

Kapalabhati pranayama: An answer to modern day polycystic ovarian syndrome and coexisting metabolic syndrome?

Reshma Mohamed Ansari

Department of Basic Medical Sciences, Cyberjaya University College of Medical Sciences, Cyberjaya 63000, Selangor, Malaysia

Address for correspondence: Dr. Reshma Mohamed Ansari,
Department of Basic Medical Sciences, Cyberjaya University College of Medical Sciences,
No: 3410, Jalan Teknokrat 3, Cyberjaya 63000, Selangor, Malaysia.
E-mail: reshmaansari77@gmail.com

ABSTRACT

Breath, the vital force of life, is controlled positively by pranayama to ensure homeostasis and wellbeing in humans. Kapalabhati is the rapid breathing technique of pranayama, which is considered as a cure for various ailments. The possible use of this technique to combat metabolic syndrome (MS) and polycystic ovarian syndrome (PCOS) has been discussed in this article. Various published literature from PubMed, Scopus, and theses were reviewed to reinforce the hypothesis that this technique is the answer to ailments due to modernization. It was worthwhile to note that Kapalabhati does combat various features of MS, but its efficacy against PCOS is yet to be proven. However, since both syndromes arise due to a common factor hyperinsulinemia primarily induced by stress in this modern world, it is hypothesized that Kapalabhati holds good against PCOS too. Hence, in conclusion, it can be said that it would be beneficial to conduct a study on PCOS women to ascertain the efficacy of Kapalabhati in their population.

Key words: Hyperinsulinemia; kapalabhati pranayama; metabolic syndrome; polycystic ovarian syndrome; stress.

INTRODUCTION

The Sanskrit word “Yuj” which means “union” gives origin to the word “yoga.”^[1] The principles of yoga therapy, which target to establish homeostasis in the organism as a whole, have been a source of intrigue among researchers since the beginning of the 20th century.^[2] As breath is the key to life, regular rhythmic breathing and its conscious control is said to have enhance mental and physical power in people.^[1] Hence, breathing or respiration is known as vital force, and pranayama yoga ensures complete knowledge and control of this vital force. As a result, enrichment of breathing techniques leads to rhythmic respiration and the practitioner attains a calm, yet alert state of mind.^[3]

Pranayama, one of the pillars of Ashtanga yoga, generally denotes extension of life; as “prana” means life force

and “ayama” means expansion. Pranayama increases life span and maintains health by the practice of prolonging and shortening the breath cycle.^[4] This is because respiratory impulses, one of the main channels of the flow of the autonomic nerve currents are controlled by pranayama. These breathing exercises could prevent and cure conditions which involve disruption of homeostatic state of autonomic nervous systems such as obesity, hypertension, and diabetes. Normal rhythmic breathing also tends to reduce the intensity of psychosomatic ailments.^[2]

Pranayama encompasses two types of breathing techniques; one is slow and the other is rapid. Kapalabhati is one of the rapid breathing techniques, known as automatic inhalation technique, the other one being forced inhalation

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or Bhastrika. Though Kapalabhati is the common term used for both automatic and forced inhalation, some practitioners use Bhastrika for a more advanced technique that includes breath holding.^[2]

KAPALABHATI PRANAYAMA

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.^[3] In another note, it is said that regular performance of Kapalabhati makes the forehead luminous.^[5] 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.^[6]

PHYSIOLOGICAL CHANGES DURING AND AFTER KAPALABHATI

As mentioned earlier, Kapalabhati is a rapid breathing technique otherwise known as automatic inhalation technique.^[6] The air is inhaled normally, but expiration is forced with the help of the abdominal musculature.^[1,5,7]

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.^[6] 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 leveled off to the higher side.^[6]

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.^[6] 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.^[6]

PROVEN BENEFITS OF KAPALABHATI

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 cleanses the body as a whole.^[4] 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.^[5]

