BELLY BREATHING

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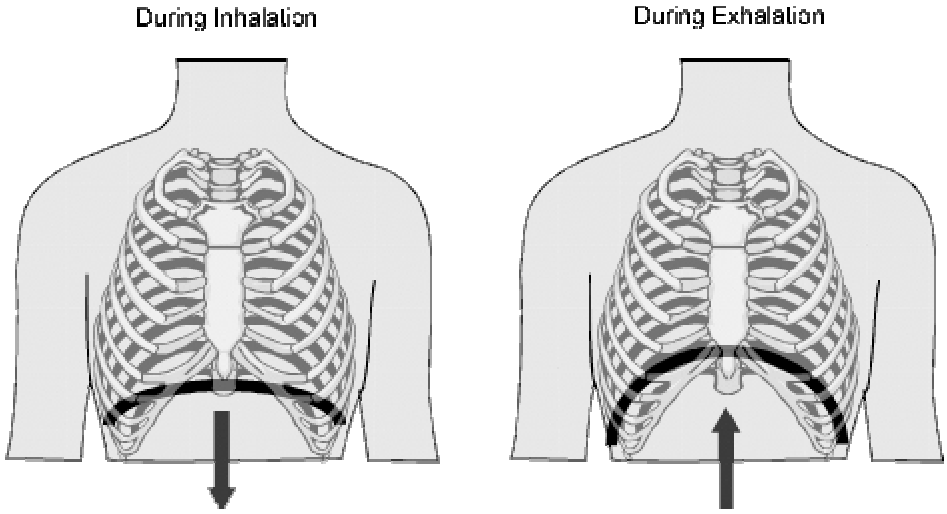
Respiration occurs partly because of the interaction between the diaphragm and the lungs, rib cage, and abdomen. The diaphragm is a large, thin, dome-shaped skeletal muscle that originates mostly from the lower six ribs, but also from two muscular slips from the back of the xiphoid process (the tail-like structure at the bottom of the sternum) and from the lumbar vertebrae by two pillars, effectively creating two separate compartments—thoracic and abdominal. All fibers then insert into to a tendon in the center of the diaphragm. This tendon is a thin sheet of connective tissue and, like all tendons, it cannot be stretched.

Breathing is usually on autopilot. We breathe during sleep, when passed out or awake, driven as we are by the needs of the body to take in oxygen and get rid of CO_2. But, we can also exert conscious control of tidal volume, breathing frequency, and relative expansion of the rib cage and abdomen.[1] You can even hold your breath up to a point at which it is no longer possible (the breakpoint). According to Parkes[2], the central respiratory rhythm appears to continue throughout breath-holding and cannot be interrupted voluntarily. "Instead, the breath-holder merely suppresses expression of that rhythm and voluntarily 'holds' the chest at a chosen volume until the breakpoint."



Diaphragm contracts and flattens creating negative pressure to pull air into the lungs.

Diaphragm relaxes and moves upward to expel air from the lungs.

INSPIRATION

During inspiration, the diaphragm contracts, flattens and pushes down on the abdominal organs, displacing the abdomen outwards and causing the intercostal muscles to contract and expand the rib cage.[1] The magnitude of diaphragmatic contraction is related to flow rates and lung volume.[3]

Don't fight that natural expansion of the abdominal muscles during inspiration; they **want** to bulge out, decreasing the intra-abdominal pressure and helping to create a stronger vacuum so that air can be pulled down to the very base of the lungs, inflating all of those little air sacs (alveoli). How is it that we have become so *abdominally inhibited* that we actually need to learn how to let loose of those abs during inspiration–something that is meant to occur naturally?

Some proponents of "diaphragmatic breathing" teach that chest expansion should be suppressed. [link] I don't know why they think that is a good idea–especially since nature gives you a **huge** clue by not *allowing* you to completely suppress your intercostal muscles, although it is true that you can control the relative magnitude of rib expansion.[3]

Studies by Britto et al[4] suggest that the aging process of the respiratory system reduces inspiratory muscle strength—no big surprise there; lord knows everything else is "reduced". So, the effects of aging on "big breaths" is another reason to keep the intercostals strong into and through elderly-ness. I don't know if allowing the intercostals to fully expand the thoracic cage will actually help preserve their strength. I do however know from experience that every one of you CrossFit athletes would never think of suppressing a muscle that is meant to give you a deeper breath.

