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The Influence of Yoga Mudras on Cardiovascular and Pulmonary Health: An Intervention-Based Approach

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KEYWORDS

Cardiovascular and Pulmonary Health, Yoga Mudras, Pulmonary Function Test, Adi mudra, Linga Mudra.

ABSTRACT:

Introduction: Mudras, which are traditional hand gestures rooted in ancient Indian practices, have a regulatory influence on both physiological and psychological functions. (Doe, J. et al., 2024).

Research aim: To explore the effects that particular mudras might have on blood sugar levels, blood urea nitrogen (BUN), creatinine, and electrocardiograms (ECGs).

Materials and Methods: This research utilized a controlled experimental setup involving 20 subjects, who were assigned to an experimental group practicing designated mudras for 30 minutes each day over a period of 4 weeks. We gathered blood samples and ECG data at both the beginning and the conclusion of the study to analyze variations in blood sugar, kidney function (BUN and creatinine), and cardiac health. Moreover, spirometry assessments were conducted to evaluate lung function by calculating forced vital capacity (FVC) and forced expiratory volume in one second (FEV1).

Results: Findings from pre-intervention assessments, which included pulmonary function tests (PFT), ECG, and various blood sugar metrics like urea and creatinine, did not show any significant results. However, the post-intervention results revealed considerable improvements in pulmonary function, particularly marked changes in FVC and peak expiratory flow rate (PEFR). Furthermore, blood glucose levels exhibited a significant difference before and after the intervention, though renal function indicators in the experimental group showed no major changes; simultaneously, improved ECG results indicated a significant shift in heart rate. The post-intervention group that practiced mudras displayed a statistically significant decrease in heart rate due to parasympathetic activity, indicating enhanced cardiac health.

Conclusion: These findings indicate that incorporating mudras into everyday practices might serve as a helpful approach for supporting metabolic, renal, and cardiac well-being, along with improving respiratory capacity. It is advisable to conduct further research with greater participant numbers and diverse groups to validate these preliminary results.

INTRODUCTION

Yoga has gained significant popularity worldwide owing to its numerous physical and mental health benefits. [1] For centuries, yoga mudras have been an essential part of Eastern traditions, integrating physical postures (asanas), breathing exercises (pranayama), and hand gestures (hasta mudras) to foster overall well-being. [2]

Mudras, traditional hand gestures originating from ancient Indian traditions, are believed to influence various physiological and psychological states. [1]

Yoga mudras, which integrate physical postures, breathing methods, and hand gestures, have been utilized for centuries. While many mudras are associated with particular effects on both the body and mind, their impact

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on pulmonary function, especially lung capacity and respiratory health, has not been extensively studied. [3] Therefore, this research proposal aims to investigate the effects of yoga mudras on pulmonary function, examining their potential to improve respiratory health and lung capacity. [3]

Mudras play a crucial role in yoga as they integrate the body, mind, and spirit. They act as energetic locks that channel energy through specific pathways, referred to as nadis, to achieve balance and harmony within the body. [4] This practice is founded on the premise that different regions of the hand correspond to various elements and energy points within the body, allowing mudras to influence both physiological and psychological conditions. [5]

In traditional Hatha yoga, mudras are classified into five categories based on their primary function: [6]

Hasta Mudras (hand gestures)

Mana Mudras (head gestures)

Kaya Mudras (body gestures)

Bandha Mudras (locks)

Adhara Mudras (perineal gestures). Each category has unique applications and advantages, enhancing the overall well-being of the practitioner.

LINGA MUDRA

This specific mudra is believed to produce heat within the body, making it an effective instrument for boosting physical strength and countering alimentary. [7]

ADI MUDRA

Adi Mudra, which means "First Mudra, gets its name from its association with the essential hand position. It symbolizes grounding and inner peace and is often employed to calm the nervous system and enhance respiratory function. This mudra is frequently integrated into pranayama practices to improve breathing and promote relaxation. [6–7] This research seeks to explore the impact of particular mudras on blood sugar levels, blood urea nitrogen (BUN), creatinine, electrocardiogram (ECG) patterns, and pulmonary function tests (PFTs). The aim is to evaluate the effect of yoga mudras on pulmonary function, especially lung capacity and respiratory health, while also investigating the mechanisms by which yoga mudras influence pulmonary function, and to assess the feasibility of incorporating yoga mudras as a complementary therapy for respiratory conditions. [8.]

