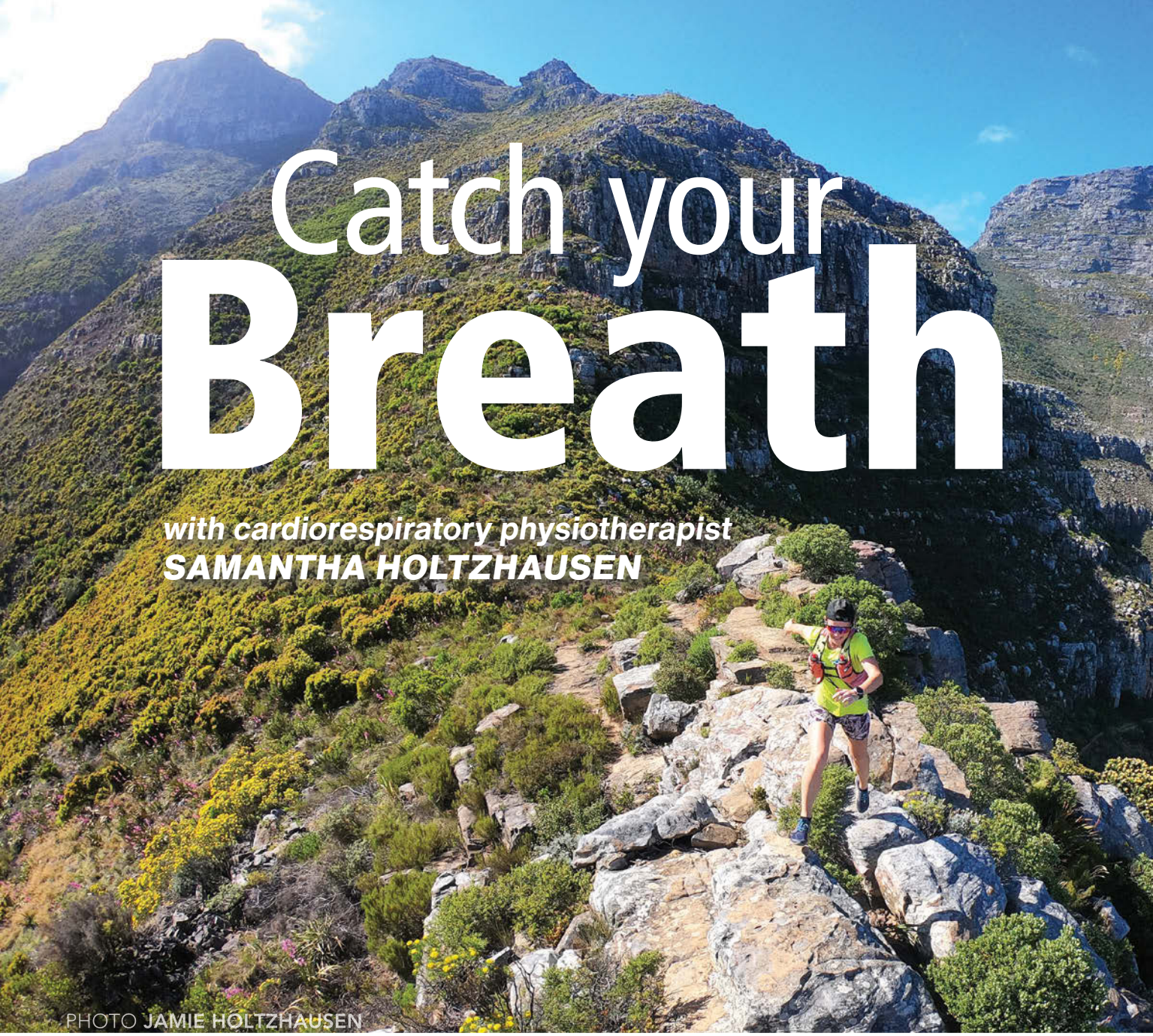


Catch your Breath

with cardiorespiratory physiotherapist
SAMANTHA HOLTZHAUSEN

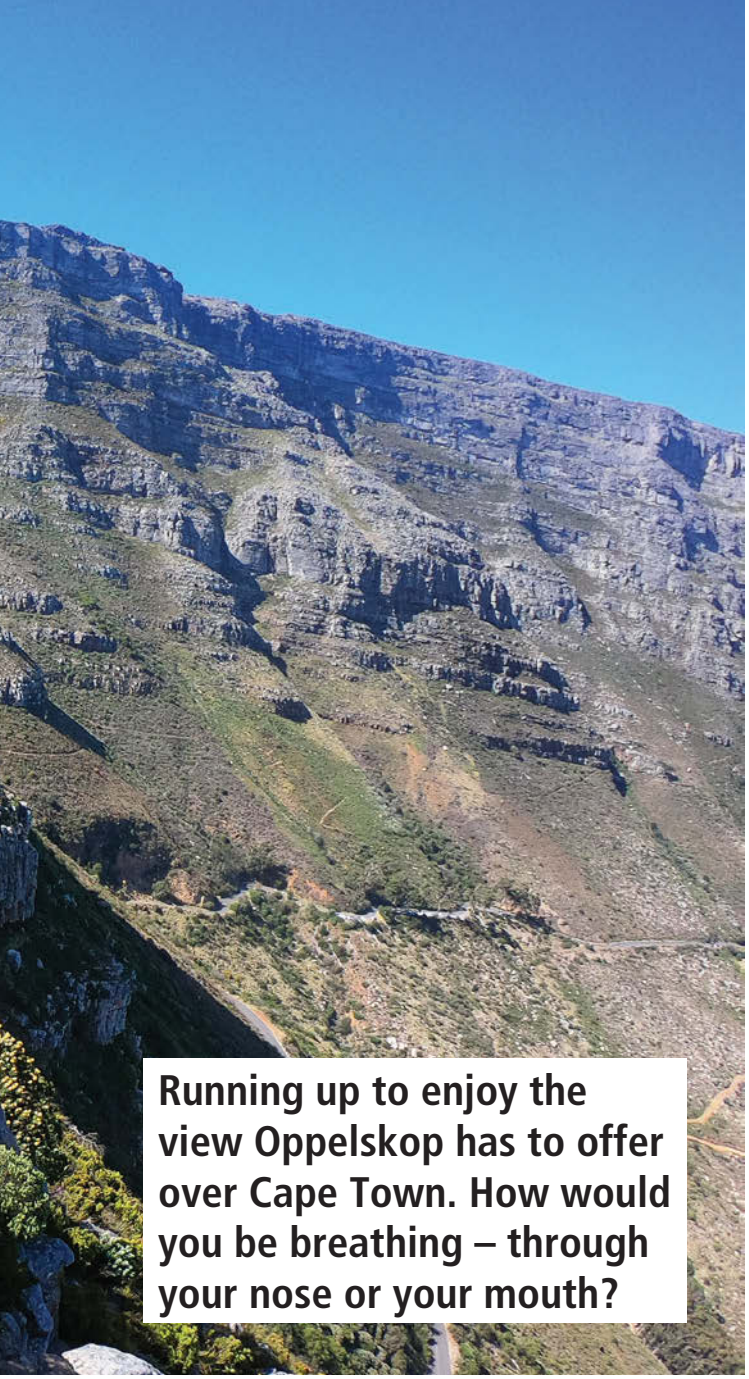
PHOTO JAMIE HOLTZHAUSEN

Breathing is a movement. Are you moving well?

Ever felt particularly breathless out on the trails? Are you huffing and puffing before you've even hit the climb?

What about heavy and tired legs that just won't settle into the run? Yawning when you should be working hard? Sighing a little too often during that interval run? What about tingling fingers, headaches, lack of focus, coughing or suddenly very aware of your beating heart? These are all signs that your breathing might need some attention.

Did you know that breathing influences your training more



Running up to enjoy the view Oppelskop has to offer over Cape Town. How would you be breathing – through your nose or your mouth?

than training influences your breathing? Breathing efficiency and physical fitness are both independent and complimentary; while physical fitness does not always translate into breathing efficiency, breathing efficiency is the gateway to attaining physical fitness.

And yet it is the last thing we think of to train, isn't it? I suppose it's because breathing is one of our body's autonomic functions, occurring on a subconscious level without any input from us, so it's easy to assume we're pretty good at it. But this is not always the case and by improving the way you breathe, both at rest and during movement, it will positively impact your running performance.

Of the three body systems contributing most to performance – cardiovascular, respiratory and musculoskeletal – the respiratory system is, without a doubt, the least appreciated.

"Respiratory health in athletes still remains overlooked," says Dr James Hull, "despite the fact that one in four endurance athletes experience asthma or asthma-type symptoms.

"Many athletes and their coaches often attribute their respiratory symptoms to de-conditioning or assume it is 'just the way you breathe' and yet it is our experience that many of these individuals will ultimately turn out to have evidence of under-treated asthma or breathing pattern problems."

How to breathe

How do we breathe?

