The diagnosis of CKD is typically based on the persistence of kidney damage for more than three months (Lai et al., 2019). Although individuals with CKD may maintain a relatively normal life, they are likely to experience a gradual deterioration in kidney function, ultimately requiring Renal Replacement Therapy (Levey et al., 2020). Studies have identified several risk factors for chronic kidney disease (CKD), including genetics, sex, ethnicity, family history, low birth weight, obesity, smoking, exposure to nephrotoxins, acute kidney injury, diabetes mellitus, and hypertension (Okolie, 2024). Symptoms of CKD, as reported in the literature, include anemia, cognitive changes, hypertension, gastrointestinal disturbances, shortness of breath, impaired kidney function, itching and muscle cramps, damage to the glomerular capillary walls and tubules, and peripheral edema due to sodium retention. The major complications of CKD primarily include anemia, bone disease, cardiovascular disease (CVD), and cancer (Webster et al., 2017). Chronic kidney disease (CKD) is a global health problem with a steadily increasing prevalence. The Basic Health Research (Riskesdas) reported that the prevalence of CKD (eGFR < 60 ml/min/1.73 m^2) in 2018 was 3.8 per mille (‰), an increase from 2.0 per mille (‰) in 2013. In South Kalimantan Province, there were 459 new cases of kidney failure in 2020, with Banjar Regency reporting the second highest number of cases at 97, following Barito Kuala Regency (Hustrini et al., 2022). The number of CKD patients actively undergoing dialysis has also increased, from 30,000 in 2015 to more than 50,000 in 2016 (Kustriyani & Endang Supriyanti, 2024). Management of CKD through Renal Replacement Therapy (RRT) has become increasingly common. One form of RRT is hemodialysis (HD), which involves the removal of solutes through a semipermeable membrane along a concentration gradient (Murdeshwar & F, 2023).

The initiation of hemodialysis (HD) through the insertion of a Central Double Lumen (CDL) catheter is commonly used as a temporary route for hemodialysis (Chen et al., 2019). Patients diagnosed with chronic kidney disease (CKD) are reported to experience anxiety, especially when faced with unfamiliar procedures involving surgical intervention (Cimen et al., 2020; Suryawanshi et al., 2023). Psychological factors that influence individuals prior to surgery include depression, low self-efficacy, and anxiety. Anxiety is an unpleasant subjective feeling triggered by fear of improbable events, such as the perception of impending death. It is often accompanied by restlessness, fatigue, concentration difficulties, and muscle tension.

Perioperative anxiety is described as a vague and uneasy feeling, often stemming from unknown or unspecified sources. The perioperative period is a stressful event that elicits specific emotional, cognitive, and physiological responses in patients (Sigdel, 2015). Psychological stress plays a significant role in anxiety. Stressful life events are known to precede anxiety disorders, and individuals with such disorders often report experiencing greater psychological stress and being more affected by stressful events. Situations perceived as threats or stressors can lead to changes in cardiovascular activity, such as an increased heart rate (HR) (Trotman et al., 2019).

Deep breathing exercises are one method to reduce anxiety. Studies have shown that deep breathing techniques, including pranayama breathing, can effectively reduce anxiety in

preoperative cardiac patients and help lower blood pressure and heart rate (Chandrababu et al., 2019; Garg et al., 2024). However, the use of the Alternate Nostril Breathing Exercise (ANBE) technique in patients experiencing anxiety during the preoperative phase of CDL insertion has not yet been explored. Different types of breathing exercises produce varying physiological responses in healthy young volunteers. ANBE has been reported to influence cardiorespiratory and autonomic functions, as well as to reduce anxiety and stress scores (Roshni, 2024). The alternating nasal breathing cycle is a result of the decongestion response of the erectile tissues in the nasal turbinates and septum of both nostrils, effectively altering unilateral nasal resistance. This phenomenon occurs due to the prevailing sympathetic and parasympathetic tone. Alternate Nostril Breathing (ANB) influences the proper balance between sympathetic and parasympathetic activity, enhancing digestion, reducing heart rate, and relaxing the body. Slow and regulated breathing produces a number of acute beneficial effects through the cardiovascular reflex control system, including increased heart rate variability and baroreflex sensitivity, reduced blood pressure, and improved oxygen saturation in cases of chronic heart failure (Roshni, 2024).

