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THE EFFECTS OF SEA SAND THERAPY ON BLOOD PRESSURE AND PULSE RATE

Pengaruh Terapi Pasir Laut terhadap Tekanan Darah dan Denyut Nadi

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ABSTRAK

Kejawanan terkenal sebagai destinasi wisata yang menarik perhatian berkat praktik terapi pasirnya yang unik, yang erat kaitannya dengan kepercayaan mistis dan tradisi budaya. Selain itu, dalam pasir dan air terdapat kandungan mineral yang dapat berguna bagi kesehatan. Penelitian ilmiah lebih lanjut diperlukan untuk memvalidasi manfaat langsung dari praktik terapi tersebut. Penelitian ini bertujuan untuk menyelidiki efek terapi pasir laut terhadap tekanan darah dan detak jantung. Desain kuasi-eksperimental kuantitatif digunakan dengan melibatkan 34 peserta yang dibagi menjadi kelompok perlakuan dan kelompok kontrol. Purposive sampling digunakan untuk menetapkan partisipan. Terapi pasir laut dilakukan pada kelompok perlakuan dengan mengoleskan campuran pasir dan air laut ke anggota tubuh selama 15 menit. Pengukuran sebelum dan sesudah intervensi dilakukan untuk kedua kelompok. Analisis statistik menggunakan uji Wilcoxon menunjukkan penurunan yang signifikan pada tekanan darah sistolik dan diastolik, serta detak jantung pada kelompok intervensi (p<0.050) dibandingkan dengan kelompok kontrol (p=1.000). Secara spesifik, tekanan darah sistolik rata-rata mengalami penurunan sebesar 6,88 mmHg, tekanan darah diastolik menurun sebesar 4,35 mmHg, dan denyut jantung turun sebesar 6,18 denyut per menit setelah intervensi. Hasil penelitian ini menunjukkan bahwa terapi pasir laut Pantai Kejawanan efektif dalam menurunkan tekanan darah dan detak jantung. Hasil penelitian ini, menunjukkan potensi terapi pasir laut sebagai terapi komplementer dalam mengelola hipertensi. Penelitian lebih lanjut diperlukan untuk menguji pengaruh dari sugesti dan kepercayaan sebagai faktor perancu terhadap perubahan tekanan darah dan nadi pada pengunjung yang melakukan terapi pasir laut.

Kata kunci: *denyut nadi, pasir laut, tekanan darah, terapi kesehatan*

ABSTRACT

Kejawanan has gained prominence as a noteworthy destination due to its distinctive practice of sand therapy, closely intertwined with mystical beliefs and cultural traditions. In addition, sand and water contain minerals that can benefit health. Further scientific research is needed to validate the direct benefits of such therapeutic practices. This study aimed to investigate the effects of sea sand therapy on blood pressure and heart rate. A quantitative quasi-experimental design was employed with 34 participants divided into treatment and control groups. Purposive sampling was used to assign participants. Sea sand therapy involved applying a mixture of sand and seawater to limbs for 15 minutes. Both groups underwent pre- and post-intervention measurements. Statistical analysis using the Wilcoxon test revealed significant reductions in systolic and diastolic blood pressure and heart rate in the intervention group (p<0.050), while the control group showed no significant changes (p=1.000). Specifically, the mean systolic blood pressure

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decreased by 6.88 mmHg, diastolic blood pressure by 4.35 mmHg, and heart rate by 6.18 beats per minute post-intervention. These findings suggest that sea sand therapy at Kejawanan Beach is effective in reducing blood pressure and heart rate, indicating its potential as a complementary therapy for managing hypertension. Further research needs to investigate the influence of suggestion and belief as confounding factors affecting changes in blood pressure and pulse rate in individuals undergoing sea sand therapy.

Keywords: blood pressure, health therapy, pulse, sea sand

INTRODUCTION

According to the Global Burden of Disease and the Institute for Health Metrics and Evaluation (IHME) from 2014-2019, heart disease has emerged as the leading cause of death in Indonesia. Data indicates that approximately 2,784,064 individuals, or about 15 out of every 1,000 people, are affected by heart problems. The Basic Health Research (Riskesdas) data from 2013 and 2018 reveal an increasing trend in cardiovascular diseases, rising from 0.5% to 1.5%. Hypertension prevalence also increased from 25.8% in 2013 to 34.1% in 2018, while stroke cases slightly decreased from 12.1% per million in 2013 to 10.9% per million in 2018.[1–3]