POLYCYSTIC OVARIAN SYNDROME - TRADITIONAL AND MODERN CONCEPTS

Polycystic ovarian syndrome (PCOS) has been the center of debate and intrigue among allopathic practitioners and traditional healers since time immemorial. Currently, it has been considered as the most common endocrinopathy of women in the reproductive age group.^[8] The term PCOS was coined in 1935 by Irving Stein and Michael Leventhal as a Triad of “Amenorrhea,” “Obesity,” and “Hirsutism.” Since then, it has been in the limelight as the most common endocrine ovarian disorder of women of reproductive age group worldwide.^[9] Recently, the syndrome has been branded as a lifestyle disorder plagued by over-nourishment, hyperinsulinemia, ovarian confusion, and ovulatory disruption. According to the Rotterdam revised 2003 criteria (2 out of 3) of oligo-and/or anovulation, clinical and/or biochemical signs of hyperandrogenism and polycystic ovaries and exclusion of other etiologies (congenital adrenal hyperplasia, androgen-secreting tumors, and Cushing’s syndrome) pinpoint the diagnosis of PCOS.^[10] Apart from this, currently, anti-Müllerian hormone levels that correlate independently with both polycystic ovarian morphology by ultrasound and androgenic profile have been proposed as better diagnostic parameters.^[9]

PCOS is now considered as a multifaceted metabolic disorder associated with insulin resistance leading to hyperinsulinemia. The scientific basis of PCOS has been explained by the low levels of insulin utilization due to high activity levels of a micro-RNA named miR-93 in fat cells.^[9] Apart from genetic factors which share a similar cause to obesity has been implicated in PCOS, psychological factors such as increased stress induce raised levels of cortisol and prolactin which can

disrupt the normal menstrual cycle.^[9] Obesity caused by modifiable risk factors such as sedentary lifestyle, high calorie diet, and poor physical activity also contributes to PCOS. Obesity is now gaining reputation as a modifier of PCOS.^[9]

Women with PCOS are prone to long-term health consequences such as type 2 diabetes mellitus, hypertension, dyslipidemia, atherosclerosis, and Frank metabolic syndrome (MS). This is due to the reason that insulin resistance plays a very important role in the pathogenesis of both the syndromes. Hence, researchers conclude that MS is highly prevalent in women with PCOS, both obese and nonobese.^[11] Similar findings about the common prevalence of MS and its individual components in PCOS were reported by other researchers, especially in women with high circulating insulin levels and high body mass index (BMI). Treatment strategies which target to treat insulin resistance, the key pathogenic factor in both syndromes, have been found to be beneficial.^[12] The reason for the high susceptibility of PCOS women to develop MS is insulin resistance. Obesity serves as a modifiable factor in these two self-made syndromes.^[8]

Currently, the concept of BMI as the predictor of obesity and its related disorders such as PCOS is slowly waning, and the concept of assessing an individual's obesity risk through abdominal fat is gaining momentum. This is because health problems are more pronounced in individuals with more fat on their abdomen than the extremities. Hence, waist-to-hip ratio or waist circumference is one of the most important assessors of body fat pattern. Abdominal obesity is also associated predominantly with female infertility.^[1]

Stress, which is rampant in the current world, has now been identified as one of the causative factors of PCOS and MS. Stress induces increased sympathetic firing and eventually produces changes in the physiological responses such as heart rate, breath rate, and blood pressure. The result is increased burden on body homeostasis and if left untreated, can disrupt normal homeostasis. One such outcome is the development of mitochondria malfunctioning and metabolic rigidity leading to MS. Though oxygen consumption is noted to be higher in individual components of MS, the overall oxygen consumption in patients with MS is found to be lower in certain studies.^[13] The detrimental relationship between stress and cardiovascular health can be explained by the induction of higher allostatic load in such patients. This load manifests as changes in the sympathetic-parasympathetic responses, hormonal changes induced by changes in the hypothalamic-pituitary-adrenal axis, and endothelial dysfunction. A greater allostatic load may also hinder fast recovery from psychological stress.^[13]

Rapid, shallow, thoracic ventilation is identified as the breathing pattern during stress. When undergoing stress, this breathing pattern induces sympathetic dominance which is expressed as high heart rate and cardiac output. However, due to eventual muscle vasodilation, there is detrimental blood flow to the heart and brain. A person who hyperventilates chronically is almost always hypocapnic and he may fail to cope in the untoward event of any additional stress.^[6]

As a conclusion by several researchers, PCOS coexisting with MS is considered as an oxidative injury state due to reactive oxygen species which oxidizes membrane phospholipids comprising unsaturated fatty acids. The resultant lipid hydroperoxides yield cytotoxic products such as malondialdehyde, which are highly detrimental to the cells.^[14]

