

Pranayama - The Art of Yoga Breathing

“When the breath wanders, the mind is unsteady, but when the Breath is still, so is the mind still. The blue sky can only be seen from sea bed when deep sea water is clear and still” - Hatha Yoga

Summarized Conclusions

Hatha Yoga, the union of these two Yogic Principles Pranayamic breathing, Asana/Posture, is considered as the highest form of purification and self-discipline to bring peace to the mind and body, preparing the body for deeper spiritual practices such as meditation.

Breathing is life, one of our most vital functions. Pranayamic breathing promotes proper breathing to bring right level of oxygen to the blood, brain and to control Prana - the vital life energy. Pranayamic breathing also goes hand in hand with the Asanas/posture: The synchronization of breath and movement brings about a meditative flow.

Purpose of “Pranayamic Breathing” is to achieve “Normal Proper Breathing” Respiratory Activity consistent with our Metabolic or Activity Requirements:

- If your body is engaging in **high level of activity** (Intensive Yang style Yoga, running) hence requiring larger than usual supply of O₂, **deeper and fuller or more rapid breathing is perfect appropriate** (*Same pattern of breathing if applied to resting state of metabolic activity would produce hyperventilation, too low in Co₂ and too much O₂ in blood but not enough in tissues*)
- If **your body is at rest** (reading, sitting, Yin Yoga) & does not require a huge supply of O₂ to fuel, **breathing should be quiet en relaxed.**
- If **your body is at stress: Take a 5-10 Freeing Long Deep Breaths** to Calm Mood, Emotion & Metabolism to allow respiratory activity to more closely match body metabolism by *releasing excessive oxygen-hungry tension from the breathing musculature*

Definition of Breathing: The intaking and expelling of air in lungs, caused by changing the Shapes of Thoracic & Abdominal cavities

- **Diaphragm, the Principal Muscle for Breathing, causes 3-Dimensional Shape Change in Both Thoracic & Abdominal cavities. All breathings are “Diphragmatic breathing”**
- **Abdominal cavity changes shape - Upper Abdo above navel rises as the Diaphragm contract and push down the organs in Abdomen. Do not actively push Abdomen muscles out.**
- **Accessory muscles (Intercostals, Abdomens, Pecto) “steer” the Breath or Shape Change *not the ”Air”*:** a particular region of the chest moves more than another does not mean more air going into lung just beneath that movement
- **“Top to Bottom” breath encourages the expanding inhale to proceed from upper reaches of the thorax in a downward direction towards the abdomen**
- **Inhaling oftens goes with Spine Extension. Exhaling oftens goes with Spine Flexion (there are exceptions)**
- **For Asana/Yoga Postures with Back Bending or Hyper-Extension of Shoulders, Shape change during breathing will come from little shape change in Abdomen Cavity (fully stretched) hence more change in Chest Cavity**
- **For Asana/Yoga Postures with Prone position (Body facing down towards Mat), Shape change during breathing will come mostly from Back and side of rib cage**

Engaging 3 diaphragm (Pelvic, Respiratory & Vocal) or Ujjayi Breathing has benefits 1- giving length & texture to breath 2-creating back pressure throughout abdominal & thoracic cavities to protect spine during long, slow flexion & extension movement occurring in breath synchronized flowing yoga practice (Vinyasa)

Take a 5-10 Freeing Long Deep Breaths to Calm Mood, Emotion & Metabolism during Stressful situation: freeing the breath, allowing respiratory activity to more closely match body metabolism by releasing excessive oxygen-hungry tension from the breathing musculature

Zenergy Breathing Techniques (based on Ujjayi Breathing)



This technique is used at the beginning of the class to:

- 1- **Freeing the breath, allowing respiratory activity to more closely match body metabolism** by releasing excessive oxygen-hungry tension from the breathing musculature (diaphragm, intercostal muscles, abdomens). This help correcting fast shallow breathing that inappropriately match body metabolism due to body “fight & flight” reaction to stressful situations before the class
- 2- Slowly establish **Deep even breath and engage 3 Diaphragms to prepare for more dynamic asana/posture.**
- 3- Moving into a **Calm meditative state/flow to discover the subtle inner world: Synchronization of breath and movement**
- 4- **Respiratory activity consistently matches Metabolic Requirements:**
 - **During Intensive pose: Deeper breathing** with inhaling changing shapes of 2 cavities (Abdomen & Chest), exhaling involve contraction of musculatures surrounding 2 cavities (Diaphragm, Abdomens, Intercostal)
 - **During Yin/resting poses: Relax & quiet breathing applies.** Inhaling changes shape of abdomen cavity and little change in chest cavity while exhaling is a passive reversal of this process/ passive recoil of diaphragm, very little engagement of accessory musles (intercorstal, abdomens)

Preparation:

- Lying on your back, legs and arms open and falling to sides. Body totally relax and let go of all tension
- Put one hand on upper abdominal above navel, left hand on rib cage.
- Begin to observe your current breathing pattern
- Gradually & Slowly deepen your breathing pattern to make it longer and even or inhaling length is equal exhaling length
- The lower Abdominals (between belly button & pubic) and pelvis floor always slightly engaged

Step 1: Engage the Respiration Diaphragm & Pelvis Diaphragm to make the breath deep and even

Inhalation

- Inhale deeply and slowly
- Keeping lower abdo & Pelvis Diaphragm slightly engaged to support lower back & spine.
- Feeling left hand slightly lifting as intercostal muscles contracting & lifting rig cage
- Feeling right hand lifting slightly (diaphragm lower from above rib cage-nipple level towards belly button, pushing organs in abdomen cavity down and out – changing shape of abdomen cavity). *(Do not actively pushing abdominal muscles out)*
- Total chest cavity expands fully 3-dimensionally

Exhalation:

- Exhale deeply and slowly
- Right hand/ navel lower down - diaphragm relaxes & goes up
- Left hand lower down - intercostal muscles relax
- Tighten navel further towards lower back to fully engage abdomen and Pull up to engage Pelvis floor
- Total chest cavity contracts fully 3-dimensionally

Step 2: Engage Vocal Diaphragm to control the speed (slow down) of breathing

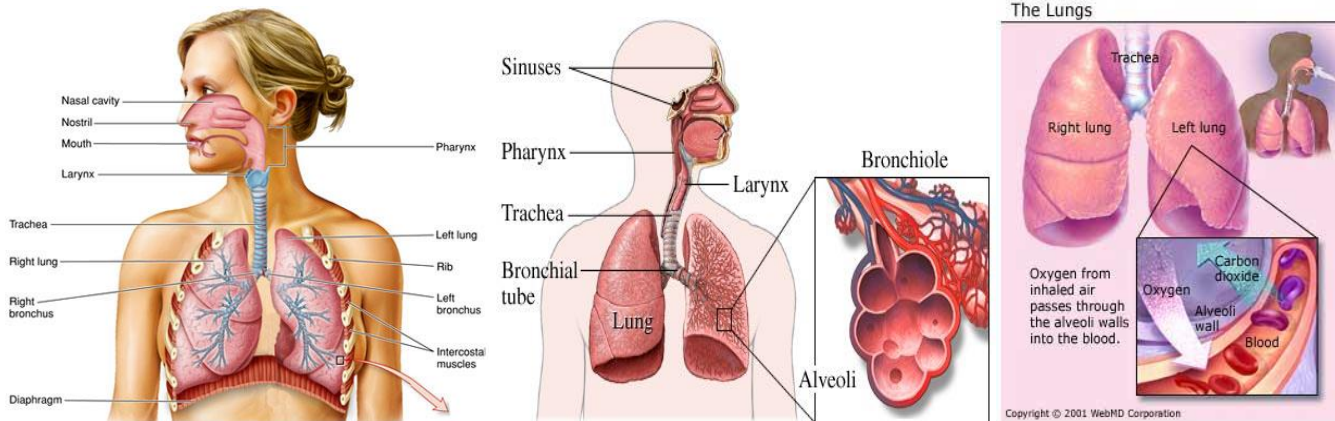
- Start by making inhale and exhale deep and same length (Result of step 1)
- Count slowly 1-2-3-4-5 on the inhale and on the exhale
- Start learning the exhale:
 - Open your mouth and say “Hhhhaaammmm” at the exhale as though you are whispering
 - Repeat a few times, feeling the vibration and swirl of air in the back of your throat
 - Move on making the sound “Hhhhaaammmm” keeping your mouth closed on the exhale
 - Create a deep breath at the top of your throat behind your nostrils (not at the tip of your nose). Technically you need to control your glottis
- Learn the inhale: Continue with your Ujjayi breathing on the exhale. On the inhale, create the same deep swirling sound