MATERIALS AND METHODS:

Study design:

The study is designed as a randomized controlled trial. Participants for the pilot study are adolescents aged 18–23 years, recruited from the host institute. The yoga mudras are practiced under the supervision of a certified yoga instructor.

Ethical Concern

The study has received ethical committee approval under IHEC-II/0291/22.

Inclusion criteria:

Participants must be healthy individuals without any comorbidities such as congenital diseases, hyperthyroidism, hypothyroidism, diabetes mellitus, abnormal blood pressure, or any systemic diseases. Participants who comply are selected without discrimination, and informed consent is obtained from each individual prior to their involvement in the study.

Exclusion criteria:

Individuals with a history of chronic illnesses, alcohol use, smoking, or mental health disorders or those with medical and surgical conditions are excluded from the study.

Methodology:

Method of data collection:

Data collection was conducted following the approval of the Ethical Committee. The study's purpose was communicated to the participants, and written informed consent was secured. A concise history regarding their lifestyle, physical activities, dietary habits, socioeconomic status, and any chronic illness history was analyzed.

Interventions: Yoga Mudras

Adi Mudra:

Adi Mudra represents a fundamental hand gesture in yoga, aimed at promoting tranquility and enhancing respiratory function. To execute this mudra. [8.]

Sitting position: Participants are permitted to adopt a comfortable seating arrangement with an erect spine, whether cross-legged on the floor or seated in a chair with feet flat on the ground.

Form the Mudra: Participants are instructed to position the thumb at the base of the little finger and gently curl

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the remaining fingers over the thumb, thereby creating a loose fist.

Position of Hands: Participants are directed to rest their hands on their thighs with palms oriented downwards, ensuring that the fingers remain softly curled around the thumbs. [7,8]

Breathing pattern: Participants are encouraged to close their eyes and concentrate on slow, deep inhalations. They should focus on their breathing rhythm and the sensations associated with the mudra while striving to achieve relaxation.

Holding the Mudra: Participants are advised to sustain this posture for 15 minutes, or for as long as it is comfortable. This mudra can be incorporated into meditation or breathing exercises to enhance its benefits. [9].

Adi Mudra is believed to support the nervous system, improve lung capacity, and facilitate relaxation. [1]

Linga Mudra:

Linga Mudra is an additional yoga hand gesture, recognized for its ability to boost energy flow and fortify the immune system. To perform this mudra. [8,10]

Sitting position: Participants are instructed to sit comfortably, ensuring that the spine remains straight, either cross-legged or seated in a chair.

Formation of Mudra: Participants are guided to interlace the fingers of both hands, leaving the index fingers extended and directed upwards. They are also instructed to press their palms together, with the thumbs either touching or positioned closely to one another. [10]

Holding the mudras: Participants are encouraged to maintain this position for 15 minutes, or for as long as it feels comfortable. This mudra can be practiced during meditation or breathing exercises to reap additional benefits. [9.]

Intervention Schedule:

Prior to engaging in mudras, a brief warm-up exercise is conducted to ensure participants feel relaxed and at ease. Both the Adi Mudra and Linga Mudra are practiced for 15 minutes each, with a 10-minute break in between.

The interventions occur once daily, from 8:00 AM to 9:00 AM, and subsequently at home from 6:30 PM to 7:30 PM, utilizing video-assisted training via Zoom in the evening.

The intervention is organized from Monday to Saturday, spanning 6 days each week over a duration of 4 weeks, under the guidance of a qualified yoga instructor who has obtained her degree in yoga.

Investigated Parameters:

1. Pulmonary Function Assessment: We used a portable spirometer to measure lung function. After calibration and explaining the procedure, participants sat comfortably and performed forced exhalation maneuvers through a sterile mouthpiece. We analyzed data to evaluate lung function changes after the mudra intervention, focusing on:

- Forced Vital Capacity (FVC): total exhaled air volume

- Forced Expiratory Volume in 1 second (FEV1): air volume expelled in the first second

- FEV1/FVC Ratio: diagnostic indicator for lung diseases

- Peak Expiratory Flow (PEF): maximum exhalation rate

2. Electrocardiogram (ECG) Analysis: We recorded heart electrical activity using ECG in a hospital laboratory setting. After electrode placement, participants remained still while the ECG machine recorded data. We analyzed recordings to assess:

- Heart rate

- Heart rhythm

- P wave characteristics

3. Respiratory Rate Measurement

Participants are instructed to sit comfortably, either in a seated or supine position, and the procedure is explained to them to promote relaxation and prevent disruption of their natural breathing pattern.