To understand why breathing is so important for running performance, we must take a look at how oxygen makes its way from the air that we breathe to the tissues of the body.

Running muscles require oxygen to function. While getting oxygen into the bloodstream is easy – you simply take a breath – getting oxygen from the bloodstream to muscles is more complex. It requires carbon dioxide and oxygen to work in unison.

When we breathe, we take in oxygen, nitrogen, carbon dioxide and trace amounts of argon. This diffuses into the bloodstream and gets carried to cells where mitochondria use them to generate ATP – the energy for contraction. During this process, carbon dioxide pushes oxygen off of haemoglobin and into the cells in a process known as the Bohr Effect.

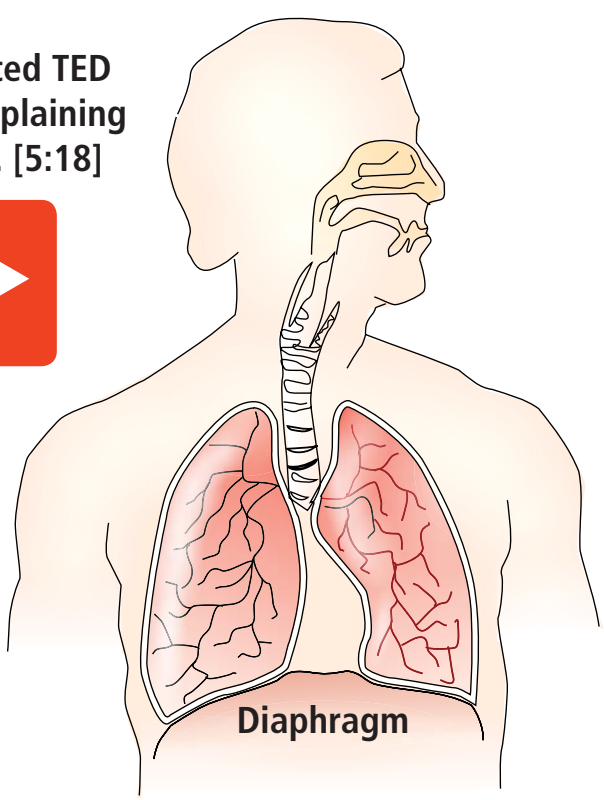
Given the nature of this process, it is fair to say that your running fitness is largely defined by your ability to tolerate carbon dioxide levels in order to use oxygen efficiently.

What is normal breathing?

Normal breathing at rest should be:

- Quiet and relaxed.
- Smooth and rhythmic.
- Through the nose and not the mouth (which should stay closed).
- Shoulders and upper chest should stay still with no accessory muscle use.
- Abdominal ribcage movements using the lower intercostal muscles and the diaphragm.
- Expiration passive and relaxed.
- Rate of 8–14 breaths per minute.
- Inspiration to expiration ratio approximately 1:2 (one second in, two seconds out).

Animated TED Talk explaining breath. [5:18]



Carbon dioxide sensitivity test

Inhale, exhale, and pinch your nose. Time how long it takes before you feel the desire to breathe. You might feel the need to swallow, a constriction of the airways, or involuntary contractions of your breathing muscles in your abdomen or throat as the body gives the message to resume breathing.

Was it 10 seconds? 20 seconds? 30 seconds? More? Your sensitivity to carbon dioxide indicates how well your body can use oxygen to fuel cells while running. The more sensitive you are, the quicker you will want to get rid of it, which means you start breathing faster, delivering less oxygen to the working muscles. This kicks off anaerobic (without oxygen) respiration, which means glucose is used as fuel, lactate builds up, and you lose energy.

A common score for a runner is 20 seconds. If your score is lower, you will likely experience a blocked nose, fatigue, and breathlessness when running. Improving this score can lead to improved physiological economy and a superior exchange between oxygen intake and carbon dioxide output. You could increase your run performance by improving your breathing.

Located below the lungs, the diaphragm is the primary muscle used for respiration. It plays a role in everything from oxygen utilisation to the removal of waste to core stabilisation when running.

But due to the nature of our everyday tasks, with most of us spent hunched over a desk, we place the diaphragm at a mechanical disadvantage. We therefore don't use this powerhouse of a muscle nearly as much as we should.

Instead, we use the mouth to do the nose's job, gulp large volumes of air into the upper chest and use the neck and shoulder muscles (accessory muscles) to do so. Let's change that.