How the Lungs and Respiratory System Work

Without noticing, you breath 12-20 times per min, 17000 per day, 6 millions breath per year thanks to body's respiratory system. Lungs expand and contract, supplying life-sustaining oxygen to body & removing from it, a waste product called carbon dioxide.

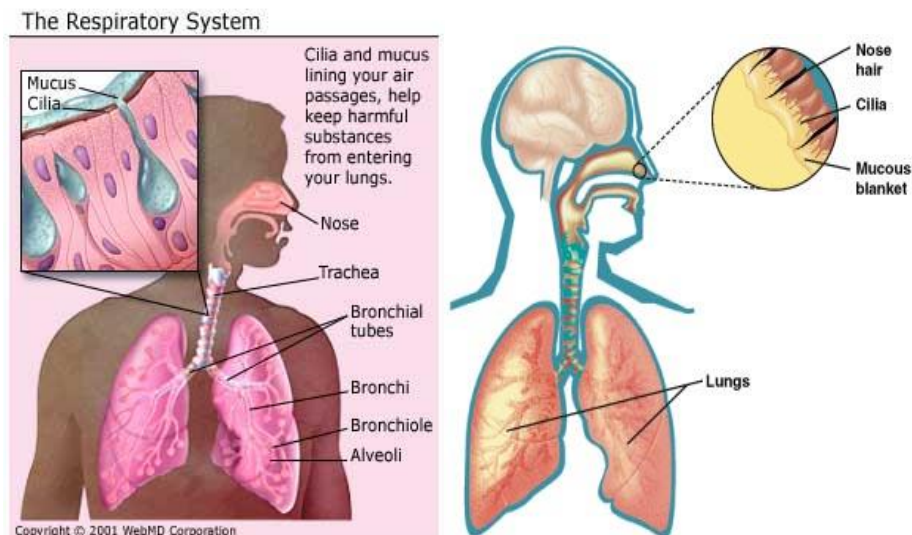
The Act of Breathing

- Breathing starts at the nose and mouth. You inhale air into nose or mouth, air travels down the back of the throat and into windpipe/trachea. Trachea divides into air passages called bronchial tubes.
- For your lungs to perform their best, these airways need to be open during inhalation and exhalation & free from inflammation or swelling and excess or abnormal amounts of mucus.
- The Lungs: as bronchial tubes pass thru lungs, they divide into smaller air passages called bronchioles. The bronchioles end in tiny balloon-like air sacs called alveoli. Your body has over 300 million alveoli. Surface of lung roughly as tennis court. The alveoli are surrounded by a mesh of tiny blood vessels called capillaries. Here, oxygen from the inhaled air passes through the alveoli walls and into the blood.
- After absorbing oxygen, the blood leaves the lungs and is carried to your heart. Your heart then pumps it through body to provide oxygen to cells of tissues and organs. As cells use oxygen, carbon dioxide is produced & absorbed into blood. You blood then carries carbon dioxide back to lungs where it is removed from body when you exhale.



Clearing the Air

- The respiratory system has built-in methods to prevent harmful substances in the air from entering the lung.
- Hairs in nose help filter out large particles. Microscopic hairs, called cilia, found along air passages & move in a sweeping motion to keep the air passages clean. But if harmful substances (cigarette smoke), are inhaled, cilia stop functioning properly, causing health problems like bronchitis.
- Mucus produced by cells in the trachea and bronchial tubes keeps air passages moist and aids in stopping dust, bacteria and viruses, allergy-causing substances, and other substances from entering the lungs.
- Impurities that do reach the deeper parts of the lungs can often be moved up via mucous and coughed out or swallowed.

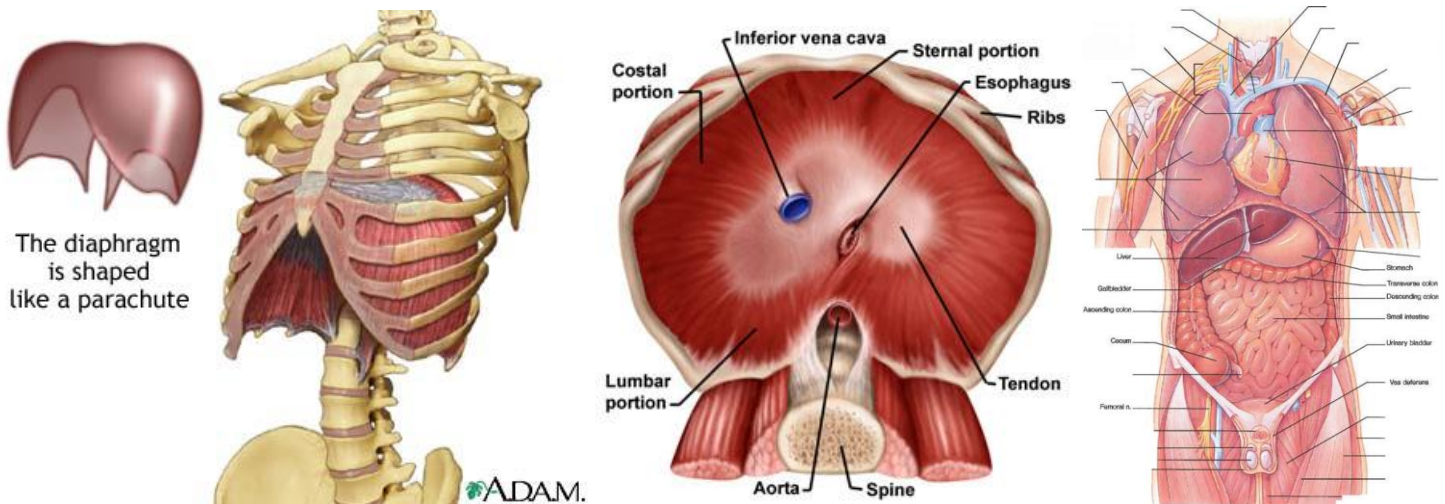


Breathing Muscles Anatomy and Physiology

The **muscles of respiration** contribute to **inhalation & exhalation** by **aiding in expansion & contraction of thoracic cavity**.