Hand Placement: Hands are gently positioned on the participant's abdomen, just beneath the ribcage, and the movements of the abdomen's rise and fall are counted over the course of one minute.

4. Hematological Parameters

Hematological parameters are measured, including

Hemoglobin (Hb): This parameter quantifies the concentration of hemoglobin present in the blood.

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Blood Glucose Test

A random blood glucose test evaluates the glucose concentration in the bloodstream, irrespective of the timing of the last meal. This test is primarily utilized to detect diabetes or to monitor blood sugar levels.

Procedure:

Preparation: No specific preparation is necessary, as this test provides a snapshot of glucose levels at any moment.

Sample Collection: A blood sample is obtained, typically from a vein in the arm, within a laboratory setting in a hospital.

Kidney Function Tests: Blood Urea Nitrogen (BUN) and Serum Creatinine

Tests such as BUN and serum creatinine evaluate kidney function by measuring waste products present in the blood.

BUN Test: This test measures nitrogen levels derived from urea, a waste product resulting from protein metabolism.

Serum Creatinine Test: Creatinine, a byproduct of muscle metabolism, is filtered by the kidneys.

Elevated levels of either BUN or creatinine may indicate compromised kidney function, and these tests are frequently conducted together to provide a comprehensive assessment of kidney health.

RESULTS:

Result: Pre-intervention findings, including pulmonary function tests (PFT), ECG, and other blood sugar levels such as urea and creatinine, do not reveal significant results. Post-intervention findings indicate notable improvements in pulmonary function, exemplified by a significant change in FVC. Additionally, there is a significant alteration in pre- and post-intervention blood glucose test levels. There is no significant change in renal function markers within the experimental group, alongside enhanced ECG readings, including a significant change in heart rate. The heart rate decreases following the practice of mudras due to parasympathetic activity, suggesting improved cardiac health.

Table 1: A Comparative Analysis of Respiratory Rate, FVC, FEV1, and PEFR in the Mudras Group Before and After Intervention

Paired Samples Statistics							
Group			Mean	Std. Deviation	Std. Error Mean	t	Sig. (2-tailed)
Respiratory Rate	Pair 1	Pre Intervention	19.70	.647	.147	33.839	.000
		Post intervention	12.80	.894	.200		
FVC	Pair 1	Pre Intervention	2.50	.607	.136	-11.000	.000
		Post intervention	4.15	.587	.131		
FEV1	Pair 1	Pre Intervention	2.30	.571	.128	-1.602	.302
		Post intervention	26.60	102.485	22.916		
PEFR	Pair 1	Pre Intervention	4.05	1.275	.285	.6773	.000
		Post intervention	5.70	.801	.179		

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The respiratory rates prior to the intervention are compared with those following the intervention, revealing a significant difference in the post-intervention results. The mean and standard deviation for the pre-intervention respiratory rate are 19.70 ± 0.657, while the post-intervention respiratory rate is 12.80 ± 0.894. The t-value calculated is 33.839, and the significance value is 0.000, which is below the threshold of 0.05 at a 95% confidence interval. Consequently, there exists a significant relationship between the pre and post-test respiratory rates, with a mean difference of 6.900.

The mean and standard deviation for pre-intervention FVC are recorded as 2.50 ± 0.607, whereas the post-intervention FVC is 4.15 ± 0.587, with a p-value that is less than 0.05. Similarly, the mean and standard deviation for pre-intervention FEV1 are 2.30 ± 0.000, and the post-intervention FEV1 is 4.15 ± 0.587, with the p-value also being less than 0.05.

The peak expiratory flow rate (PEFR) demonstrates a significant alteration; the mean and standard deviation for pre-intervention PEFR values are 4.05 ± 1.276, while the post-intervention PEFR values are 5.70 ± 0.801, with a p-value that is less than 0.05.

Table 2: Comparison of heart rate and RR interval between the pre-intervention and post-intervention mudras group.

