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Application of Head Up 30 Degree Positioning to Improve Oxygen Saturation in Stroke Patients in the Emergency Room of Pandan Arang Regional General Hospital Boyolali

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ABSTRACT

Background: Stroke is a brain disease that attacks the brain suddenly and causes impaired nerve function, caused by blockage of blood vessels and lack of oxygen in the blood to the brain. Poor blood flow in stroke patients results in hemodynamic disorders, including decreased oxygen saturation. One of the independent nursing actions to increase oxygen saturation is to give a 30-degree head-up position. **Objective:** To determine the results of applying a head-up position of 30 degrees in increasing oxygen saturation in stroke patients in the Emergency Room of Pandan Arang Boyolali Hospital. **Methods:** This research uses a descriptive method (case study). **Results:** Oxygen saturation before applying the head-up position, 30 degrees in both respondents, was included in the mild hypoxia category. After applying a head-up position of 30 degrees in both respondents, oxygen saturation was included in the normal category. **Conclusion:** There are differences in oxygen saturation results before and after applying the 30-degree head-up position in stroke patients.

Keywords: Stroke, Oxygen saturation, Head up 30 degrees

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1. INTRODUCTION

Poor lifestyle and physical activity habits significantly increase the risk of non-communicable diseases that can be life-threatening. One such non-communicable disease posing a serious threat is stroke, as it is a complication of other non-communicable diseases whose prevalence continues to rise annually, becoming a leading cause of disability and mortality worldwide, including in Indonesia (Khariri & Saraswati, 2021). Stroke is a cerebral disease affecting the brain caused by a blockage in blood vessels and reduced oxygen supply, leading to

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hypoxia, sleep disturbances, and permanent disabilities (Kiswanto, 2021).

According to the World Health Organization (2022), there are 12,224,551 new cases annually, with 101,474,558 people globally having experienced a stroke. Meanwhile, according to the 2023 Indonesia Health Profile, the number of stroke cases in Indonesia is relatively high, with 3,461,563 Indonesian residents experiencing stroke. In Central Java, reports indicate that 1.0% of new stroke cases were recorded in the province in 2022 (Dinkes, 2023).

Stroke is defined as a sudden functional disturbance of the brain lasting more than 24 hours due to impaired blood flow to the brain, resulting in neurological dysfunction. It can be caused by hypertension, unhealthy eating habits, alcohol consumption, lack of physical activity, dyslipidemia, obesity, and stress. Patients who suffer from stroke may experience physical disabilities, speech difficulties, vision loss, confusion, and paralysis. The manifestations of stroke vary among patients depending on which cerebral artery experiences ischemia. Common clinical symptoms include facial weakness, arm and leg weakness, hemiplegia or hemiparesis, vision loss, difficulty speaking, severe headaches, and balance disorders (Afifah, 2024).

Impaired blood flow in stroke patients leads to hemodynamic disturbances, including decreased oxygen saturation. Interruption of blood supply to the brain and insufficient oxygen delivery result in reduced oxygen saturation, causing shortness of breath in stroke patients. Therefore, appropriate monitoring and management are required because hemodynamic conditions greatly influence oxygen delivery throughout the body, ultimately affecting heart function, and most stroke patients experience a drop in oxygen saturation.

Nursing interventions for managing stroke patients include oxygen therapy, administration of isotonic fluids, oral nutrition, total bed rest, airway clearance, and positioning the head at a 30-degree elevation (head-up position). The head-up position at 30 degrees improves cerebral blood flow and enhances brain tissue oxygenation, thereby increasing oxygen saturation levels. Implementing this position is one strategy to reduce mortality rates and the risk of stroke complications, aiming to ensure adequate cerebral oxygenation and improve oxygen saturation in stroke patients.

Oxygen saturation reflects the adequacy of oxygen in the body and helps determine the appropriate treatment. Applying the head-up position in stroke

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patients can improve hemodynamic status by facilitating increased blood flow to the cerebrum and maximizing cerebral tissue oxygenation. Head-up positioning involves elevating the patient's head 30 degrees above the body axis while keeping the legs straight and aligned (Sholekhah & Suyanto, 2023).