Previous studies have shown that ANBE is effective in lowering blood pressure, heart rate, and anxiety levels in hypertensive populations and general preoperative patients, as reported by Soliman (2020) in hypertensive patients and El-ghafar (2025) in general preoperative patients (El-ghafar et al., 2025; Mohamed Soliman, 2020). However, these studies have not specifically explored the effects of ANBE on preoperative patients undergoing CDL, who have different clinical and psychological characteristics compared to general surgery patients. Patients undergoing CDL procedures often experience increased anxiety due to the perceived risk of invasive procedures and the possibility of cardiovascular complications. This anxiety response can trigger activation of the sympathetic nervous system, which contributes to increased blood pressure and heart rate. Although ANBE has been shown to modulate the balance of the autonomic nervous system through increased parasympathetic activity, as reported in a study by Kalaivani et al. (2019), there have been no studies evaluating changes in blood pressure and SRAS scores in a population of preoperative CDL patients (Kalaivani et al., 2019).

The main novelty of this study lies in the integration of two main outcome parameters, namely blood pressure and SRAS scores, in a quasi-experimental design in preoperative CDL patients. Most previous studies tended to assess physiological or psychological parameters separately, without examining the relationship between the two in the context of invasive cardiovascular procedures. Thus, this study not only expands the clinical application of ANBE but also contributes to the development of a simple, safe, and easily applicable evidence-based preoperative nursing intervention protocol.

Based on the results of the preliminary study, it was found that none of the participants were aware of the non-pharmacological management method, namely Alternate Nostril Breathing (ANB), which can reduce physiological and psychological impacts in patients undergoing preoperative CDL procedures. Therefore, the researcher is interested in examining the effect of Alternate Nostril Breathing on physiological and psychological responses in preoperative CDL patients at Ratu Zalecha Hospital, Martapura.

METHODS

The design of this study is a Quasy Experimental with Pretest-Posttest Control Group Design. The study took place in Ratu Zalecha Hospital, Martapura between February and May 2025. The population in this study consisted of all patients scheduled for Central Double Lumen (CDL) catheter insertion in 2023, totaling 112 individuals. The sampling technique employed was non-probability sampling, specifically purposive sampling. Sampling was further refined by applying inclusion and exclusion criteria. The inclusion criteria were: (1) age between 19 and 59 years; (2) patients scheduled for CDL insertion; (3) patients

willing to participate as respondents by signing informed consent; (4) patients with no history of previous surgery. The exclusion criteria were: (1) patients with complaints of coughing; (2) patients who did not complete the intervention; and (3) patients using supplemental oxygen. The sample size in this study was determined based on the guidelines of Borg and Gall (2007) as cited in (Gall et al., 2007), which recommend 15–30 respondents per group for experimental and comparative research. The total sample size in this study consisted of 30 respondents, divided into two groups of 15 participants each. The first group was the intervention group, which received the alternate nostril breathing treatment for 10 minutes over 2 days, performed once a day, and the second group is the control group that received deep breathing exercises. The second group was the control group, which was given deep breathing exercises. Before recruitment into the study, each participant provided written informed concent. The instruments used in this study were observation sheets and questionnaires. Blood pressure was measured using a digital sphygmomanometer, while pulse rate was measured using a wristwatch. Psychological responses, specifically anxiety, were assessed using the Zung Self-Rating Anxiety Scale (SAS/SRAS), an anxiety assessment tool for adult patients developed by William W.K. Zung, based on anxiety symptoms outlined in the Diagnostic and Statistical Manual of Mental Disorders (DSM-II). Univariate analysis was conducted using frequency distribution, mean, median, standart deviation (SD), and minimum-maximum values, Bivariate data analysis was conducted using paired t-test and independent t-test, preceded by a normality test of the data. The normality test was performed using the Shapiro-Wilk test with a $\rho > 0.05$, indicating that the data is normally distributed. This study was declared ethically feasible and received ethical approval under review number 003/EC/KEPK_STIKES_KENDAL/II/2025 by the Ethics Committee of STIKes Kendal.

RESULTS

1. Respondent Characteristics Data

Table 1. Frequency Distribution of Respondent Characteristics in the Intervention Group andControl Group by age and duration of sufferingof patients pre operative with CDL at Ratu Zalecha Hospital (n=30)

	Mean	Median	SD	Min.-Max.
Age				
Intervention Group	45,27	45	13,07	19-59
Control Group	51,67	56	9,59	37-59
Suffering duration				
Intervention Group	3,13	2	2,69	1-12
Control Group	4,73	4	3,17	2-12

Source: Primary Data, 2025

Based on the table above, the average age is 45.27 years, with a minimum age of 19 years and a maximum age of 59 years in the intervention group and an average age of 51,67 years, with a minimum age of 37 years and a maximum age of 59 years in the control group. The average duration of suffering is 3,13 months in the intervention group, the average duration of suffering is 4,73 months in the control group.