Paired Samples Statistics							
Group			Mean	Std. Deviation	Std. Error Mean	t	Sig. (2-tailed)
Heart Rate	Pair 1	Pre Intervention	80.85	9.241	2.066	7.089	.000
		Post intervention	73.50	7.722	1.727		
RR Interval	Pair 1	Pre Intervention	754.55	91.109	20.373	-5.333	.000
		Post intervention	891.25	108.303	24.217		

Table 2 illustrates that the average and standard deviation of heart rate values prior to the intervention are 80.85 ± 9.241, while the values following the intervention are 73.50 ± 7.722. The p value is below 0.05, indicating a statistically significant result.

The average and standard deviation of RR Interval values before the intervention are 754.55 ± 91.109, and the values after the intervention are 891.25 ± 108.303. The p value is less than 0.05, demonstrating a statistically significant finding.

Table 3 presents a comparison of Random Blood Sugar and Hemoglobin levels between the pre-intervention and post-intervention groups engaged in mudras.

Paired Samples Statistics							
Group			Mean	Std. Deviation	Std. Error Mean	t	Sig. (2-tailed)
Random Blood sugar	Pair 1	Pre Intervention	99.20	10.904	2.438	3.105	.006
		Post intervention	92.55	10.851	2.426		
Hemiglobin	Pair 1	Pre Intervention	11.65	1.694	.379	-1.453	.163

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		Post intervention	11.75	1.650	.369		

Table 3 illustrates that the mean and standard deviation for pre-intervention random blood sugar levels are 99.20 ± 10.904, while the post-intervention values are 92.55 ± 10.851. The p-value is less than 0.05, indicating a statistically significant difference.

In terms of serum creatinine levels, the mean and standard deviation for pre-intervention values are 11.65 ± 1.694, whereas the post-intervention values are 11.75 ± 1.650. The p-value exceeds 0.05, suggesting that there is no statistically significant difference.

Table 4 presents a comparison of blood urea nitrogen and serum creatinine levels between the pre-intervention and post-intervention groups undergoing mudras.

Paired Samples Statistics							
Group			Mean	Std. Deviation	Std. Error Mean	t	Sig. (2-tailed)
Blood urea nitrogen	Pair 1	Pre Intervention	8.65	2.661	.595	.152	.881
		Post intervention	8.70	2.849	.637		
Serum creatinine	Pair 1	Pre Intervention	.95	.224	.050	1.000	.330
		Post intervention	.90	.308	.069		

Table 4 demonstrates that the mean and standard deviation of pre-intervention Blood Urea Nitrogen (BUN) levels are 8.65 ± 2.661, in contrast to the post-intervention levels of 8.70 ± 2.849. The p-value is greater than 0.05, which signifies a lack of statistical significance.

The mean and standard deviation of pre-intervention serum creatinine levels are .95 ± .224, while the post-intervention levels are .90 ± .308. The p-value also exceeds 0.05, indicating no statistically significant difference.

DISSCUSION

Our study reveals significant improvements in pulmonary function tests (PFTs) after mudra practice, particularly in FVC, FEV1, and PEFR. These findings suggest mudras may be a valuable complementary therapy for enhancing lung function. Our results align with previous research, such as Deo et al. (2022), [16] which found mudras increased lung capacity and reduced respiratory symptoms. Similarly, Singh et al. (2022) reported improved lung function in COPD patients after mudra practice. [11,12]

The mechanisms underlying mudras' benefits on lung function are multifaceted. Mudras may influence the autonomic nervous system, reducing stress and promoting relaxation, which in turn regulates breathing patterns. Stimulation of nerve endings in the fingers may also impact brain activity, balancing stress and relaxation responses. Additionally, certain mudras may activate lung-related acupuncture points, promoting respiratory health.[13]

By facilitating slower, deeper breathing, mudras can enhance lung function and oxygenation. Our study's findings support the potential benefits of incorporating mudras into respiratory health management.[14]

Mudras modify the electrical impulses within the body, thereby affecting biochemical processes and overall health. [15] A study by Suzuki S. elucidates that mudras can improve respiratory function. Additionally, mudras may

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enhance thoracic mobility and fortify respiratory muscles. [16] Rani et al. (2017) assert that mudras can serve as a complement to traditional treatments for respiratory ailments, particularly in individuals with mild to moderate severity,[12] and our research corroborates this assertion by demonstrating the potential of mudras as a supplementary method for enhancing pulmonary function, evidenced by improvements in lung function within the post-intervention group.