KAPALABHATI COMBATING THE COMPONENTS OF METABOLIC SYNDROME

MS is a combination of impaired glucose tolerance, dyslipidemia, hypertension, and elevated waist circumference or waist-to-hip ratio, denoting central obesity.^[6] Kapalabhati is considered as a form of abdomino-respiratory-autonomic exercise which stimulates the respiratory, abdominal, and gastrointestinal receptors. Since Kapalabhati induces a positive influence on the centers within the skull, the vital areas of the brainstem, cortex, their efferent pathways, and effector organs may also get stimulated. As a result, the synchronous discharge from the autonomic nervous system, pineal gland, and hypothalamus that regulate the endocrine and metabolic processes increases which, in turn, accelerates fat metabolism. This eventually increases basal metabolic rate, reduces fat deposition, and ultimately ends up in weight reduction. Kapalabhati is found to have change in body fat distribution and hence reduce both waist circumference and hip circumference. Studies have also shown that weight loss as a result of Kapalabhati practice correlates with the loss of subcutaneous fat rather than visceral fat which proves that there is a substantial decrease in waist-to-hip ratio.^[1] The regulation of neuroendocrine and autonomic nervous system mechanisms by the continuous practice of Kapalabhati is said to decrease lean body mass and body fat.^[1,15] Kapalabhati pranayama tones the abdominal muscles and reduces abdominal fat^[9] apart from the reduction of abdominal skinfold thickness in obese individuals.^[7] The exercise also increases hepatic and lipoprotein lipases which induces increased uptake of triglycerides.^[14]

The elevated blood sugar and impaired glycemic state of MS is primarily controlled by catabolizing blood sugar which is the end result achieved in heavy physical exercises. However, mental and spiritual

status which controls the brain–pancreas–endocrine axis can induce a positive control of hyperglycemia and dyslipidemias.^[16] Kapalabhati is known to regulate this brain–pancreas–endocrine pathway and hence corrects the features of MS, primarily hyperinsulinism and dyslipidemias.^[16] The abdominal stretching which occurs during Kapalabhati helps in the regeneration of pancreatic cells which helps the increased uptake and enzymatic peripheral utilization of glucose in tissues, thereby reducing hyperglycemia.^[14] Moreover, being an abdomino-respiratory exercise, Kapalabhati is proven to directly stimulate the pancreas to release insulin and counteract hyperglycemia.^[14]

Insulin resistance, the common problem in PCOS and MS, is combated by improving the blood supply to muscles and enhanced insulin receptor expression on the muscles. Hence, hyperinsulinism and the resultant impaired glucose tolerance are effectively treated by long-term Kapalabhati practice.^[14]

Yogic exercises are noted to reduce oxidative stress and hence aid in anti-oxidant defense mechanism.^[14] Pranayama techniques such as Kapalabhati improve autonomic function by balancing the sympathetic and parasympathetic activity which is beneficial in stress-related disorders.^[17] Kapalabhati reduces oxidative stress which affects lipid peroxidation.^[14]

In combating stress-induced cell disruption, relaxation practices synchronize the mind and body and balance the physiological and psychological mechanisms of the individual. Studies suggest that a single yoga session improves oxygen saturation and sympathovagal balance, which might enhance recovery from a stressful stimuli primarily initiated from a personal experience, workplace, or examinations. Stress is primarily relieved by bringing a state of lower psychophysiological activity different from that of regular sleep or other relaxation techniques. This yogic state also reduces oxygen consumption of up to 40%. Studies have also proven that regular yoga practitioners have lower lipid profiles.^[13] Relaxation by Kapalabhati in stressed patients induces improved mitochondrial energy production and utilization culminating in the upregulation of ATPase and insulin function that aids in mitochondrial resilience.^[13]

On the negative note, the time required for Kapalabhati practice to eventually observe the results is yet to be standardized. A study conducted in university students showed that a 4-week practice of Kapalabhati did not produce any significant improvement in the hematological parameters.^[18] This indicates that these exercises should be carried out for longer periods of time to evaluate the efficacy.

CONCLUSION AND RECOMMENDATIONS

It can be ascertained that with the available literature and studies, Kapalabhati effectively targets and combats the features of MS. Since PCOS and MS share a common pathogenic pathway, it is worthwhile to consider that Kapalabhati can be effective against the features of PCOS too, though there is a dearth of studies and literature in this regard. On a positive note, Kapalabhati would help to address infertility in PCOS women, a main cause of concern in women of reproductive age. However, only earnest research and therapeutic pursuits by scientists and clinicians may perfect the technique and make it more refined and suitable to the practitioners. Hence, it would be beneficial if a study is conducted in a large population of PCOS women with coexisting MS to confirm the benefits of Kapalabhati in their population.

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Conflicts of interest

There are no conflicts of interest.

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