Table 2. Frequency Distribution of Respondent Characteristics in the Intervention Group and Control Group of Patients pre operative with CDL at Ratu Zalecha Hospital, Martapura (n=30)

Respondent Characteristics	Interventions group		Control group	
	f	%	f	%
Gender				
Male	9	60	5	33,33
Female	6	40	10	66,67
Total	15	100	15	100
Comorbidities				
Hypertentions	8	53,3	9	60
CKD	7	46,7	6	40
Total	15	100	15	100

Source: Primary Data, 2025

Based on the table above, it was found that the majority of the male gender was 60%, the majority of comorbidities were hypertension at 53,3% in the intervention group. The majority of the female gender was 66,67%, the majority of comorbidities were hypertension at 60% in the control group.

Specific Data

Tabel 3. Shapiro Wilk test normality test on post-operative CDL installation patients at Ratu Zalecha Hospital, Martapura (n=30)

Variables	ρ value
Systole (Pre)	0,052
Dyastole (Pre)	0,483
Heart Rate (Pre)	0,754
SRAS Score (Pre)	0,088
Systole (Post)	0,386
Dyastole (Post)	0,171
Heart Rate (Post)	0,181
SRAS Score (Post)	0,071

Source: Primary Data, 2025

Based on the table above, the results of the data normality test show $\rho>0.05$ for all variables before and after treatment, meaning that the data is normally distributed so that the variable analysis in this study uses parametric tests

Table 4. Results of Paired T-Test Analysis of Blood Pressure (Systole-Dyastole), Heart Rate and SRAS Score in the Intervention Group and Control Group in Pre-Operative Patients with CDL Installation at Ratu Zalecha Hospital, Martapura (n=30)

	Mean	SD	Min.-Max.	ρ value
Systole				0,004*
Intervention Group				
Before	173,20	17,64	152-222	
After	156,87	12,97	133-174	
Control Group				0,011*
Before	179,60	28,45	152-221	
After	154,93	15,69	133-170	
Dyastole				0,048*
Intervention Group				
Before	101,0	7,34	90-112	
After	92,27	6,93	79-104	
Control Group				0,671
Before	102,47	10,41	89-112	
After	91,40	7,82	78-103	
Heart Rate				0,079
Intervention Group				
Before	82,33	12,96	61-102	
After	77,13	9,77	62-99	
Control Group				0,157
Before	82,87	14,44	61-100	
After	77,67	10.04	60-99	
SRAS Score				0,001*
Intervention Group				
Before	38,80	7,58	28-49	
After	35,27	7,56	26-48	
Control Group				0,315
Before	35,73	6,96	24-50	
After	34,53	7,12	26-47	

*ρ value <0.05. *Source: Primary Data, 2025*

Based on the table above, changes in systolic pressure reduction were obtained between before and after treatment in both groups. Changes in diastolic pressure in the intervention group statistically decreased significantly (meaningful) between before and after intervention. Changes in SRAS Score in the intervention group statistically decreased significantly (meaningful) between before and after intervention (ρ<0.05). In the control group, statistically insignificant changes were obtained before and after treatment in both diastolic pressure, heart rate and SRAS score (ρ>0.05).

Table 5. Results of *independent t-test* analysis of the difference in mean difference between the intervention group and the control group on Blood Pressure (Systole-Dyastole), Heart Rate and SRAS Score inPatients with CDL Installation at Ratu Zalecha Hospital, Martapura (n=30).

Variables	Intervention group	Control group	ρ value
	Mean±SD	Mean±SD	
Systole	179,6±28,45	154±15,96	0,012*
Dyastole	102,47±10,41	91,40±7,82	0,019*
Heart Rate	77,13±9,77	77,67±10,04	0,978
SRAS Score	35,27±7,56	34,53±7,12	0,971

*ρ value <0.05. *Source: Primary Data, 2025*

Based on the results of table 5, there is a significant difference in systolic pressure between the control group and the intervention group with an average value of mean±SD in the intervention group of 179.6±28.45 and in the control group 154±15.96. Likewise, there is a significant difference in diastolic pressure between the control group and the intervention group with an average value of mean±SD in the intervention group of 102.47±10.41 and in the control group 91.40±7.82. Meanwhile, there is no significant difference in heart rate and SRAS Score between the control group and the intervention group (ρ>0.05).