1-Principal muscle: Diaphragm

- A thin, dome-shaped muscle that separates the abdominal cavity from the thoracic cavity.
- Inhalation: the diaphragm contracts, its centre moves caudally (downward) & its edges move rostrally (upward) that compresses abdominal cavity, raises ribs upward & outward -> thoracic cavity expand -> draws air into the lungs.
- Exhalation: Diaphragm relaxes, elastic recoil of the thoracic wall causes thoracic cavity to contract, forcing air out of the lungs.
- Also involved in non-respiratory functions, helping to expel vomit, feces, and urine from the body by increasing intra-abdominal pressure, and preventing acid reflux by exerting pressure on the esophagus/foodpipe as it passes through the esophageal hiatus/hole in diaphragm



2- Other Muscles

Secondary muscles: Intercostal muscles:

- Three layers of intercostal muscles attached between the ribs important in manipulating the width of the rib cage..
- External intercostal muscles: most significant in respiration with fibres angled obliquely downward and forward from rib to rib. The contraction of these fibres raises each rib toward rib above raising the rib cage assisting in inhalation.

Accessory muscles of respiration' assist, but do not play a primary role, in breathing:

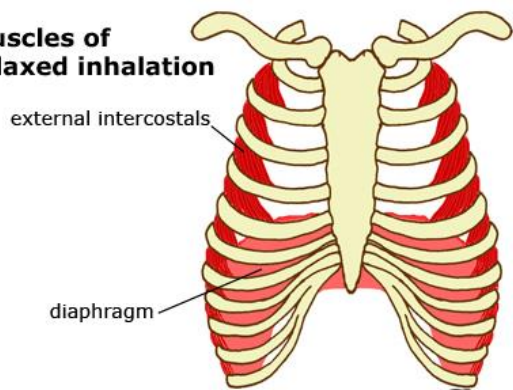
- Neck Muscles - sternocleidomastoid & scalene muscles (anterior, middle and posterior scalene)
- Others: serratus anterior, pectoralis major and pectoralis minor, trapezius, latissimus dorsi, erector spinae, iliocostalis lumborum, quadratus lumborum, serratus posterior superior, serratus posterior inferior, levatores costarum, transversus thoracis, subclavius
- Only used under conditions of high metabolic demand (e.g. exercise) or respiratory dysfunction (e.g. an asthma attack)

Muscles of exhalation

Quiet Respiration

Quiet breathing: little or no muscle contraction involved in exhalation, driven by elastic recoil of the thoracic wall.

Muscles of relaxed inhalation



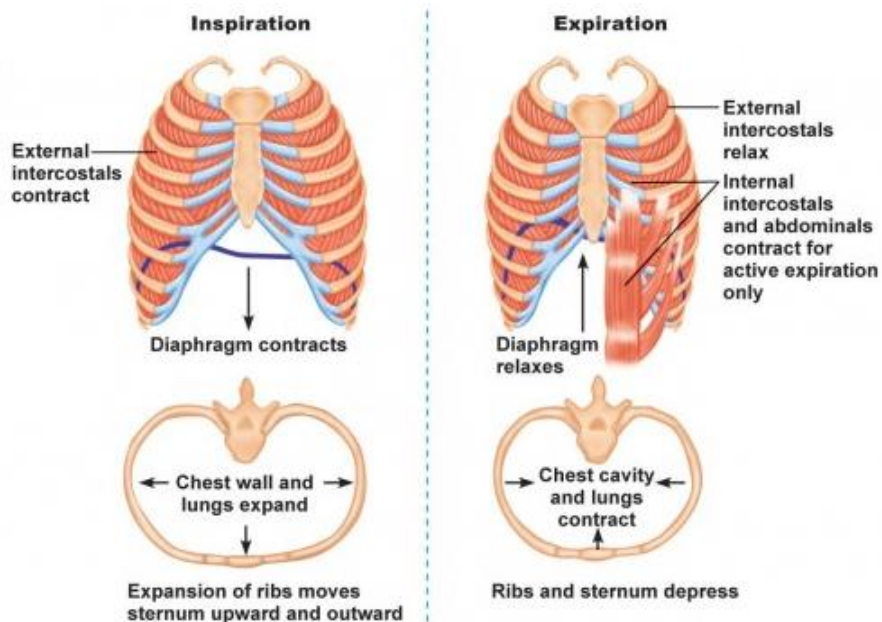
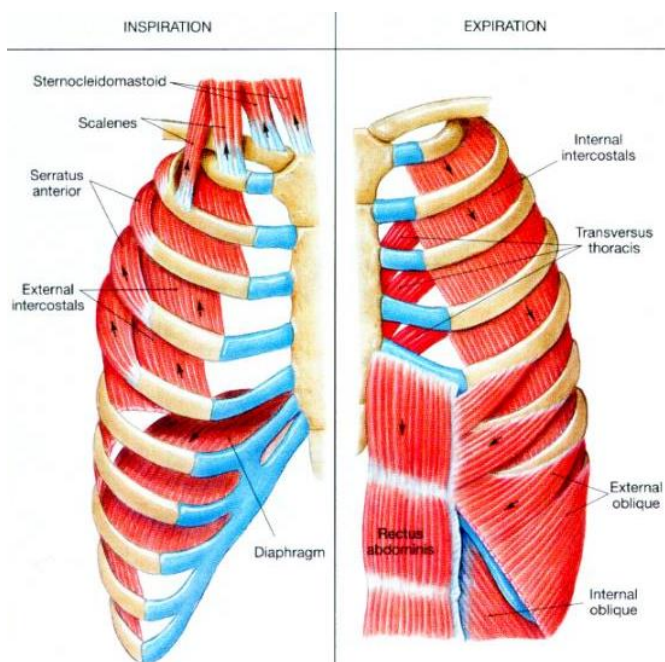
Relaxed exhalation

No muscles are required for exhalation - muscles of inhalation relax and tissues undergo "elastic recoil" to their original position.

Forceful exhalation

- **When**
 - Active sports
 - Problem – reduced elasticity of the lungs (in emphysema/ Chronic obstructive pulmonary disease),
- **How:**
 - Contraction of the abdominal wall muscles (rectus abdominus, transverse abdominus, external oblique muscle and internal oblique muscle). These press the abdominal organs caudally (upward) into the diaphragm, reducing the volume of the thoracic cavity.
 - The internal intercostal muscles have fibres that are angled obliquely downward and backward from rib to rib. These muscles can therefore assist in lowering the rib cage, adding force to exhalation.