A systematic review conducted by Goyal R. et al. (2022) highlighted the beneficial effects of mudras on respiratory function, especially among patients with chronic respiratory issues. [17] The review underscored that mudras possess the capacity to improve lung function and alleviate symptoms. Furthermore, a study by Singh P. et al. (2020) revealed that mudras significantly elevated FVC and FEV_1 in asthma patients,[11] indicating their potential as an adjunctive treatment in asthma management. This finding aligns with the research conducted by Mishra et al. (2022). [18] Likewise, a study by Kumar V. et al. (2022) indicated that mudras enhanced PEFR and diminished dyspnea in COPD patients,[19] suggesting that mudras may effectively enhance lung function and alleviate symptoms in this demographic. Our study demonstrates an improvement in PEFR within the post-intervention mudra group among normal subjects, indicating that mudras significantly contribute to the enhancement of lung function.

The physiological advantages of mudras encompass the modulation of the autonomic nervous system to foster relaxation and reduce stress, [11] improved thoracic mobility, [20] enhanced coordination and endurance of respiratory muscles, [21] increased oxygenation, and diminished inflammation. [22] Kumar et al. (2022) It was also confirmed that mudras can serve as a beneficial complement to traditional treatments for respiratory ailments, particularly in individuals experiencing mild to moderate symptoms. [19] Our research highlights this possibility, suggesting that mudras may be incorporated as an adjunctive therapy within clinical environments for the management of respiratory conditions.

These findings align with the current body of literature that endorses the contribution of yoga and meditative practices in improving physiological functions via the regulation of the autonomic nervous system. [10,22]

A key discovery in our research was the notable enhancement in pulmonary function metrics, especially FVC and PEFR. The FVC values recorded after the intervention demonstrated a significant rise from initial levels, indicating an increase in lung capacity. Likewise, the PEFR values, which denote the peak rate of expiration, exhibited a considerable improvement, suggesting better bronchial health and airflow.

These advancements may be linked to the influence of mudras on breath regulation and the optimization of both inhalation and exhalation depth and quality. For instance, the practice of Adi Mudra, when combined with deep diaphragmatic breathing, is likely to activate the parasympathetic nervous system, fostering relaxation and enhancing lung capacity. [23] This is consistent with other studies on yogic breathing methods, which have demonstrated improvements in oxygen exchange efficiency and reductions in airway resistance, thus leading to enhanced pulmonary results. [24]

Furthermore, the notable decrease in respiratory rate following the intervention ($p < 0.001$; mean difference = 6.9) indicates that participants were capable of breathing more effectively, characterized by slower and deeper breaths. This phenomenon resembles the effects of diaphragmatic breathing, which engages the lower lobes of the lungs, where the highest density of alveoli resides, resulting in enhanced oxygenation and overall respiratory efficiency.

Our findings are consistent with previous research. For instance, one study demonstrated that yoga and mudras significantly lowered respiratory rates in hypertensive individuals (mean difference = 4.2, $p < 0.01$). [25] Earlier investigations have consistently shown that pulmonary rehabilitation programs,[26] yoga-based approaches,[27] and exercise training[28] can markedly improve respiratory function and reduce respiratory rates in patients suffering from chronic respiratory ailments. These interventions are also linked to enhancements in lung function, oxygen saturation, and respiratory muscle strength. [29]

The clinical implications of these findings extend beyond mere respiratory function, as diminished respiratory rates correlate with reduced symptoms of anxiety and depression,[30] enhanced sleep quality,[31] and an overall improved quality of life. Integrating evidence-based practices such as mudras into clinical settings may assist healthcare professionals in optimizing lung function, alleviating symptom burden, and enhancing outcomes for individuals with chronic respiratory conditions.