DISCUSSION

There was a reduction in systolic blood pressure observed between the pre- and post-intervention phases in both groups. This reduction was statistically significant, indicating that ANBE may serve as a beneficial non-pharmacological intervention for managing blood pressure prior to surgery. The effectiveness of ANBE in lowering systolic blood pressure can be attributed to its ability to activate the parasympathetic nervous system, which plays a role in reducing stress responses and blood pressure levels. These findings are consistent with various international studies highlighting the effectiveness of ANBE in reducing blood pressure. A quasi-experimental study conducted at Benha University Hospital, Egypt, involving 100 preoperative patients, found that ANBE significantly reduced systolic blood pressure from an average of 134.80 mmHg to 116.40 mmHg ($p < 0.001$) following the intervention (Hanan Mohamed Mohamed, 2020). Additionally, a meta-analysis by Lee et al. (2024), which included 1,377 participants, demonstrated that ANBE effectively reduced systolic blood pressure, with an average decrease of 7.16 mmHg compared to the control group (Nam et al., 2024). Another study conducted at JIPMER, Puducherry, India, reported a significant reduction in systolic blood pressure after five days of twice-daily ANBE practice, with a p-value < 0.0001. The mechanism underlying this blood pressure reduction is believed to be associated with parasympathetic nervous system activation via vagus nerve stimulation during the breathing exercises, which leads to decreased sympathetic activity and reduced blood pressure (Hasaini, 2024).

Thus, ANBE can be regarded as an effective and easily applicable non-pharmacological intervention for managing blood pressure in preoperative patients, particularly in the context of central dialysis line (CDL) placement. The diastolic pressure in the intervention group showed a statistically significant decrease between the pre- and post-intervention measurements, indicating a reduction in diastolic blood pressure among preoperative patients undergoing CDL insertion. This finding aligns with the meta-analysis by Wang et al. (2024), which reported that ANBE significantly reduced both systolic and diastolic blood pressure compared to a non-intervention control group and enhanced heart rate variability (HRV), an indicator of autonomic balance and improved cardiac health. Supporting this, research by (Telles et al., 2014) demonstrated that ANBE improved HRV and reduced blood pressure, while a

study found that practicing ANBE for five consecutive days significantly decreased both systolic and diastolic blood pressure in patients with hypertension (El-ghafar et al., 2025; Khalid et al., 2024; Upadhyay Dhungel et al., 2008).

The reduction in diastolic blood pressure can be explained by the activation of the parasympathetic nervous system that occurs during the practice of ANBE. This technique involves deep, controlled breathing through alternating nostrils, which is known to stimulate the vagus nerve, decrease sympathetic activity, and enhance parasympathetic tone. As a result, peripheral vasodilation and a reduction in systemic vascular resistance occur, contributing to a decrease in diastolic blood pressure. Moreover, a study by (Hanan Mohamed Mohamed, 2020) demonstrated that four weeks of ANBE practice significantly reduced blood pressure, heart rate, and anxiety levels in patients with hypertension. This supports the notion that ANBE offers both physiological and psychological benefits, which are particularly relevant in the preoperative context, where patients frequently experience elevated anxiety levels (Hanan Mohamed Mohamed, 2020). In clinical settings, the integration of ANBE as a non-pharmacological intervention in preoperative preparation may serve as an effective strategy for managing patients' blood pressure and anxiety. The technique is simple, safe, and requires no special equipment, making it a practical option within hospital environments.

The change in SRAS scores in the intervention group showed a statistically significant decrease ($\rho < 0.05$) between the pre- and post-intervention measurements, indicating that ANBE is effective in reducing anxiety in patients undergoing invasive procedures such as central dialysis line (CDL) insertion. This finding is consistent with the study which demonstrated that a 15-minute ANBE practice reduced experimentally induced anxiety in healthy individuals, although the difference was not statistically significant compared to the control group (Kamath et al., 2017). Furthermore, research found that ANBE significantly reduced anxiety levels among physiotherapy students before examinations, as measured by the Beck Anxiety Inventory (Raut & Deshmukh, 2020).

ANBE is believed to influence the autonomic nervous system by enhancing parasympathetic activity and reducing sympathetic activity, thereby contributing to anxiety reduction. A study indicated that ANBE can shift autonomic tone toward vagal dominance, which is associated with lowered blood pressure and increased heart rate variability (Jahan et al., 2021). Moreover, the activation of mechanoreceptors in the nasal mucosa during ANBE may transmit signals to the hypothalamus—the highest center for autonomic regulation—playing a key role in balancing sympathetic and parasympathetic nervous system activity (Kumar & Pradhan, 2017). Integrating Alternate Nostril Breathing Exercise (ANBE) as a non-pharmacological intervention in preoperative preparation may offer additional benefits in managing patient anxiety. A study demonstrated that ANBE was effective in reducing anxiety, blood pressure, and heart rate in preoperative patients (El-ghafar et al., 2025). Therefore, brief ANBE training can be provided to patients prior to surgery as part of the preoperative preparation protocol to enhance patient comfort and physiological stability.