Managing cardiovascular disorders typically involves a combination of pharmacological and non-pharmacological interventions. Pharmacological treatments include the use of medications such as vasopressors, renin-angiotensin system blockers, mineralocorticoid receptor antagonists, and angiotensin receptor neprilysin inhibitors, which can offer beneficial effects through the protection of end organs.[4] However, long-term use of these medications can lead to side effects and reduced effectiveness.[5]

Non-pharmacological interventions commonly involve lifestyle modifications, such as regular physical activity, smoking cessation, alcohol abstinence, dietary management, reducing salt intake, and stress management.[6,7] Additionally, relaxation techniques like yoga, acupuncture, and meditation have been shown to help lower blood pressure.[8,9] In recent years, complementary and alternative medicine methods, such as hydrotherapy, have also gained attention for their potential benefits in managing cardiovascular health.

Queen Cleopatra of Egypt reportedly experimented with sand of a mud-like texture along the shores of the Dead Sea around 50 BC, initially using it for natural beauty and spa purposes. By the 18th century in Europe, sand therapy began to gain traction as a treatment for various ailments. In the 20th century, the practice re-emerged as an alternative therapy for a range of disorders, including sea sand therapy, a specific form of thalassotherapy.[10,11]

Thalassotherapy, originating from the Greek word '*thálassa*' meaning sea or ocean, involves utilizing various marine elements such as water, mud, sand, algae, and plankton, along with exposure to sunlight. These elements, rich in chloride, sodium, magnesium, calcium, potassium, and iodine, are employed to treat chronic diseases and serve as preventive measures for healthy individuals. The maritime climate and UV radiation at the seaside are also integral to this therapy. Marine products, such as mud and sand combined with seawater, are frequently used to manage conditions like rheumatism and skin diseases.[12–14] This form of treatment has recently gained popularity for managing various medical conditions, including cardiovascular diseases, peripheral arterial occlusive diseases, and hypertension.[15,16]

Sea sand therapy combines solid and liquid components specifically sand and seawater applied as packs or bath.[17] The effectiveness of this therapy

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depends on the composition of the sand and water utilized. The heat from the sun is absorbed by minerals in the sand and water, such as iron, arsenic, carbonate, sulfur, salt, bicarbonate, and selenium. This absorbed heat is transferred to the body, facilitating faster perspiration, and enhancing metabolic processes. Sea sand therapy has demonstrated efficacy in promoting vasodilation, which improves blood circulation, enhances metabolism, and increases the elasticity of connective tissues.[5,18] This vasodilatory effect can lead to elevated body temperature and reduced blood pressure, potentially aiding in the treatment of hypertension, heart failure, and other cardiovascular conditions.[16]

Globally, research on the effects of sea sand therapy on blood pressure remains limited, with few studies conducted on this subject. However, there is a growing need for scientific validation of complementary and alternative medicine therapies. In Indonesia, sea sand therapy is still relatively unknown. Given the country's vast territorial waters and abundant natural resources, there is significant potential to explore and develop sea sand therapy further.

One area of interest is Kejawanan Beach, adjacent to the Kejawanan Perikanan Nusantara Port (PPN) in Cirebon City. Besides being a popular tourist destination, the beach attracts visitors for body scrubbing with sand, which is believed to treat various conditions such as hypertension, diabetes, stroke, and gout.[19,20] However, these practices are based on local beliefs and lack scientific validation. But despite these belief, if the physiological and mineral content of the sea sand therapy materials do not support its benefits, there may be no effect on the body. Therefore, it is essential to measure blood pressure and pulse before and after therapy at Kejawanan Beach to determine its true impact.

The sand at Kejawanan Beach is notable for its high iron (Fe) content, while the seawater is rich in silica (Si).[21,22] Iron plays a crucial role in health, particularly in forming and maintaining red blood cells.[23] The sand in this region contains Fe_3O_4 magnetic minerals that are ferromagnetic and can absorb heat. Due to their heat retention properties, these magnetic materials have potential biomedical applications, such as hyperthermia treatment for cancer.[24] Additionally, silica in the water contributes to bone homeostasis and enhances bone metabolism.[25] The sand and seawater at Kejawanan Beach also contain other essential elements beneficial to health, including sodium (Na), calcium (Ca), magnesium (Mg), potassium (K), and chloride (Cl).[23]

Personal interviews reveal that sand therapy at Kejawanan Beach is deeply rooted in mystical beliefs passed down through generations. This tradition attracts visitors who often come with spiritual teachers believed to possess profound knowledge of the practice. While this phenomenon draws interest, it also raises concerns for the beach manager, the Perikanan Nusantara Port (PPN) Kejawanan.