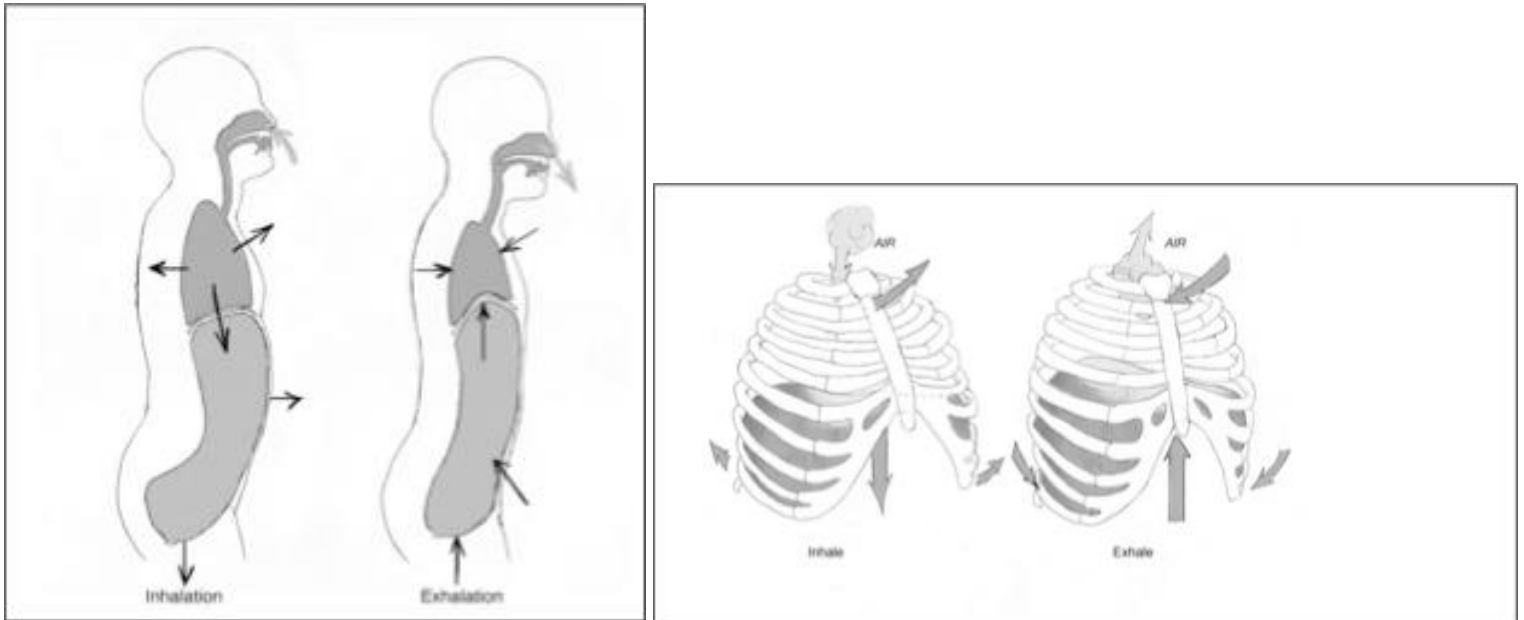
'Forced' Breathing



Diaphragm causes Shape Changes in Both Chest and Abdomen cavities

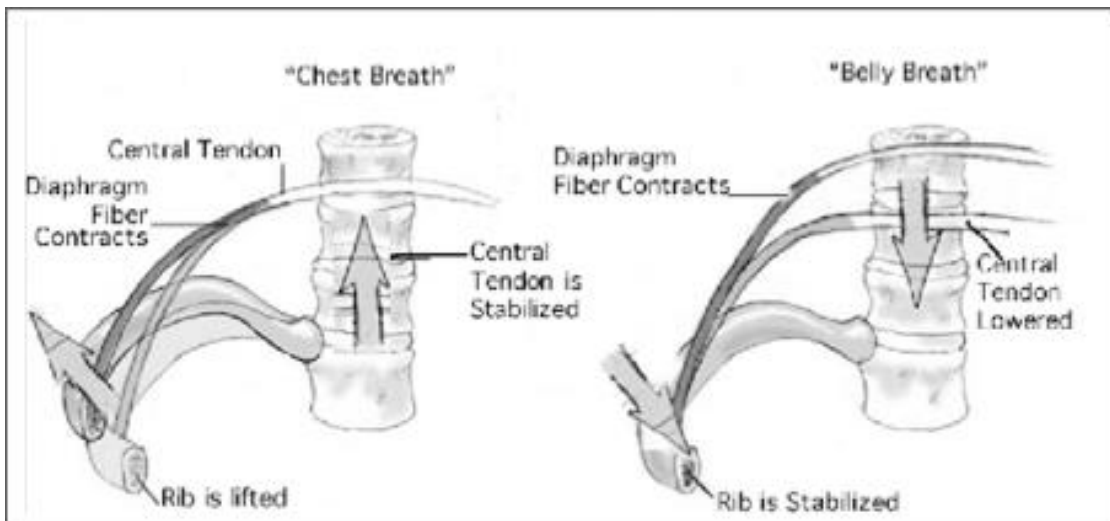
Inhalation: Diaphragm contracts, abdomen cavity (like water balloon) changes shape (not volume) by expand upper abdomen. Chest Cavity (like Accordion) increases in volume and shape thus expand 3-dimensionally.

Exhalation: Diaphragm relaxes/recoils, abdomen cavity (change shape) contracts above push up to chest cavity. Chest Cavity decreases in volume and shape hence contracts 3-dimensionally.

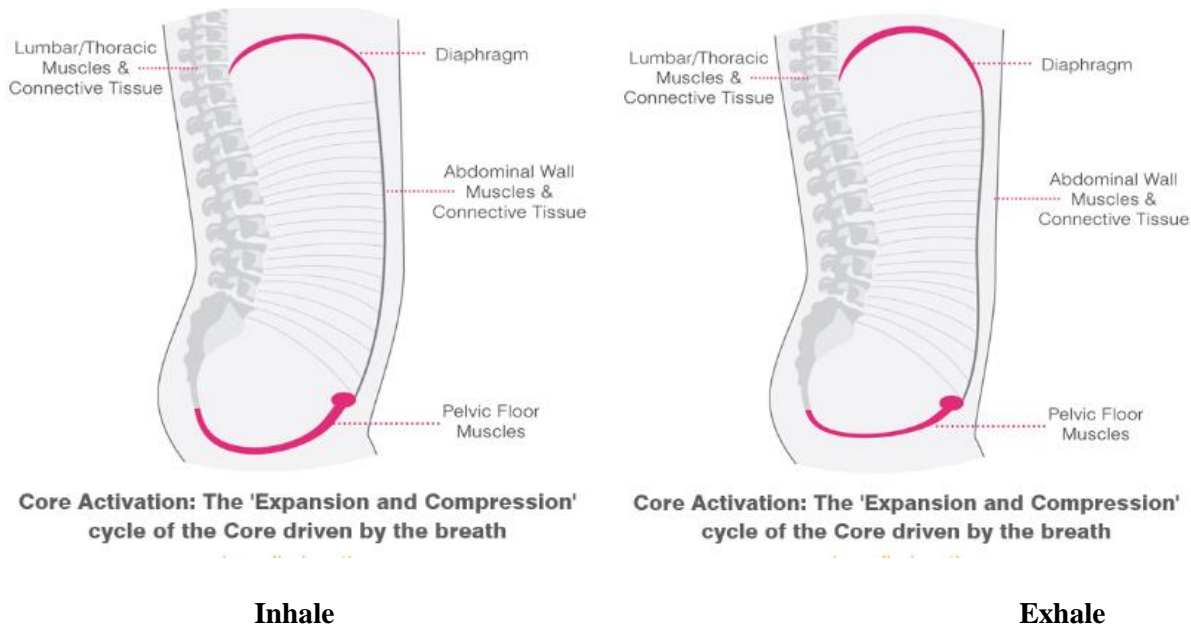
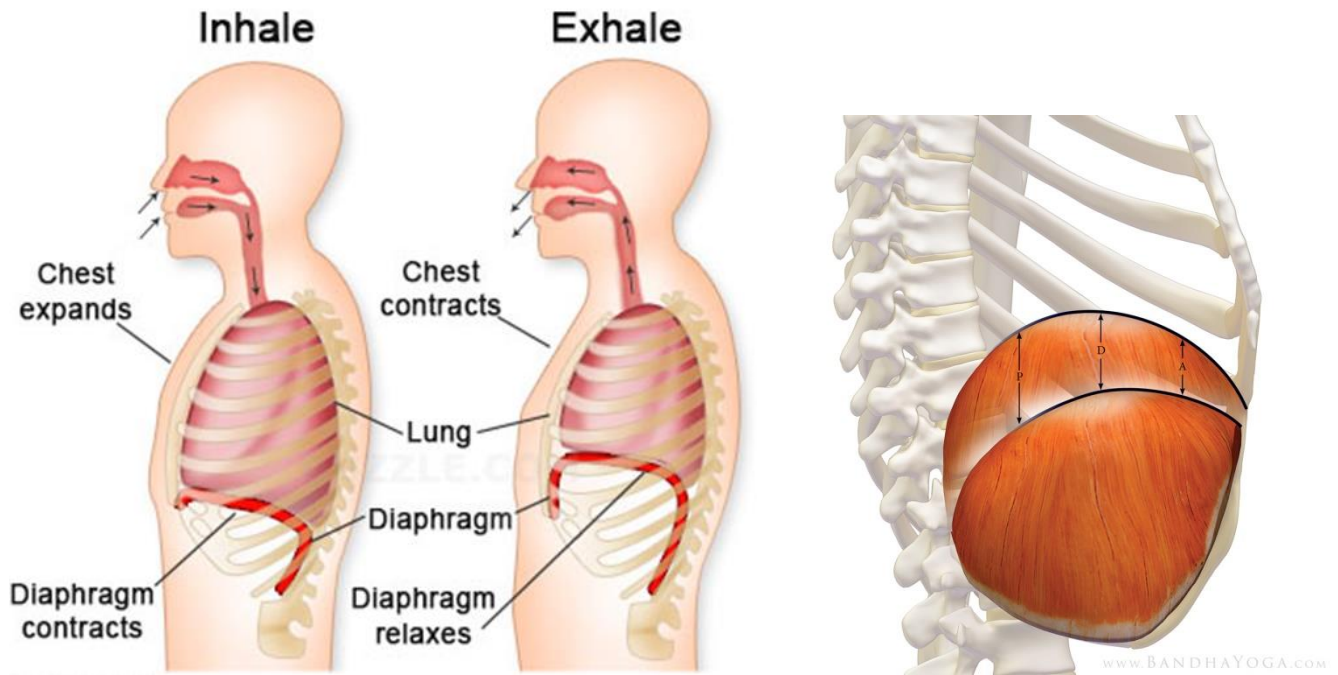