To summarize, the inspiratory volume depends on that strong vacuum created by full expansion of the thoracic cage via contraction of the diaphragm, activation of the intercostal and relaxation of the abdominal muscles. Of course, we want inspired air to come in through the nose so that it can be filtered, warmed, and moisturized before filling our tender lungs. Mouth breathing is good for expiration but only second best for inspiration.

EXPIRATION

During expiration the diaphragm relaxes and rises, the abdominal muscles contract and a different set of intercostal muscles are activated to reduce the size of the thoracic cage. All work together to push the CO_2 laden air out.

An amazing feature of the lungs is their elasticity which allows them to rebound after expanding for inspiration. They bounce back to their deflated state, squeezing air out to assure the successful exchange of gases. In people with emphysema, the rebound has been destroyed (literally) – often the result of cigarette smoking, in which case exhaling becomes incomplete and a life-long repetitive physical effort.

BENEFITS OF RELAXATION TECHNIQUES

When I asked Dr. Wilson his opinion on the benefits of emphasizing diaphragmatic or abdominal breathing, he said that there is nothing in the respiratory mechanics literature (his specialty) that would explain a benefit and that "any benefits are similar to the benefits of conscious control of breathing that is used in relaxation techniques, and although those benefits have been verified by experience, respiratory physiologists who measure pleural and abdominal pressures and the excursions of the rib cage and abdomen have no idea of the source of those benefits. They apparently reside in the interconnections of the nervous system, not in the mechanics of lung expansion."[3]

TOO MUCH BEDREST!

Now you can see just why things go south when someone is confined to bedrest. Lying there, half propped up with pillows, neck and head at a crunched angle, dead space in the lungs multiplying–an invitation for pneumonia. In an elderly person, this scenario may be the last of life's indignities.

I lived, worked, and studied in a teaching hospital in Ireland for a bunch of years. The rule where I was living at that time was that if you were "sick"–cystitis, upper respiratory infection, a cold, stubbed toe, broken arm, whatever, you went to bed and you stayed there, "resting", until all signs of the malady were gone or clots had broken loose from your inactive leg veins and made a bee-line for your lungs, which by that time were already filled with bacterially infected fluids.

LET'S TRY THIS "BELLY BREATHING"

Learn it well for the times when you have a miserable upper respiratory viral infection; it will help prevent pneumonia by keeping those lungs moving well and deeply, permitting no nasty little warm puddles to hang out in your precious alveoli waiting to support colonies of bacteria.

Ready?

- Relax.
- Unload any tension in your abs. Think about breathing in through your nose – that may release those tight abs.
- When you breathe in, your abs bulge out and your chest expands, right? Your diaphragm has contracted and flattened, creating negative pressure for the inhalation.
- If your belly didn't rise with inspiration, try to relax that 6-pak and check out the inhalation again; sometimes this relaxing thing takes a little practice and patience.
- On the exhale, contract your abs, helping the lungs expel all of the CO2 lurking in the alveoli of the lung bases.

How about a cranking it up a notch? James Baker M.A., M.F.T., CrossFit Central trainer, has given me a marvelous exercise that he learned in South Korea. This one will *really* help you to get in touch with the strength of a series of abdominal contractions on expiration.

- Inhale through your nose, allowing your belly to expand.
- Exhale through your mouth. Tighten those abs – now tighten more – more again – and again if you can (no sneaky inhales). Wow! Reminds me of PNF.

It impressed me how much more air was expelled by the third "again"—my abs felt like they were plastered to my spinal column. This is *supposed* to relax one. I can't quite get in touch with that part of the exercise.

So now we've another way to strength those abdominal muscles while attending to the health of our lungs. Thank Jim Baker and that guru in South Korea for this one.

NOTE: The interesting phenomenon of **high altitude periodic breathing** was not discussed here. However, if you are interested, it can be found on this web-site on page 4 of an article entitled "*Climbing High"*, written by me with Marshall G. Delk, B.S., M.S., our own CrossFit Central Mountaineer.

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