Research conducted by Trisila et al. (2022) titled "The Effect of Applying a 30-Degree Head-Up Position on Oxygen Saturation in Stroke Patients in the Emergency Department of Dr. T.C Hiller Hospital, Maumere, Sikka Regency" showed a p-value of 0.000 < α (0.05), indicating a significant effect on oxygen saturation after applying the 30-degree head-up position in stroke patients. Specifically, oxygen saturation was measured at 96% in the supine position, but increased to 100% after elevating the head to 30 degrees for 30 minutes.

Based on preliminary studies conducted by the researcher in January 2025 in the Emergency Department of Pandan Arang Regional Hospital of Boyolali, 43 stroke patients were admitted to the ER. It was found that most stroke patients experienced decreased oxygen saturation, and the interventions provided included pharmacological therapy and oxygen administration. Stroke is considered an emergency case requiring prompt and accurate intervention; otherwise, the longer it remains untreated, the higher its severity becomes, worsening the level of disability due to expanding neuronal death and infarcted areas in the brain, potentially leading to altered consciousness and even death.

Given the importance of timely and effective management of hemorrhagic and non-hemorrhagic stroke patients to maintain adequate oxygen saturation and enhance tissue perfusion, the researcher is interested in conducting the study: "Application of the 30-Degree Head-Up Position to Improve Oxygen Saturation in Stroke Patients in the Emergency Department of Pandan Arang Regional Hospital of Boyolali."

2. METHODS

The research method used is a descriptive case study approach. The study involved two respondents. The researcher conducted an initial assessment of oxygen saturation, applied the 30-degree head-up position for 30 minutes, and then measured oxygen saturation again to evaluate any changes. The subjects were selected based on inclusion and exclusion criteria. Inclusion criteria included stroke patients (ischemic or hemorrhagic) with oxygen saturation below 95%, those already diagnosed by a physician, and individuals

capable of communication and willing to participate. Exclusion criteria included critically ill patients or those experiencing apnea.

The 30-degree head-up position was implemented on two stroke patients in the Pandan Arang Regional Hospital of Boyolali Emergency Department. The first patient, Mr. S, aged 65 years, presented with left-sided weakness, right leg weakness, facial droop, slurred speech, and unclear articulation. He had a history of hypertension and diabetes mellitus. Vital signs showed blood pressure of 140/90 mmHg, heart rate of 88 bpm, respiratory rate of 21 breaths per minute, SpO_2 of 94%, temperature of 36.7°C, and blood glucose of 586 mg/dl. The interventions included applying the 30-degree head-up position, administering intravenous NaCl 500 cc at 20 drops per minute, Santagesic injection, Ranitidine injection, Citicoline injection, and insulin. CT scan results indicated cerebral infarction in the right frontoparietal lobe. Blood tests showed hemoglobin at 15.1 g/dL, leukocytes at 10,480 cells/mm³, eosinophils at 1.00%, basophils at 0.30%, segmented neutrophils at 84.40%, lymphocytes at 11.00%, monocytes at 3.30%, hematocrit at 47%, platelets at 267 x10³/mm³, red blood cells at 5.36 million/mm³, MCV at 87.8 fL, MCH at 28.3 pg, MCHC at 32.2 g/dL, and RDW-CV at 12.4%.

The second patient, Mr. M, aged 71 years, arrived with complaints of left limb weakness upon waking, slurred speech, facial droop, and dizziness. His vital signs were blood pressure of 110/70 mmHg, heart rate of 70 bpm, respiratory rate of 22 breaths per minute, SpO_2 of 93%, temperature of 36.3°C, and blood glucose of 82 mg/dl. Interventions included the 30-degree head-up position, Asering infusion, Citicoline injection, Ranitidine injection, and nasal cannula oxygen at 3 liters per minute. CT scan revealed cerebral infarction in the right frontotemporoparietal and occipital lobes. Blood test results showed hemoglobin at 12.2 g/dL, leukocytes at 6,820 cells/mm³, eosinophils at 5.30%, basophils at 0.70%, segmented neutrophils at 41.60%, lymphocytes at 47.10%, monocytes at 5.30%, hematocrit at 39%, platelets at 353 x10³/mm³, red blood cells at 4.40 million/mm³, MCV at 88.7 fL, MCH at 27.7 pg, MCHC at 31.2 g/dL, and RDW-CV at 13.4%.