Diaphragm causes both Chest & Abdomen cavities to move simultaneously

- If the diaphragm's origin (the base of the ribcage) is stable, and its insertion (the central tendon) is mobile, a diaphragmatic contraction will cause an expansion of Abdomen "Belly Breath"
- If the central tendon is stabilized, and the ribs are free to move, a diaphragmatic contraction will cause an expansion of the ribcage
- If the diaphragm's stabilizing muscles releases (not 100%, some respiratory stabilizing muscles/postural muscles remain active through all phases of breathing), hence its origin and insertion move freely towards each other, both the chest and abdomen would move simultaneously



How much does your diaphragm actually move?



It depends on how deep of a breath you take and what part of the diaphragm you are asking about. The diaphragm is a sheet like dome-shaped muscle (when it is relaxed). Upon contraction, it flattens out and presses down on the abdomen. The net result is a negative inspiratory pressure, which draws air into the lungs.

Tidal, resting breathing, results in smaller movements of the diaphragm. While **vital capacity breathing (as in a deep diaphragmatic breath) results in much larger movement** - a complete full inhalation.

The posterior, or back part of the diaphragm exhibits the greatest excursion: the posterior region moving an average of 10 cm between inhalation and exhalation. (MRI studies)

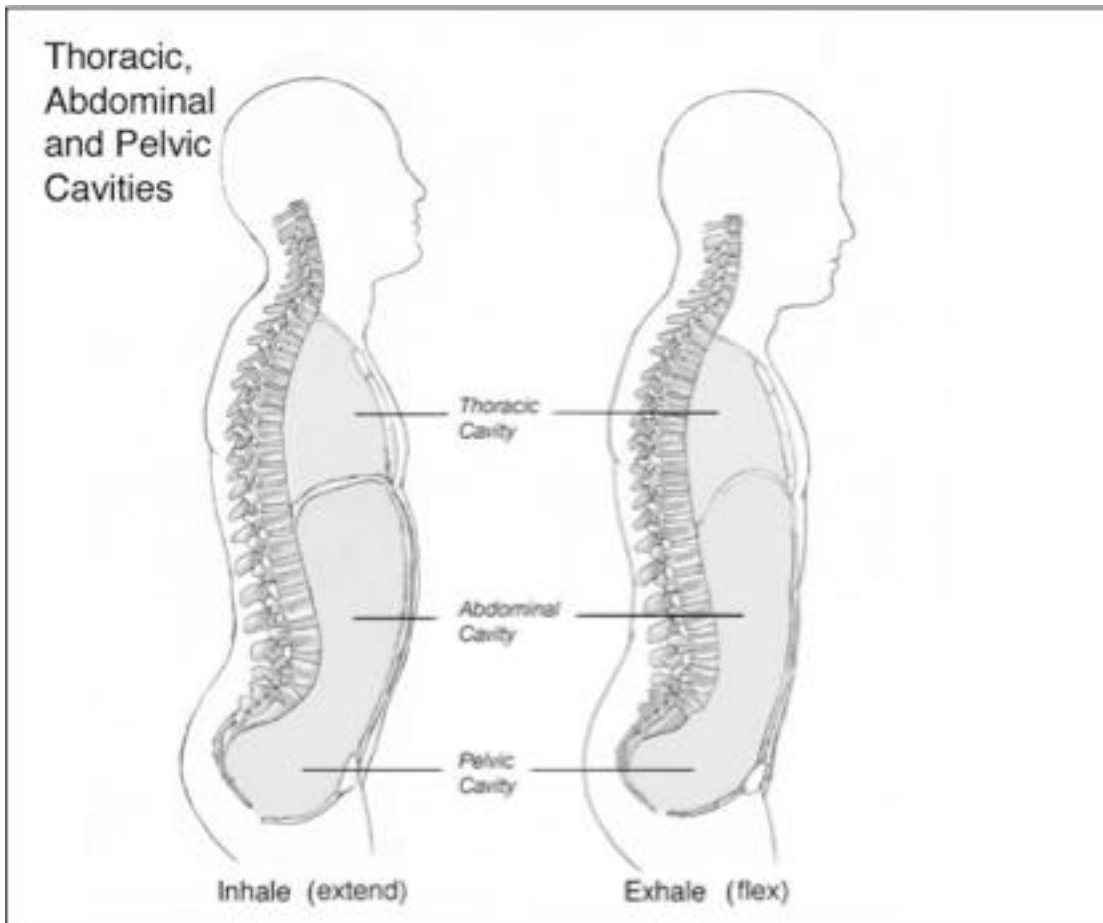
The amount of diaphragmatic motion decreases progressively as we come forward w/most **anterior portion moving about half that of the posterior thus 5cm**

Diaphragmatic motion decreases by about 1/3 in the sitting position compared to lying on your back.