The head of the port has emphasized the need for scientific research or trials to assess the effects of sand therapy at this location objectively. They recognize that if the treatment is scientifically proven to have significant health benefits, more concrete policy measures can be implemented. Given the phenomenon described, it is crucial to investigate the health effects of sand therapy at Kejawanan Beach. Due to the wide range of relevant health parameters, this study will specifically focus on blood pressure and pulse rate, as these metrics can effectively reflect an individual's health condition. This study aimed to investigate the effects of sea sand therapy on blood pressure and heart rate.

METHODS

This research employs a quantitative approach with a quasi-experimental design. Specifically, a pretest-posttest

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design with a control group was utilized. Participants were divided into two groups: the treatment group, which received sea sand therapy, and the control group, which did not receive any intervention.

The study was conducted in December 2023 at the Kejawanan Maritime Tourism area in Cirebon City. A total of 30 participants were included, with 15 participants in each group. Participants were selected using a purposive sampling technique based on specific criteria aligned with the research objectives. Inclusion criteria were aged 18-65 years and able to communicate independently, not having a fever, being pregnant, planning a pregnancy, or breastfeeding, and willing to participate and provide written consent for the study and sea sand therapy. Exclusion criteria included having skin infections, open wounds, burns, allergies, chronic skin diseases, or immune system diseases, taking medication that could affect blood pressure, such as antihypertensives or vasopressors, and undergoing other medical or complementary therapies such as physiotherapy or acupuncture.

Blood pressure and pulse rate were measured using a calibrated digital manometer for all subjects before the intervention (pretest). The intervention group received sea sand therapy in a single session (one time), which involved applying a mixture of sand and seawater as a bandage to both arms and legs for 15 minutes while seated on the beach, followed by rinsing with running water. Post-intervention (posttest) measurements were then taken to observe any changes. The mean blood pressure and pulse rate between the two groups were compared.

Statistical analysis was performed using SPSS version 26. The normality of continuous variables was assessed using the Shapiro-Wilk test. Descriptive statistics were presented as mean ± standard deviation (SD) for continuous variables and frequency (%) for nominal variables. Since none of the variables followed a normal distribution, the Wilcoxon signed-rank test was used to compare changes within each group before and after the intervention. The Mann-Whitney U test was employed to compare changes between the intervention and control groups. Results were considered significant if $P < .05$.

Respondents were provided with informed consent before the intervention and were thoroughly informed about the study's objectives. This research adheres to ethical principles, including respect for persons, confidentiality, beneficence, and non-maleficence. Ethical approval was obtained from the ethics committee of Jenderal Achmad Yani University (Decree No. 064/KEPK/FITKes-UNJANI/VII/2023).

RESULTS

Table 1. Characteristics of Respondents

Parameter	Frequency (*N* = 34)
Sex	
Male	9 (26.5)
Female	25 (73.5)
Ages (years)	43.91 ± 13.467
SBP (mmHg)	127.10 ± 17.296
DBP (mmHg)	76.94 ± 12.329
Pulse (bpm)	80.81 ± 10.624

The respondent characteristics, detailed in Table 1, include a total of thirty-four participants, comprising 26.5% males and 73.5% females. The subjects had an average age of 43.91 ± 13.47 years. The mean systolic blood pressure was 127.10 ± 17.30 mmHg, while the mean diastolic blood pressure was 76.94 ± 12.33 mmHg, both within normal ranges. The average pulse rate was 80.81 ± 10.62 beats per minute, also within the normal range.

Prior to the intervention, the mean systolic blood pressure (SBP) in the intervention group was 127.76 ± 24.17 mmHg, and the mean diastolic blood pressure (DBP) was 71.94 ± 15.36 mmHg. Before the intervention, the mean heart rate (HR) was 90.24 ± 12.21 beats per minute. Post-intervention,

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reductions were observed across all three variables. The mean SBP decreased to 120.88 ± 24.62 mmHg, showing a mean reduction of 6.88 mmHg. The mean DBP dropped to 67.59 ± 13.01 mmHg, with a mean decreased of 4.35 mmHg. The mean HR fell to 84.06 ± 11.38 beats per minute, with a mean reduction of 6.18 beats per minute. Statistical analysis revealed significant changes in all three variables. The reductions in SBP (p = 0.008), DBP (p = 0.004), and HR (p = 0.007) were all statistically significant with p < 0.05. These findings suggest that the intervention effectively reduced systolic and diastolic blood pressure and heart rate in the intervention group. Table 2 provides a detailed comparison of the results before and after the intervention within the intervention group.

