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# Comparative Study of Kapalbhati and Deep Breathing Exercise on Blood Pressure on Healthy Individuals

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**Abstract:** ***In my view, the intricate relationship between breath and well-being takes center stage in this compelling study, which examines the physiological effects of Kapalabhati and deep breathing exercises on novice practitioners. Conducted among healthy college students aged 18-25 at Alvas College of Naturopathy and Yogic Sciences, this research pits the rapid, forceful exhalations of Kapalabhati-a revered yogic purification technique-against the slow, deliberate inhalations of deep breathing. It is evident that both practices spark a notable rise in systolic and diastolic blood pressure, hinting at a surge in sympathetic nervous system activity, though deep breathing appears to edge out with more pronounced effects. This suggests that even among beginners, these techniques wield a tangible influence on cardiovascular responses. What strikes me as particularly intriguing, however, is the lack of significant change in oxygen saturation despite the increased blood pressure-a finding that challenges conventional assumptions about breathing and oxygenation. The study's strength lies in its pioneering comparison of these methods on vital signs, yet its small sample size leaves room for deeper exploration. Taking this further, the findings illuminate the potential of disciplined breathing as a tool for modulating autonomic functions, offering a glimpse into how ancient practices might inform modern health strategies. For those invested in yoga's therapeutic promise, this work underscores both its immediate physiological ripples and the need for broader investigations into its long-term benefits.***

**Keywords:** KB, Kapalabhati, DBE, Deep breathing exercise, NB, Normal breathing

## 1. Introduction

Yoga is an integrated individual life style [(1)]. According to Swami Kuvalayananda yoga has multiple physical, mental and spiritual benefits and the influence of the mind on body is far more powerful than the influence of the body on mind [(2)]. Pranayama is an essential ingredient of yogic discipline. The breath is the most vital process of the body. It influences the activities of each and every cell and most importantly, is intimately linked with the performance of the brain. Human beings breathe about 15times per minute and 21,600 times per day. Respiration fuels the burning of oxygen and glucose, producing energy to power every muscular contraction, glandular secretion and mental process. The breath is intimately linked to all aspects of human experience. Although breathing is mainly an unconscious process conscious control of it may be taken at any time. Consequently, it forms a bridge between the conscious and the unconscious areas of the mind [(3)].

Kapalabhati is one of the components of body cleansing techniques. The word Kapalabhati is derived from two words: "kapala" meaning "skull" and the organs inside it and "bhati" meaning "illuminating," Kapalabhati technique may correct these organ functions and help to purify blood and tone abdominal muscles. In another note, it is said that regular performance of Kapalabhati makes the forehead luminous. Kapalabhati should be discontinued if the practitioner experiences dizziness or syncopal attacks. It is advisable to keep the stomach, bladder, and bowels empty while performing the pranayama. [(4)]

Kapalabhati (romanized: kapālabhāti), also called breath of fire is an important Shatkarma, a purification hatha yoga. The word kapalabhati is made up of two sanskrit words: kapāla meaning 'skull', and bhati meaning 'shining, illuminating'. It is intended mainly for cleaning the sinuses but according to Gheranda samhita has magical curative effects. The Technique of Kapalabhati involves short and strong forceful exhalations and inhalation happens automatically. There are three forms of Kapalabhati:

- Vatakrama kapalabhati, a practice similar to the pranayama technique of Bhastrika, except that exhalation is active while inhalation is passive, the opposite of normal breathing.
- Vyutkrama kapalabhati, a practice similar to Jala neti, it involves sniffing water through the nostrils and letting it flow down into the mouth, and then spitting it out.
- Sheetkrama kapalabhati, can be considered the reverse of Vyutkrama kapalabhati, in which water is taken through the mouth and expelled through the nose.