Data analysis identified both patients as being at risk for ineffective cerebral perfusion due to embolism. The nursing diagnosis was based on subjective data from family reports regarding symptoms such as left-sided weakness, facial

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drooping, slurred speech, and dizziness. Objective findings included restlessness, elevated blood pressure, altered respiratory rate, decreased oxygen saturation, and CT scan confirmation of cerebral infarction. After eight hours of nursing care, the expected outcome was improved cerebral perfusion, with reduced intracranial pressure, headache, and restlessness. Nursing interventions focused on managing increased intracranial pressure through observation, therapeutic measures including the 30-degree head-up position, and collaboration with physicians for medication administration.

The independent variable in this study was the 30-degree head-up position, which was expected to influence the dependent variable, oxygen saturation in stroke patients. Operationally, the 30-degree head-up position was defined as elevating the patient's head 30 degrees from the bed while keeping the body aligned straight, maintained for 30 minutes using a standard operating procedure. Oxygen saturation was measured using an oximeter placed on the patient's finger for five seconds until a reading appeared. Normal oxygen saturation was categorized as 95–100%, mild hypoxia as 92–94%, moderate hypoxia as 85–91%, and severe hypoxia as below 85%.

The implementation occurred in the Emergency Department of Pandan Arang Regional Hospital of Boyolali starting in January 2025. Data collection involved primary and secondary sources. Primary data were gathered directly from patients and their families through interviews, observations, and documentation review. Interviews were used to collect patient identity, current complaints, medical history, family health history, and functional patterns. Observations included monitoring general condition and vital signs. The documentation study reviewed medical records, laboratory results, and treatment information.

Data processing involved comparing oxygen saturation levels before and after the intervention to determine the effect of the 30-degree head-up position. This included verifying the completeness of collected data, grouping relevant information, and organizing it into tables for more straightforward interpretation. Ethical principles followed during the study included informed consent, anonymity, autonomy, confidentiality, justice, beneficence, non-maleficence, and veracity. Participants were informed about the study and provided voluntary consent. Respondents' identities were kept confidential by using only initials. Participants had the right to refuse

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without penalty, all data were treated confidentially, and the research aimed to provide benefits without causing harm. Honest communication was maintained regarding the study's purpose, procedures, and potential benefits.

3. RESULTS

This research was conducted in the Emergency Department (IGD) of Pandan Arang Regional Hospital of Boyolali. The Emergency Department is the initial treatment unit for patients based on the severity of their condition. Pandan Arang Regional Hospital, Boyolali Regency, is a Class B public hospital owned by the Boyolali Regency Government since January 13, 2021, based on the Decree of the Office of Investment and Integrated Services of Central Java Province Number 445/125/2021. The hospital at Jalan Kantil No. 14, Lorjurang, Pulisen, Boyolali. As of February 2025, Pandan Arang Regional Hospital has an inpatient bed capacity of 201 beds distributed across seven wards: VVIP room, VIP room, Class I ward, Class II ward, Class III ward, Non-Class ward, and Isolation room. The case study was conducted on two male respondents diagnosed with stroke in the Emergency Department of Pandan Arang Regional Hospital of Boyolali.

Table 1. Oxygen saturation before applying the 30-degree head-up position in stroke patients

Respondents	Date	Oxygen Saturation Before Positioning
Mr. S	05-02-2025	94%
Mr. M	07-02-2025	93%

Based on Table 1, the oxygen saturation levels before applying the 30-degree head-up position showed that Mr. S had an oxygen saturation level of 94%, while Mr. M had a level of 93%. Both respondents' oxygen saturation levels fell into the category of mild hypoxia.