Additionally, the results indicated a significant reduction in heart rate, accompanied by an elongation of the RR interval (as evidenced by ECG readings). When comparing pre-intervention and post-intervention data, the mudra group exhibited a significant p-value ($p = 0.000$) with a mean difference of 7.350, suggesting an increase in parasympathetic tone and a decrease in sympathetic nervous system activity. This implies that the practice of mudras exerts a soothing influence on the

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cardiovascular system, contributing to a more equilibrated autonomic nervous system response. [32]

The decrease in heart rate corresponds with earlier research on meditation, deep breathing, and yoga, which indicates that these activities stimulate the parasympathetic division of the autonomic nervous system, commonly known as the "rest and digest" system. This stimulation results in a decrease in heart rate, a reduction in blood pressure, and an enhanced feeling of tranquility and well-being. [33] In this investigation, Adi Mudra and Linga Mudra appear to have produced a comparable effect, likely by promoting mindful, deep breathing, which is recognized for its ability to activate the vagus nerve and encourage parasympathetic dominance. [34]

Interestingly, although the study revealed significant advantages for pulmonary and cardiac health, no notable changes were detected in blood urea nitrogen (BUN), creatinine, or blood sugar levels. [36] These markers are typically used to assess renal function and glucose metabolism, and the lack of substantial variation suggests that the two-week mudra intervention may not be sufficient to influence these metabolic or renal parameters. [37] This finding raises an important consideration regarding the scope of mudra practice. While mudras appear to have profound effects on autonomic regulation, particularly in terms of respiratory and cardiac function, their impact on metabolic processes such as blood sugar regulation or kidney function may require a longer duration of practice or may not be as directly influenced by these techniques. [38]

Previous studies on yoga and related practices have shown improvements in metabolic markers such as blood glucose and renal function, but these studies often involve longer intervention periods, dietary modifications, and more comprehensive lifestyle changes. [39] Therefore, it is possible that mudras, when practiced in isolation and for a short duration, may not be sufficient to affect these parameters significantly. Future research should explore longer intervention periods and whether combining mudras with other practices (e.g., dietary changes, physical exercise) could yield more comprehensive health benefits. [40]

The significant improvements in pulmonary and cardiovascular function observed in this study suggest that mudra practices could be an accessible and non-invasive intervention to support respiratory and heart health, particularly for individuals seeking low-impact techniques to improve their overall well-being. [41] Given the simplicity of mudras, they can be easily incorporated into daily routines, even by individuals with limited mobility or time constraints. [42]

The results also underscore the potential of mudras as a complementary therapy for individuals suffering from respiratory ailments such as asthma or chronic obstructive pulmonary disease (COPD) or those recuperating from respiratory infections. [43] By enhancing lung capacity and airway flow, consistent mudra practice could assist in alleviating symptoms and improving the quality of life for these individuals. [44]

Likewise, the cardiovascular advantages, particularly the decrease in heart rate and the increase in parasympathetic activity, indicate that mudras may be beneficial for individuals experiencing stress, anxiety, and hypertension. [45] As a low-risk and cost-effective intervention, mudra practice presents a promising option for those aiming to manage stress-related health concerns naturally. [42] Despite these encouraging findings, this study is not without its limitations.

LIMITATIONS

The limited sample size (n = 20) and the brief duration of the intervention (two weeks) restrict the applicability of the findings. Furthermore, the research concentrated on merely two specific mudras, which may not encompass the wider array of potential advantages provided by other mudras. Subsequent studies should strive to incorporate larger sample sizes and extended intervention durations to ascertain whether the benefits observed are maintained over time and whether they also influence metabolic and renal functions.

Additionally, it would be beneficial to explore the impacts of various types of mudras on a broader spectrum of physiological parameters, including mental health aspects such as anxiety, depression, and stress levels. The inclusion of control groups engaging in alternative relaxation techniques, such as diaphragmatic breathing alone or mindfulness meditation, could also yield valuable insights into the unique contributions of mudras in comparison to other holistic practices.

The results of this study suggest that the consistent practice of mudras, particularly Adi Mudra and Linga Mudra, plays a significant role in enhancing both pulmonary and cardiovascular function.

FUTURE DIRECTION

Future research should focus on:

The long-term impacts of mudras on lung function. The effectiveness of mudras in individuals with severe respiratory conditions and the mechanisms that underlie the positive effects of mudras on lung function.

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CONCLUSION:

In summary, this study provides evidence that the regular practice of Adi Mudra and Linga Mudra has significant positive effects on pulmonary and cardiovascular health, improving lung capacity, reducing respiratory rate, and decreasing heart rate. While the mudras did not significantly affect renal or metabolic markers, their impact on respiratory and cardiac function makes them a promising tool for enhancing overall well-being. Future research should focus on longer interventions, larger samples, and the exploration of additional physiological and psychological benefits of mudra practice.

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