Since this process is related to breathing, it should be performed sitting in Padmasan. The muscles of the stomach should be moved freely in this process. This freeness cannot be achieved while sitting or sleeping, hence the process can be performed well while sitting in a dhyana pose. Padmasan is a very suitable asana for dhyana pose, hence this process should be performed while sitting in Padmasan. It may be performed by sitting in Swastikasan or Vajrasan, but as compared to Padmasan, these asanas are not so important. The pose of the body during Padmasan is essential here.

As mentioned earlier, Kapalabhati is a rapid breathing technique otherwise known as automatic inhalation technique. The air is inhaled normally, but expiration is forced with thehelp of the abdominal musculature.

In normal circumstances, exhalation is a passive process by which there is an automatic recoiling of the diaphragm forcibly exhaling the air out of the lungs. The abdominal muscles, namely the external and internal obliques, rectus,

and transversus abdominis, which are not normally used in quiet breathing, are the most powerful muscles for forced exhalation. Contraction of these muscles applies pressure on the abdominal organs which then eventually push diaphragm up ending in forcible exhalation.

Abdominal breathing produces a slow yet large tidal volume and is known to produce emotional stability and controlled responses to the stressful environment. This can be due to elevated parasympathetic over sympathetic activity leading to better oxygenation of brain and heart in spite of low heart rate. Oxygen consumption rates during kapalabhati breathing practice are approximately 1.1–1.8 times higher than while sitting quietly. As far as heart rate is concerned, there was a rise in heart rate for the initial 20–40 s of rapid breathing which then levelled off to the higher side. [(5)]

Although Kapalabhati is rapid breathing, it does not cause hyperventilation. This can be proved by the fact that the side effects of hyperventilation such as dizziness does not occur during the practice. Adding on, patients with dizziness and syncopal attacks are advised to stop the pranayama immediately. The heart rate during and after Kapalabhati is different from that of occurring in hyperventilation. The mean carbon dioxide concentrations after Kapalabhati technique are similar to that of resting state.

Rapid Kapalabhati Pranayama is known to maintain acid–base balance. Deep inhalation makes the dead space of the lungs active, thus improving oxygenation of tissues and cleansesthe body as a whole. [(6)]

In Kapalabhati, the breathing is with high force in a shorter span and hence greater impact is made on the abdomen and its contents, especially the glands. The resultant increase in blood circulation and correction of glandular secretions help in disease management. Though the beneficial effects of Kapalabhati are numerous, the noteworthy ones include balance of vata (wind), pitta (bile), and kapha (phlegm), psychological balance, awakening of "Kundalini" power, and improvement in concentration. [(7)]

Deep breathing is called "diaphragmatic" because it emphasizes the use of the diaphragm, the muscular sheet underlying the rib cage. When the diaphragm contracts, it pushes down on the internal organs of your abdomen, enlarging the space allotted to your thoracic cavity and causing your lungs to expand. The stronger this contraction, the more airyou'll inhale. [(8)]

Diaphragmatic breathing, or deep breathing, is breathing that is done by contracting the diaphragm, a muscle located horizontally between the thoracic cavity and abdominal cavity. Air enters the lungs as the diaphragm strongly contracts, but unlike during traditional relaxed breathing, the intercostal muscles of the chest do minimal work in this process. The belly also expands during this type of breathing to make room for the contraction of the diaphragm. [(35)]

Breathing exercise involves sitting or lying in comfortable position and breathing deeply. The in breath is performed by expanding the abdomen followed by chest and to imagine breath going into the head. The out breath is performed simply by relaxing the body and releasing the breath. The rhythm of the breathing is circular, meaning it is a continuous flow. [(34)]

Many of us take shallow breaths that begin and end in our chest. When stressed, the breathing becomes even more shallow and at times we even "forget to breathe" and find ourselves holding our breath. This speeds the heart rate and causes us to cheat our body of much neededoxygen, which in turn negatively affects our entire body. Just as breathing is necessary to live, breathing properly is necessary to live well. Breathing deep, cleansing breaths from the "gut" takes practice, but it will help you to remain calm in stressful situations, release painful emotions and memories and can improve our general health and sense of well-being. [(33)]