Table 1. Oxygen saturation after applying the 30-degree head-up position in stroke patients

Respondents	Date	Oxygen Saturation Before Positioning
Mr. S	05-02-2025	98%
Mr. M	07-02-2025	99%

Table 2 shows oxygen saturation levels increased after applying the 30-degree head-up position. Mr. S's oxygen saturation rose to 98%, and Mr. M's increased to 99%.

Table 3. Development of oxygen saturation after applying the 30-degree head-up position in stroke patients

Respondents	Date	Oxygen Saturation Before Positioning	Category	Oxygen Saturation After Positioning	Category
Mr. S	05-02-2025	94%	Mild Hypoxia	98%	Normal
Mr. M	07-02-2025	93%	Mild Hypoxia	99%	Normal

Based on Table 3, there was an improvement in oxygen saturation after applying the 30-degree head-up position. Mr. S's oxygen saturation increased from 94% to 98%, and Mr. M's oxygen saturation increased from 93% to 99%.

Table 4. Comparison of final oxygen saturation results before and after applying the 30-degree head-up position

Respondents	Date	Oxygen Saturation Before Positioning	Oxygen Saturation After Positioning
Mr. S	05-02-2025	94%	98%
Mr. M	07-02-2025	93%	99%

Based on Table 4, the final oxygen saturation results showed an increase after applying the 30-degree head-up position. For Mr. S, oxygen saturation improved from 94% to 98%, and for Mr. M, it increased from 93% to 99%.

4. DISCUSSION

Oxygen Saturation Before Implementation of the 30-Degree Head-Up Position

Based on observations before applying the 30-degree head-up position on Mr. S and Mr. M in the Emergency Department of Pandan Arang Regional Hospital of Boyolali, oxygen saturation levels before implementation were 94% for Mr. S and 93% for Mr. M. These results indicate that both patients experienced mild hypoxia. Mr. M's oxygen saturation level was slightly lower than Mr. S's, possibly due to age and medical history differences.

According to interviews conducted with the families, Mr. S had a blood pressure of 140/90 mmHg (hypertension), while Mr. M had a blood pressure of 110/70 mmHg. Hypertension can damage blood vessels; kidney damage may occur if the blood vessels in the kidneys are affected. Hypertension is one of the risk factors for stroke. Hypertension refers to increased arterial blood pressure (Ginanjar, 2024).

The respondents' ages in this study were 65 years for Mr. S and 71 years for Mr. M, placing them in the elderly category.

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Elderly individuals are more prone to stroke because, as they age, body tissues become less flexible and stiffer, including blood vessels. This doubles the risk of stroke, and as people get older, their oxygen saturation levels tend to decrease. With aging, there is also a decline in lung function capacity (Santama, 2025).

Stroke patients experience impaired blood flow to the brain, which reduces oxygen supply. The brain requires oxygen and glucose as energy sources to maintain optimal function. The brain has almost no oxygen reserves and heavily depends on continuous blood flow. Brain neurons require a constant oxygen supply to maintain normal function. Severe oxygen deficiency can lead to unconsciousness and even death. Impaired blood flow in stroke patients causes hemodynamic disturbances, including decreased oxygen saturation. Therefore, appropriate monitoring and management are required because hemodynamic conditions greatly influence oxygen delivery throughout the body, ultimately affecting heart function. Nursing interventions to assist in managing stroke patients include applying the 30-degree head-up position (Santama, 2025).

Oxygen Saturation After Implementation of the 30-Degree Head-Up Position

Mr. S experienced an increase in oxygen saturation from 94% before the intervention to 98% after 30 minutes of the 30-degree head-up position. Mr. M also showed improvement, with oxygen saturation rising from 93% before the intervention to 99%, further optimized by nasal cannula oxygen administration at 3 liters per minute.

Applying the 30-degree head-up position improves cerebral blood flow in stroke patients with poor circulation, thereby preventing neurological disturbances that cause impaired oxygen diffusion in the lungs' alveoli. This condition often leads to reduced oxygen levels in the blood. Patients experiencing low oxygen saturation must receive immediate specialized care. Management of decreased oxygen saturation in stroke patients can involve pharmacological methods, such as oxygen therapy, or non-pharmacological methods, like the 30-degree head-up position. Higher oxygen levels are expected to improve oxygen saturation. The 30-degree head-up position in stroke patients influences oxygen saturation, helping to stabilize respiratory system functions so they work optimally

and provide comfort to stroke patients (Ginanjar, 2024).