Inhalation often with Spine Extension & Exhalation with Spine Flexion

The supporting shape changing structure that occupies the back of the body's two primary cavities - *the spine*. This is why breathing and spinal movement are so intimately connected: flexion of the spine is the shape change that reduces thoracic volume (exhale) and spinal extension is the shape change that increases thoracic volume (inhale). Additionally, as we shall soon see, the musculature of the breathing mechanism is the musculature of postural support.

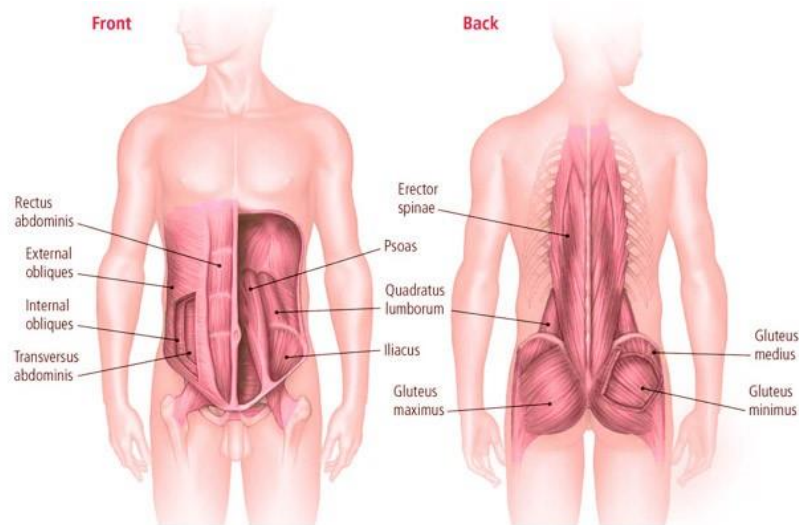
There are exceptions where you inhale during spine flexion and exhale during spine extension or respiration without changing shape of the spine



Pranayama - Yoga Conscious Controlled Breathing, Bandha & Core Strength

Pranayamic breathing - The science of breath control

What is the core: core muscles go well beyond the six-pack abs of the *rectus abdominus*. Core muscles are a group of about 10 muscles that surround the spine, front & back: Abs, Pelvis muscles, back muscles, hip flexors & glutes.

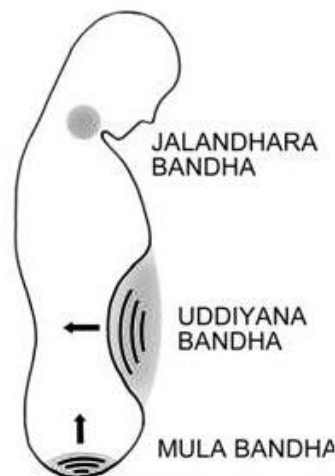


Functions of Core strength:

- Stabilises spine & pelvis to provide power & strength for movement.
- Improves posture, alleviates back pain & helps to protect back from injury both in and out of our yoga class.
- Provides platform for advanced yoga poses: 'engage your core & bandhas to support spine & pelvis.
- Prolonged sitting, poor posture and pregnancy can all contribute to a weakened core.

What are bandhas: The 'core' of core strength are bandhas – mula, uddiyana, jalandhara.

- They act as the base-mula-Pelvis diaphragm, the middle- uddiyana-Respiration diaphragm and the 'lid' – jalandhara-Vocal diaphragm of the core, retaining prana or life force energy.
- A bandha refers to the **coactivation or contraction of muscle groups** to provide a **lock or seal**
- The base-mula-Pelvis, the middle- uddiyana-Respiration diaphragm are always slightly 30% engaged when inhale and 100% when exhale.
- Bandhas used in yoga to stabilise, strengthen, energise & increase stillness & body awareness
- 3 major bandhas which correspond to our 3 diaphragms:



When all three bandhas are activated it is called tri-bandha or maha bandha and acts as a great seal of energy in the body.

Core Muscles to Support Active Conscious Yoga breathing

Figure 1.15 Posterior view of the chest wall, showing the interdigitated origins of the diaphragm and transversus abdominis forming perfect right angles with each other. This is clearly an agonist-antagonist, inhalation-exhalation muscle pairing that structurally underlies the yogic concepts of prana and apana.

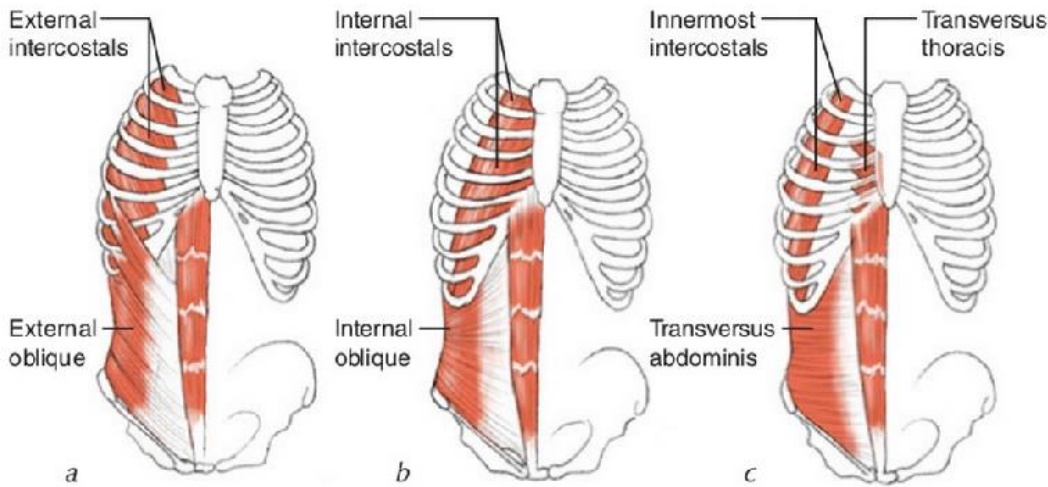
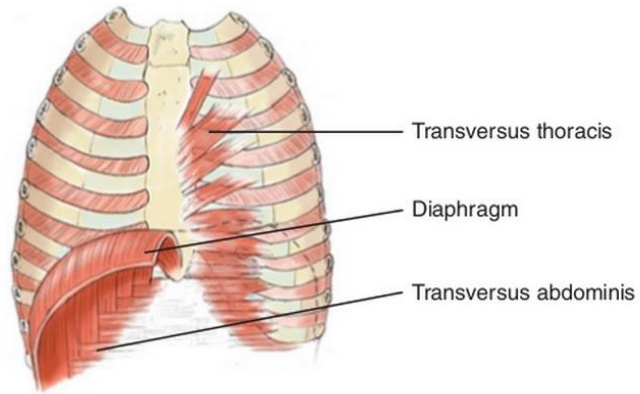


Figure 1.16 The continuity of the abdominal and intercostal layers shows how (a) the external obliques turn into the external intercostals, (b) the internal obliques turn into the internal intercostals, and (c) the transversus abdominis turns into the transversus thoracis and innermost intercostals.

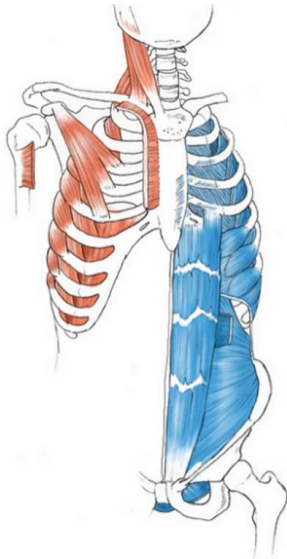


Figure 1.17 Some of the accessory muscles of respiration: Blue muscles act to reduce thoracic volume, while red muscles help to increase thoracic volume.