"Life is breathing and breathing is life" said by Sir Aurobindo Ghosh. Breathing is a function that we all do naturally and with little awareness. Bizarre as it might seem, breathing is something most people do poorly, Dennis LEWIS writes in "Free your breath and free your life". Improving the way, you breathe may be the most basic way to tackle stress and boost your immune system. Proponents claim anyone can breathe properly by practicing deep breathing techniques. [(8)]

Normal tidal volume is around 500ml, but in deep breathing exercises it increases & normal respiratory rate is 12-18 cycles per minute but in deep breathing it decreases. [(8)]

Benefits of practicing deep breathing have been found in Hindu Sanskrit texts from as early as the fifth century. However, the fact that it is such a vital component in Eastern meditation system, such as Taoist qi gong,tai chi and pranayama yoga, suggests that the practice of deep breathing in the pursuit of health and enlightenment is probably much older.[(8)]

Deep breathing relaxes the mind/body and relieves tension, emotional problems and elevates mood. It helps to strengthen the lungs, makes the heart stronger and improves cellular regeneration. In spite of all these benefits in this modern era, fresh air has been decreased due to increase population, overcrowding and sedentary lifestyle of the people. These factors gradually decrease the ventilator functions of the lungs. Considering all these factors the cardio-respiratory system gains utmost importance for the normal and healthy functioning of the body. Slow and deep breathing reduces dead space ventilation as well decreases the work load on the heart. It also renews air throughout the lungs. Increase the elastic propertiesof lungs. [(8)]

In deep breathing, subjects were asked to breath in deeply and slowly through the nose and sigh out through the mouth. Breathing through nose warms and humidifies air but doubles resistance to air flow. Inspiration is slow to decrease velocity and increase the strength of muscle contraction. Expiration is through the mouth to keep the air open patency of small airway closure. [(9)]

Controlled breathing with low rate and high tidal volume, the so called "slow deep breathing", has also been shown to improve the efficiency of ventilation by increasing alveolar and reducing dead space ventilation.[10] Slow deep breathing may also improve arterial oxygenation by increasing alveolar volume and gas exchange at alveolar capillary membrane level. [11]

As by studying both kapalbhati and deep breathing exercise techniques, both are breathing techniques. The question arises that which of the technique produces more effects on vitals. Our study is done to evaluate and compare the effect of both kapalbhati and deep breathing exercise on oxygen saturation.

## 2. Methodology

**Source of Subject:**
Thirty subjects with age group ranging between 18-25 years participated in study. Those who satisfy inclusion criteria were recruited.

Study subjects were recruited from ALVAS COLLEGE OF NATUROPATHY AND YOGIC SCIENCES, Moodbidri, shobhavana campus, Mijar, Dakshina kannada-574227

**Ethical Considerations:**
Subjects who fulfilled the inclusion and exclusion criteria were shown information sheet having details regarding the nature of study and intervention to be used. Subjects were given enough time to go through study details mentioned in the information sheet. They were given the opportunity to ask any questions and if they agree to participate in study, they were asked to sign the informed consent form (sample copy is enclosed) which was mainly provided in local language.

**Inclusion Criteria:** College students who are healthy both male and female of age group from 18-25 years who are willing to volunteer for this study were included

**Exclusion Criteria:** Any co-morbid conditions like lung disease weak and systemic illness subjects were excluded.
Subjects with addictions like alcohol consumption, tobacco chewing, smoking, and subjects with narcotic drug intake were excluded.

**Study Setting:**

**Study groups:** 30 subjects were allocated to 2 groups with 15 subjects in each group through lottery method of randomization. All subjects received intervention for a day, assessments were done before and after the intervention in empty stomach.

**Design:** It is a randomized comparative study on healthy adolescent individuals, where subjects in group 1, were given practice of kapalbhati and group 2 were given practice of deep breathing exercise. Pre-intervention and post-intervention assessment data was collected in empty stomach. The data collected was tabulated and analysed using appropriate statistical methods.