This research aligns with a study conducted by Syahrunisa (2024), which stated that the 30-degree head-up position significantly improves oxygen saturation in stroke patients. Before applying the 30-degree head-up position, oxygen saturation was measured at 96% but increased to 98% afterward. Adjusting the head position to a 30-degree angle has been proven to improve venous blood flow from the brain, reduce intracranial pressure, and maintain cerebral perfusion (Raffin et al., 2020).

This study is also consistent with Trisila's (2022) research, which found that implementing the 30-degree head-up position affects oxygen saturation levels in stroke patients. Before the intervention, oxygen saturation was 94%, but it increased to 97% afterward.

The 30-degree head-up intervention improves cerebral blood flow, optimizing brain oxygenation. The 30-degree head-up position can also restore optimal hemodynamic conditions by enhancing venous return, increasing brain tissue metabolism, accelerating oxygenation, and strengthening brain activity (Mustikarani & Mustofa, 2020).

Development of Oxygen Saturation Before and After Applying the 30-Degree Head-Up Position

Mr. S received the 30-degree head-up position intervention, and after 30 minutes, he appeared calm and no longer restless. His oxygen saturation increased to 98%, with vital signs: BP 145/80 mmHg, HR 92 bpm, RR 21 breaths/min. During rest, he remained in the head-up position, occasionally assisted by family members to turn right or left. He was occasionally placed supine without experiencing shortness of breath. For Mr. M, after 30 minutes of the 30-degree head-up position, he appeared calm and comfortable, continuing to use a nasal cannula due to slight dyspnea. There was no chest wall retraction, and his oxygen saturation improved to 99%, with vital signs: BP 130/70 mmHg, HR 96 bpm, RR 21 breaths/min.

Mr. M's lab result showed lower hemoglobin levels—12.2 g/dL compared to the normal range of 14.0–18.0 g/dL, and a CT scan confirmed cerebral infarction in the right frontotemporoparietal and occipital lobes. Ischemic stroke patients tend to have lower hemoglobin levels. Low hemoglobin indicates the extent of the infarct area, where larger infarcts correlate with worse clinical outcomes. Low hemoglobin can reduce oxygen supply to

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brain tissue, worsening ischemia and causing hypoxia in the penumbra region, disrupting cerebrovascular autoregulation, and increasing inflammatory mediators associated with ischemia (Malingkas, 2024).

Mr. S's leukocyte count was higher than the normal range (10,480 cells/µL vs. 4000–10,000 cells/µL), and the CT scan showed cerebral infarction in the right frontoparietal lobe. Mechanistically, leukocytes are involved in ischemic stroke through reperfusion injury caused by inflammatory responses when blood flow resumes. This leads to vascular endothelial blockage, reducing capillary luminal patency due to hypoxia response. High leukocyte counts trigger inflammation by releasing pro-inflammatory cytokines such as IL-1 and TNF. Excessive leukocytes worsen neurological deficits, causing cerebral occlusion, reduced perfusion pressure, leukocyte trapping in circulation, and contact with capillary endothelium. This can result in tissue hypoperfusion and brain ischemia (Bakrie, 2024).

Before receiving the 30-degree head-up position, Mr. S and Mr. M experienced mild hypoxia due to reduced tissue oxygen supply. However, oxygen saturation improved and returned to normal. The 30-degree head-up position aims to ensure patient safety and adequate oxygen supply. By lying down and elevating the head, venous return to the right atrium improves, enhancing venous return, cardiac pump load, and cardiac output.

The 30-degree head-up position increases oxygen saturation by optimizing oxygen flow to the brain and improving cerebral blood circulation. It prevents significant increases in intracranial pressure, provides comfort, and allows stable hemodynamic conditions. This improves cerebral blood flow, prevents nervous system disturbances, and avoids oxygen deficiency in the blood. The 30-degree head-up position in stroke patients shows increased cerebral blood flow and elevated oxygen saturation. This position enhances venous return, boosts blood flow to the brain, and optimizes brain tissue oxygenation (Wahyudin, 2024). Stroke patients must be closely monitored, and supplemental oxygen should be administered when oxygen saturation drops below 93% or 94%. Proper handling and monitoring are necessary because impaired blood flow disrupts oxygen delivery.