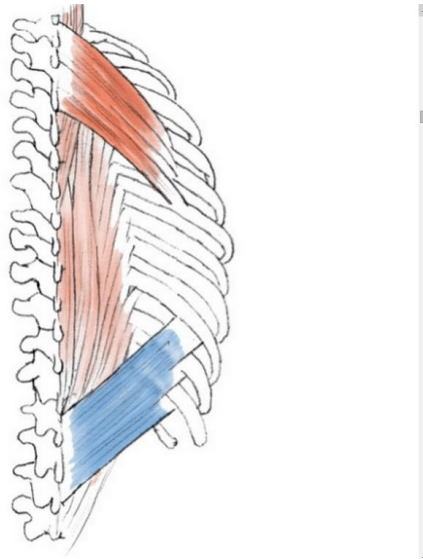


Figure 1.18 The serratus posterior muscles: Superior (red) assist thoracic volume increase; inferior (blue) assist thoracic volume reduction.

3 Bandhas/Diaphragms (Vocal, Respiration, Pelvis)

Vocal Diaphragm/ Jalandhara Bandha

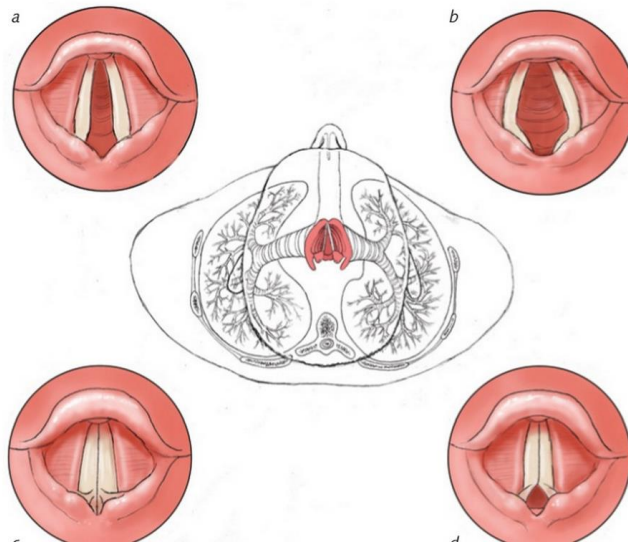


Figure 1.22 Position and location of vocal folds: (a) relaxed position, (b) maximally opened for forced respiration, (c) closed for speaking (phonation), (d) slightly opened for whispered speech (or *ujjayi*).

Jalandhara Bandha

the throat lock

Jala means a net or a web.
The bandha is the first bandha
that a yogi should master

how-to

contract the throat and neck and
bring the chin to the chest in the notch
between the collar bones.

benefits

The bandha regulates the blood flow to
the heart, the neck and head regions.
It also guides the upward flow of energy
down to fuse with the downward.



Respiration Diaphragm/ Uddiyana Bandha

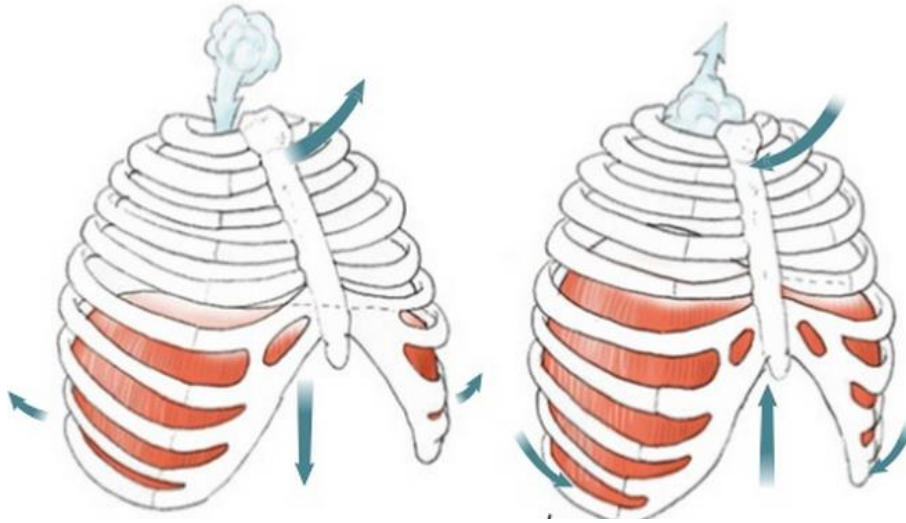


Figure 1.7 Three-dimensional thoracic shape changes of (a) inhalation and (b) exhalation.

Uddiyana Bandha

The abdominal lock

Uddiya means 'flying upward'. It is said to be the best bandha. It is "the elephant that kills the lion named Death."

how-to

Pull the abdominal muscles in and up after the complete exhalation and before the inhalation.

benefits

It massages and tones the heart muscles. It also moves the downward energy in and up toward the chest.



Pelvis Diaphragm / Mula Bandha

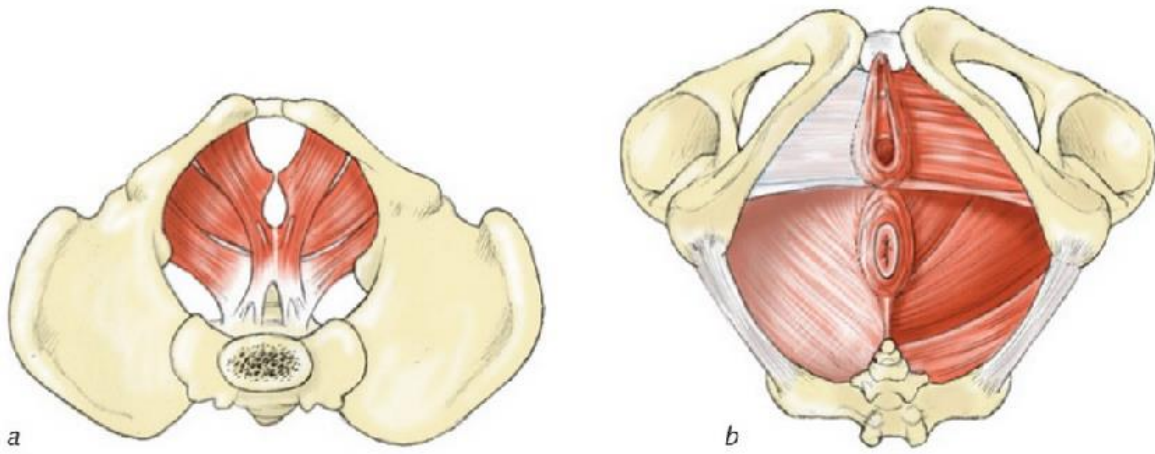


Figure 1.19 (a) The deepest muscles of the pelvic diaphragm, from above; (b) the pelvic floor from below, showing the orientation of superficial and deeper layers. The more superficial the layer, the more it runs from side to side (ischia to ischia); the deeper the layer, the more it runs front to back (pubic joint to coccyx).



Mula Bandha

the root lock

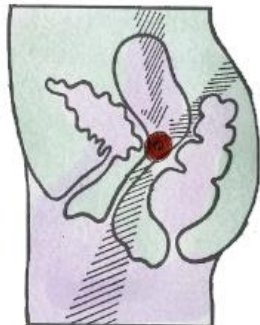
Mula means 'root', 'origin', or 'foundation'. In human body, it is located in the perineum.

how-to

Contract the same muscles used in holding the urine mid-stream.

benefits

The bandha helps balance the sexual desires. It moves apana vayu or the downward wind (in the body) up to meet with prana vayu or the master wind creating a yogic state.