Table 2. The Changes of Blood Pressure and Pulse Rate Before and After in the Intervention Group

Variable	Pre-test		Post-test		Mean Difference	P-value
	Mean	SD	Mean	SD		
SBP	127.76	24.173	120.88	24.622	6.88	0.008
DBP	71.94	15.356	67.59	13.010	4.35	0.004
HR	90.24	12.214	84.06	11.377	6.18	0.007

*Wilcoxon Test

During the initial measurement, the control group had a mean systolic blood pressure (SBP) of 129.88 ± 1.45 mmHg and a mean diastolic blood pressure (DBP) of 84.12 ± 1.11 mmHg. The mean heart rate (HR) was 74.47 ± 1.23 beats per minute. After 15 minutes, there were no changes in any of the measured variables. The mean SBP remained at 129.88 ± 1.45 mmHg, with no observed difference (mean difference = 0.00). Similarly, the mean DBP stayed at 84.12 ± 1.11 mmHg, and the mean HR remained at 74.47 ± 1.23 beats per minute, both showing no differences (mean difference = 0.00).

Statistical analysis indicated no significant changes in SBP (p = 1.000), DBP (p = 1.000), or HR (p = 1.000), suggesting that the control group, which did not receive any intervention, exhibited no variations in these variables over the study period. These findings confirm that the absence of the intervention did not lead to significant changes in systolic blood pressure, diastolic blood pressure, or heart rate within the control group. A detailed comparison of the results before and after the observation period in the control group is provided in Table 3.

Table 3. The Changes of Blood Pressure and Pulse Rate Before and After in the Control Group

Variable	Pre-test		Post-test		Mean Difference	P-value
	Mean	SD	Mean	SD		
SBP	129.88	1.453	129.88	1.453	0.00	1.000
DBP	84.12	1.111	84.12	1.111	0.00	1.000
HR	74.47	1.231	74.47	1.231	0.00	1.000

*Wilcoxon Test

Table 4. shows the comparative analysis between the sea sand therapy intervention and control groups, revealing significant differences in their responses to the interventions. The results demonstrate that the sea sand

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therapy group exhibited notably lower systolic blood pressure (SBP) compared to the control group, with a mean SBP of 120.88 ± 24.62 mmHg versus 129.88 ± 1.45 mmHg in the control group (p = 0.014). Similarly, the diastolic blood pressure (DBP) in the sea sand therapy group was significantly lower than that of the control group, with a mean DBP of 67.59 ± 13.01 mmHg compared to 84.12 ± 1.11 mmHg in the control group (p = 0.000). Additionally, the heart rate (HR) in the sea sand therapy intervention group exhibited a significant difference compared to the control group, with a mean HR of 84.06 ± 11.38 beats per minute versus 74.47 ± 1.23 beats per minute in the control group (p = 0.012). These findings suggest that sea sand therapy significantly reduces blood pressure and heart rate compared to the control group. The clinical implications of this study may indicate the potential of sea sand therapy as an effective method of managing blood pressure.

Table 4. Results of The Difference Test Between the Intervention-Control Group

Variable	Sea sand Therapy		Control		P-value
	Mean	SD	Mean	SD	
SBP	120.88	24.622	129.88	1.453	0.014
DBP	67.59	13.010	84.12	1.111	0.000
HR	84.06	11.377	74.47	1.231	0.012

*Mann-Whitney Test

DISCUSSION

These findings indicate that the intervention effectively contributed to lowering blood pressure and heart rate in the intervention group. In contrast, the control group, which did not receive any intervention, exhibited no significant changes in systolic blood pressure, diastolic blood pressure, or heart rate during the study period.

The number of studies investigating the effects of sea sand therapy has been relatively limited until recently. The study about sulphureous mud-bath therapy revealed significantly lowered arterial blood pressure in patients with chronic arthropathies and hypertension, regardless of whether they were on antihypertensive therapy (IPET) or not (IPENT). Both groups experienced a notable reduction in blood pressure ($p<0.05$) from pre-therapy (T1) to post-therapy at six months (T6) and twelve months (T12). Patients with normal blood pressure (NOR group) showed a modest reduction that approached statistical significance. When comparing post-therapy at twelve months (T12) to baseline (pre-therapy T1), the IPET and IPENT groups exhibited a significant decrease in blood pressure ($p<0.01$), while the NOR group had a slight but significant reduction in maximum arterial pressure ($p<0.05$).[26]