The study results indicated that the control group did not experience significant changes in diastolic pressure, heart rate, or SRAS scores after the intervention ($\rho > 0.05$). This may be attributed to the absence of an intervention actively modulating the autonomic nervous system. Without a calming stimulus, such as breathing exercises, the body remains in a homeostatic state influenced by preoperative stress. Alternate Nostril Breathing (ANB) is a breathing technique known in yoga as *Nadi Shodhana*. This practice involves alternating breaths through the right and left nostrils and is believed to balance hemispheric brain activity and stimulate the parasympathetic nervous system. Activation of the parasympathetic system plays a role in lowering blood pressure and heart rate, as well as reducing anxiety levels (Garg et al., 2024; Jagadeesan et al., 2022) . A study demonstrated that practicing ANB for four weeks significantly reduced blood pressure, heart rate, and anxiety

levels in patients with hypertension. Furthermore, a meta-analysis found that breathing exercises, including ANB, had a moderate yet significant effect in lowering systolic and diastolic blood pressure, as well as heart rate (Hanan Mohamed Mohamed, 2020; Geiger et al., 2025)

The non-significant changes observed in the control group highlight the importance of active interventions such as ANBE in preoperative patient management. Integrating ANBE into preoperative protocols may help stabilize physiological parameters and reduce patient anxiety, which in turn can improve postoperative outcomes and patient satisfaction. ANBE did not produce significant changes in heart rate and SRAS scores ($\rho > 0.05$). These findings are consistent with several studies indicating that the effects of ANBE on physiological and psychological parameters may vary depending on the duration and frequency of practice, as well as individual characteristics. For example, a study found that ANBE did not significantly reduce experimentally induced anxiety in healthy volunteers, although a downward trend was observed (Kamath et al., 2017). Similarly, research indicated that left-nostril breathing enhanced parasympathetic activity but did not consistently result in significant changes in overall heart rate variability (HRV) (Ashwini & Anandraj, 2020). Additionally, a study demonstrated that ANBE may improve HRV in individuals unfamiliar with yogic breathing practices; however, this effect may require time and consistency in practice to reach statistical significance (Levin & Swoap, 2019; (Sofyan et al., 2020).

The absence of significant changes in the study may be attributed to the short duration of the intervention or the participants' lack of familiarity with the breathing technique. Several studies suggest that the benefits of Alternate Nostril Breathing Exercise (ANBE) on physiological and psychological parameters require consistent and long-term practice.

LIMITATION OF THE STUDY

Limitations of the study shorter time frame and smaller group, all from a specific age range, may limit how well the results represent the general population. The study didn't look at social and demographic factors. Also, not everyone might sit correctly on the floor mat as instructed. Additionally, the study didn't check blood and urine levels of stress hormones to understand stress levels better. The advantage of this study is that it measures both physical and psychological responses of patients, which has not been found in previous similar studies.

CONCLUSION

There was a change in physiological responses, indicated by a decrease in systolic and diastolic blood pressure before and after the intervention in both groups, with a statistically significant difference observed between the control and intervention groups. This finding suggests that Alternate Nostril Breathing Exercise has potential as a method for managing preoperative stress and physiological responses (blood pressure). Additionally, there was a change in psychological responses before and after the intervention in both intervention groups, which may be beneficial in helping stabilize patients' emotional state prior to undergoing invasive medical procedures.

SUGGESTION

It is recommended that nurses in inpatient or pre-operative rooms are encouraged to provide brief training and assistance in performing Alternate Nostril Breathing Exercise to pre-operative patients, especially in cases of CDL placement that cause high anxiety and the preparation of an evidence-based Alternate Nostril Breathing Exercise implementation module/guide that can be used as a reference by health workers to improve the comfort and stability of patient conditions before invasive procedures.

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CONFLICTS OF INTEREST

The authors declare that there are no conflicts of interest regarding the publication of this paper. The authors have no financial, personal, professional, or institutional relationships that could have influenced the study design, data collection, data analysis, interpretation of the findings, or the decision to publish the results.

AUTHOR CONTRIBUTIONS

Asni Hasaini was responsible for the study's concept development, data management, formal analysis, research methods, validation, writing the original draft, as well as reviewing and editing. Muhlisoh contributed to the investigation, methodology, data collection, verification, and provided the necessary resources.

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