## 3. Discussion

This study was conducted on Novice medical students who are not exposed to yoga practices. Our study showed that there is significant raise in SBP and DBP in both the group, [kapalbhati p=0.044, p=0.05], [Deep breathing exercise p=0.009, p=0.018], suggesting sympathetic stimulation but more significant in Deep breathing exercise group [p=0.009]. The earlier study showed significant increase in the sympathetic nervous system activity with the increase of Systolic and Diastolic BP immediately following kapalabhati practice. Findings of the present study are partially in accordance with the earlier study. [25] Earlier studies on kapalabhati have concluded that Kapalabhatipranayama improves cardiovascular endurance [26]. A study on the effect of Kapalabhati on Blood Pressure in Naive subjects showed considerable increase in before and after values suggestive of sympathetic activity and considerable reduction immediately after and 3 minutes after the practice results of which are suggestive of parasympathetic activity [27].

A similar study on Kapalabhati changes cardiovascular parameters showed sympathetic dominance during kapalabhati with the increase in Heart rate, Systolic and Diastolic Blood pressure. Whereas during and after values reduced considerably suggestive of modulation of the autonomic nervous system. [25] . In the study which compared kapalabhati and bhastrika with autonomic functions also showed stimulation of the sympathetic activity immediately after these practices among which kapalabhati was more stimulating. Oxygen saturation remained the same as before in both the groups [28]. Kapalabhati purifies the whole body by blowing off carbon dioxide in the blood and tissues. At the same time, there is an increase in oxygenation of the blood stream [29].

However, there are no studies conducted to understand the influence of Kapalabhati on oxygen saturation and blood pressure for the duration of 10min in novice yoga practitioners. In any tissue of the body, a rapid increase in arterial pressure causes an immediate rise in blood flow. However, within less than a minute, the blood flow in most tissues returns to the normal level, even though the arterial pressure is kept elevated. This return of flow toward normal is called autoregulation. [30] With this mechanism the increase in the diastolic blood pressure as observed in the kapalbhati group might have resulted in enhanced blood flow and oxygenation of the tissues. This is in coordination with the vitalising effect of kapalabhati as mentioned in the scriptures: The exercise enables us to eliminate a large quantity of the toxins contained in the body, by filling the body with oxygen and purifying the tissues and nerves. [36]

In deep breathing exercise the reason behind elevated BP is due to prolong expiration during practice. In regular breathing, during expiration, the intra thoracic pressures increase as the thoracic cavity volume decreases; this results in less right heart filling and augments filling of the left heart chambers. These changes within the respiratory cycle result in only small changes in measured systolic blood pressure. [31]

As previous study suggest that pulse oximetry is reliable with a systolic blood pressure >80 mmHg. The lower the BP, the lower the pulse oximetry readings. [32] This shows that BP is directly proportional to oxygen saturation. In our study BP of both the group shown to raise significantly, but deep breathing exercise group has more significant change. SPO2 change is not significant in both the groups although there is raise in SPO2 level.

## 4. Strengths of the study

- It is the first studies which compare the effect of kapalbhati and deep breathing exercise on SPO2.
- There were no drop outs in the study.
- There was no any adverse effect of the intervention.

## 5. Limitations of the study

- The study was done on a small sample size
- Vital parameters are limited to only BP, SPO2

## 6. Future Prospects

- Study on larger sample size
- Advanced equipment can be used for heart rate.
- Further understanding is made on the cardiac hemodynamic and autonomic regulation during and immediately following kapalabhati and deep breathing exercise practices in novices

## 7. Conclusion

Practice of both kapalbhati and deep breathing exercise increases BP immediately in novices. Thus, practicing both kapalbhati and deep breathing exercise will stimulate sympathetic activity. Further studies are required to understand the physiological changes followed by the practice of kapalbhati and deep breathing exercise in a long-term change.

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