Comparison of Final Results Between the Two Respondents After the 30-Degree Head-Up Position

After applying the 30-degree head-up position for 30 minutes, differences

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between the two respondents were observed. Mr. S's oxygen saturation improved from 94% (mild hypoxia) to 98% (normal), while Mr. M's oxygen saturation increased from 93% (mild hypoxia) to 99% (normal). This indicates that the 30-degree head-up position positively affects oxygen saturation in stroke patients, shifting from mild hypoxia to normal levels.

Mr. M's oxygen saturation was slightly higher than Mr. S's due to additional nasal cannula oxygen (3 LPM) provided to prevent hypoxia. According to Mahendra's (2024) research, stroke patients should immediately assess their oxygen saturation, respiratory function, and blood pressure, and oxygen therapy should be administered carefully to maintain normal oxygen saturation levels. Common conditions seen in stroke patients involve reduced oxygen levels in the blood, which can impair organ performance. Oxygen is essential for bodily functions, so its reduction leads to functional decline. Oxygen therapy via nasal cannula is recommended as part of treatment (Pakaya & Nurliah, 2021).

Stroke occurs due to blocked cerebral blood vessels, leading to reduced or halted blood flow to brain tissue. Reduced oxygen and nutrient supply result in brain cell death (cerebral infarction). The 30-degree head-up position maximizes venous return, improves cerebral blood flow, enhances cerebral tissue metabolism, and optimizes brain oxygenation, allowing the brain to function correctly. Stroke patients require prompt and accurate treatment to minimize stroke severity and disability risks. Impaired blood flow causes hemodynamic disturbances, including changes in oxygen saturation (Trisila et al., 2022).

The 30-degree head-up position is recommended for stroke patients, especially during the acute phase. It involves raising the head using a hospital bed and positioning it above the body. The goal is to reduce intracranial pressure by enhancing venous return from the brain to the heart and preventing cerebral edema commonly caused by ischemic processes (Mahendra, 2024).

Physiologically, respiration involves gas movement from high-pressure to low-pressure areas. Thus, gas exchange between O_2 and CO_2 occurs optimally in the 30-degree head-up position. As a result, optimal volume increases, and oxygen saturation improves (Sholekhah et al., 2023).

Study Limitations

Monitoring during the application of the 30-degree head-up position was not fully effective due to the high patient load

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in the emergency department. While the journal reported a duration of 30 minutes, the actual implementation time was extended to 40 minutes.

5. CONCLUSION

The research conducted on Mr. S and Mr. M regarding applying the 30-degree head-up position leads to several key findings. Before applying the head-up position, Mr. S had an oxygen saturation level of 94% and Mr. M had 93%, falling into mild hypoxia. After implementing the 30-degree head-up position, oxygen saturation levels improved significantly, with Mr. S reaching 98% and Mr. M reaching 99%, both within the normal range. The final results show that both respondents experienced increased oxygen saturation from mild hypoxia to normal levels, indicating that the 30-degree head-up position effectively enhances oxygen saturation in stroke patients. Based on these findings, it is recommended that families be encouraged to expand their knowledge about the 30-degree head-up position so that they can assist patients independently at home, either on their own or with the help of healthcare professionals. For hospitals, it is suggested that this positioning method be adopted as a complementary non-pharmacological therapy and that patients be encouraged to perform it promptly to improve oxygen saturation in stroke cases.

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AUTHOR CONTRIBUTIONS

The author contributes in conceptualization, data collection and analysis: Amelia Ayu Kusuma Wardhani, Ida Nur Imamah, Sugito. Writing and manuscript revisions: Nadia Agus Tina.

CONFLICT OF INTEREST

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

DATA AVAILABILITY STATEMENT

The data supporting the findings of this study are available upon reasonable request from the corresponding author.

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