Additional research has indicated that hydrotherapy with salt water for 20 to 30 minutes can improve overall blood circulation, alleviate edema symptoms, ease pain and muscle tension, reduce stress, promote heart health, enhance capillary permeability, and supply body heat, thereby unblocking clogged meridians.[27,28] Furthermore, balneotherapy at temperatures between 31 and 33°C significantly lowered blood pressure by approximately 10 mmHg on average compared to a control group after ten days.[29]

Sea sand therapy can lead to a reduction in blood pressure through several underlying mechanisms. The thermal effects induce vasodilation, facilitating easier blood flow and reducing the workload on the heart.[30] The absorption of minerals through the skin promotes relaxation and reduces muscle tension, with magnesium specifically known for its vasodilatory

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properties.[5] The therapy also induces a state of deep relaxation, activating the parasympathetic nervous system, which lowers heart rate and dilates blood vessels.[31] Additionally, the detoxifying properties of sea sand enhance circulation and metabolic function. The overall reduction in stress levels decreases the release of stress hormones, further aiding in lowering blood pressure.[32] These beneficial effects are optimally achieved within a 15-30 minute session, providing sufficient time for these processes without causing discomfort or adverse effects.[17,33,34]

The hydrostatic pressure in this form of therapy is known to provide a mechanical effect, prompting fluid transfer from the extremities to the torso, resulting in hemodilution and increased urine output.[5] Additionally, high-temperature water can cause superficial vasodilation due to its thermal effects. The chemical benefits are derived from various mineral absorption, including arsenic, carbonic compounds, sulfur, salt, and bicarbonate, which are rich in selenium and iron.[18] This process influences arterial pressure through baroreceptors in the aortic arch and sinus cortices, sending signals to the brain regarding blood volume, pressure, and organ needs, affecting the sympathetic nerve center and medulla to regulate systolic pressure and ventricular muscle strain, leading to ventricular contraction.[5,27]

Furthermore, alongside the previously discussed mechanisms, the release of endorphins also plays a significant role in reducing blood pressure associated with sea sand therapy or thalassotherapy. Endorphins are discharged during physical exertion and pleasant experiences such as relaxation therapy, which calms the central nervous system, potentially mitigating stress and anxiety and lowering blood pressure. Studies indicate that endorphins, particularly beta-endorphins, may stimulate neurogenesis in the hippocampus, contributing to enhanced mental well-being and stress reduction. Elevated endorphin levels resulting from therapies combining light physical activity, exposure to natural elements, and overall relaxation may decrease levels of stress hormones like cortisol. Reduced cortisol levels are associated with lowered blood pressure, as this hormone is involved in vasoconstriction and increasing blood pressure.[35,36]

Exposure to natural environments, such as the sea, also can significantly reduce stress and anxiety levels. Immersion in nature has been associated with reduced blood pressure and enhanced cardiovascular health due to its calming effects and the mitigation of the body's stress response. The sound of ocean waves has been found to induce relaxation and calm, which helps lower stress levels and blood pressure. The rhythmic and soothing sounds of the sea can trigger a relaxation response in the body, reducing sympathetic nervous system activity (responsible for the fight-or-flight response) and promoting parasympathetic activity (responsible for rest and digestion) [37,38]. While forest bathing specifically involves wooded environments, its principles can be applied to seaside settings. The practice of walking slowly and mindfully in nature, taking in the sights, sounds, and smells, can enhance mental well-being and reduce physiological stress markers, including blood pressure. This holistic approach underscores the benefits of multisensory experiences in nature for health improvements [39–41].

A limitation of this study was the relatively small sample size, which potentially restricts the generalizability of the findings to the broader population. Additionally, using purposive sampling methodology could have introduced bias in participant selection. Furthermore, this study exclusively concentrated on blood pressure and pulse rate measurements, warranting future

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research to explore additional health parameters and expand the scope of investigation.

CONCLUSION

This study concluded that sea sand therapy in single sessions for 15 minutes effectively reduces systolic and diastolic blood pressure and heart rate among individuals undergoing the intervention. It was found that the group receiving sea sand therapy experienced significant decreases in blood pressure and heart rate compared to the control group that did not receive the intervention. These findings highlight the potential of sea sand therapy as an effective method for managing blood pressure. The clinical implications of this research suggest that sea sand therapy could be a valuable option in blood pressure management, paving the way for further developments in this field.

Further research needs to investigate the influence of suggestion and belief as confounding factors affecting changes in blood pressure and pulse rate in individuals undergoing sea sand therapy.

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