The Bandhas

All three diaphragms (pelvic, respiratory, and vocal) come together with ujjayi in yoga movements that are coordinated with inhaling and exhaling. In addition to giving more length and texture to the breath, the valve of ujjayi creates a kind of back pressure throughout the abdominal and thoracic cavities. This pressure can protect the spine during the long, slow flexion and extension movements that occur in the breath-synchronized flowing practice of *vinyasa* (arrangement or placement), such as during sun salutations. In yogic terms, these coordinated actions of the diaphragms (bandhas) create more *sthira* (stability) in the body, protecting it from injury by redistributing mechanical stress.

Figure 1.23 shows a mechanical analysis of the body entering into a forward bend from two perspectives. In figure 1.23a, we see the torso moving without breath support. Because the breathing musculature surrounding the cavities is not engaged, there is no single center of gravity to the shape, and a partial center of gravity (B) is acting upon the long arm of a lever (C), of which the fulcrum point (A) is at the vulnerable disc of the lumbosacral junction. The weight of the torso is being controlled by the posterior musculature, which compressively acts on the short end of the lever (D). The body instinctively resents this extremely poor leverage, and that's why we tend to hold our breath in situations like this to avoid damaging our spinal structures.

Figure 1.23b on page 19 pictures the same movement employing the glottal valve of ujjayi (E), which automatically engages the breathing musculature. This creates support along the entire anterior surface of the spine because it rests on the stabilized body cavities. The body now has a single center of gravity, which is being supported safely by the pelvis and legs. This is what is commonly referred to as frontal support.

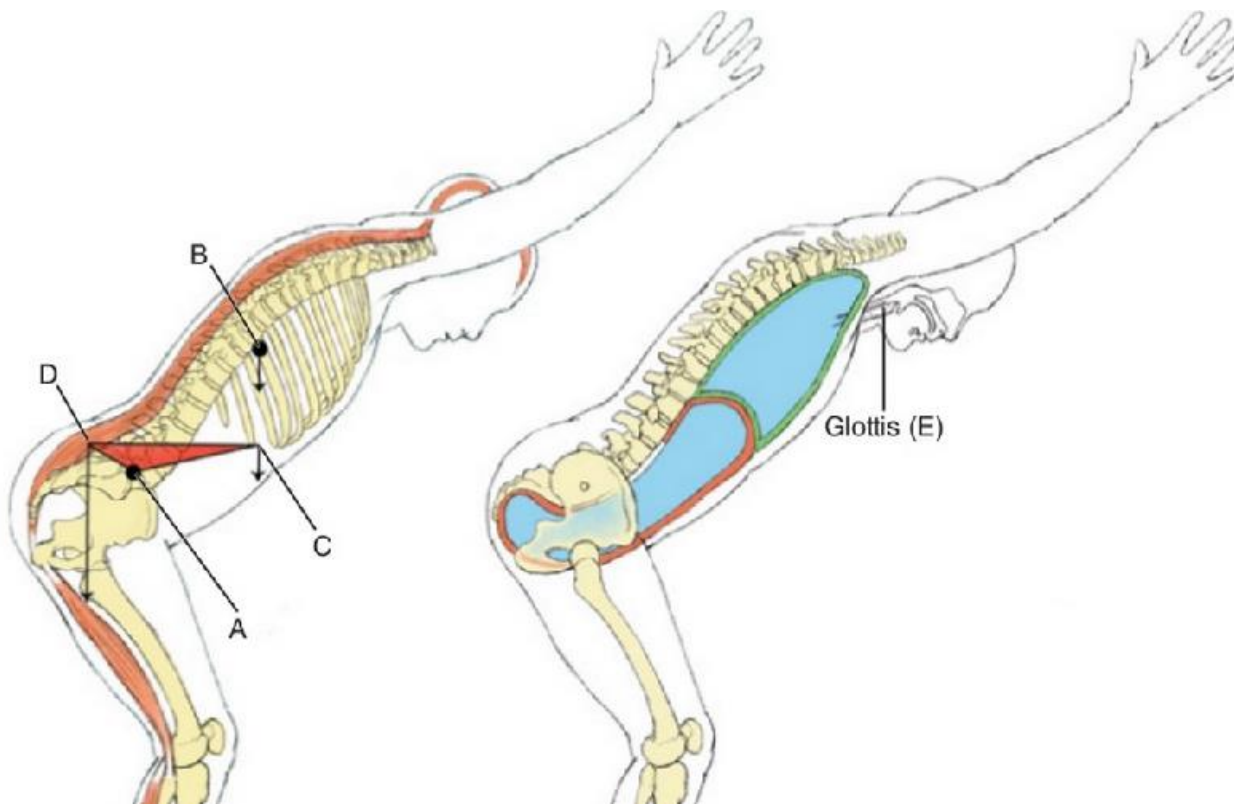


Figure 1.23 Supporting a movement (a) without the breath and (b) with the breath.

Benefits of Long Controlled Deep Breaths to Calm Mood, Emotion & Metabolism during Stressful situation

Your body breathes on autopilot. So why worry about how to inhale and exhale when you could be mastering an arm balance? Scientific research is showing that **mindful breathing—paying attention to your breath and learning how to manipulate it is one of the most effective ways to lower everyday stress levels and improve health factors ranging from mood to metabolism.** “Pranayama is at once a physical-health practice, mental-health practice, meditation using breath to make your entire life better.”

“There is a very direct relationship between breath rate, mood state & autonomic nervous system state,” The autonomic nervous system governs the body’s sympathetic (fight-or-flight) and parasympathetic (rest-and-restore) responses, dialing functions like heart rate, respiration, and digestion up or down as necessary in response to potential threats. Evolutionarily, this worked as a survival mechanism, but today’s nonstop barrage of smartphone, emails & news updates trips body’s alarms.

Breath changes in response to emotion: When people get panicky and anxious, their breath becomes shallow and rapid,” Actively bringing the breath rate back to normal – “Body metabolism matching rate” can actually change autonomic function and mood state.” : With each breath, millions of sensory receptors in the respiratory system send signals via the vagus nerve to the brainstem.

- Fast breathing pings brain at a higher rate, triggering it to activate the sympathetic nervous system, turning up stress hormones, heart rate, blood pressure, muscle tension, sweat production, and anxiety.
- Slowing breathing induces parasympathetic response, dialing down all of above -> relaxation, calm, and mental clarity.

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Zenergy Exercises

Key principles for Zenergy exercises:

- Posture (Long Spine, Hip over Knee over Ankle, Soft Knee & Elbow, Soft Relax Face (Eyes, Jaw, Lips, Tongue), Relax Shoulders back & away from Ears, Belly button drawn in towards lower back)
- Inhale in deeply via Nose (Diaphragm down hence belly out, Rib cage expand Front, Back & sides) & Exhale out via Nose (Belly in, Rib Cage down)
- Control (Mind – Breathing w/ Movement and Body – Slow Controlled Precise Movement engaging All Muscles)
- Listen to Your Body (Right option, No. Rep, Range of Motion): Burning Muscle Ok - No Pain - Stretch Tight Muscle Yang Yoga- Stress mildly Joints holding still long time (while muscles relax in yin yoga)