Place your hands below your bottom ribs. Relax the shoulders. Now, take a slow breath in through the nose and feel how the lungs expand (think: nose, low, and slow). Are you using your chest to do the work, or your diaphragm? As you breathe

How to breathe

in, you should feel your hands expand sideways, slightly to the front and slightly to the back – in a full 360° breath.

Remember, the way you breathe at rest sets the tone for how you'll breathe during exercise. You need to be consistent and put in the work at rest first. For athletes, this can be exceptionally difficult because these exercises are not very active and therefore don't seem beneficial.

Breathing during exercise

Breathing changes during exercise. It needs to, in order to meet the metabolic demands of the task. As exertion increases, changes seen include:

- Increase in rate and depth of breathing.
- Gradual transition from nose to mouth breathing.
- More forceful inspiration, coupled with increased upper chest expansion, and accessory muscle recruitment in some.

Wake up your diaphragm: exercise 1

Lie on your back, bend up both knees. Place one hand on your upper chest and one hand just below your bottom ribs. The diaphragm should contract as you inhale, so you should feel your bottom hand move up on the inhale and down on the exhale.
Ideally, your bottom hand should be moving more than your top hand. Breathe in and out slowly, using the nose and without forcing the breath in or out.

- Active expiration with increased abdominal and internal intercostal muscle use.

As exercise intensity increases athletes will transition from predominantly nose to mouth breathing, or a combination between the two. In doing so, this alters the pattern of airflow in the upper airways as well as the relative distribution of resistance within the airway tree.

When ventilation increases with increasing exercising intensity, a sense of breathlessness may develop, if the athlete is unable to adapt their breathing pattern appropriately to this scenario.

If the athlete is unable to adapt their breathing pattern to match the functional demands of the task, then their performance is likely to be compromised. It is common for coaches to perceive the poor performance, resulting from inefficient breathing, to be due to lack of physical conditioning or effort.

Wake up your diaphragm: exercise 2

Perform this if your top hand was moving more in the first exercise. Stay in the same position, but clasp your hands and place them behind your head. This should slightly reduce the movement of the upper chest. Breathe in and out slowly, using the nose. Stay in this position for five to ten minutes, if comfortable.

How to breathe

Limiting performance?

There are a number of factors that may limit exercise tolerance in endurance-trained athletes. We've briefly discussed breathing efficiency and carbon dioxide tolerance, but what about the strength and endurance of the respiratory muscles?

This is important to consider, because unlike any other skeletal muscle in the human body, the diaphragm must contract and relax continuously. That's hard work. And it's especially tough if that muscle is weak.

Did you know the strength and endurance of the diaphragm can be measured, and trained too?

Many endurance trained athletes present with diaphragm weakness, despite being strong in almost all other muscle groups. If your diaphragm is weak, it will struggle to meet the demands that the respiratory system places upon it during intense exercise. As a result, you may recruit the accessory muscles of breathing to help with the increased respiratory load, but you may also feel very breathless, easily fatigued and complain of heavy legs (specifically, the quadriceps).

Inspiratory muscle training (IMT), is a form of resistance training that strengthens the breathing muscles, specifically the diaphragm. The theoretical basis behind the use of IMT is to make respiratory muscles work harder by forced breathing against an added resistance.

The purpose is to make spontaneous breathing without this extra resistance feel easier. It should improve function and performance by decreasing the sensation of breathlessness, decreasing respiratory muscle fatigue, attenuating the metaboreflex, and reducing lactate build-up during exercise.

IMT has been extensively

Breathe to recover

After exercise, lie on your back, hands behind your head.

Close your mouth. Focus on breathing **nose** (in and out), **low** (use the diaphragm, 360° breathing) and **slow** (slow down your breath rate). Count four seconds in, four seconds out, or five seconds in, five seconds out – any duration that feels comfortable.

Dysfunctional breathing

Dysfunctional breathing is a term describing a group of breathing disorders. These changes to breathing patterns result in shortness of breath and other symptoms during exercise, and sometimes even at rest: Asthma, exercise induced laryngeal obstruction (EILO), vocal cord dysfunction (VCD) and hyperventilation all fall into this group.

Do you have strange breathing sounds coming from your throat or chest during high intensity sessions? Come and see us at NHH Pulmonary Rehabilitation, we can help!

Sam bombing down Mont Rochelle Nature Reserve singletrack.

PHOTO JAMIE HOLTZHAUSEN

researched in the cycling, rowing, and running populations, showing significant improvement in time trial efforts and performance.

The Highlanders Super Rugby Team implemented an IMT training protocol in 2012. Studies reported that a 12-week course of IMT gave significant increase in maximum voluntary ventilation (22%), maximum inspiratory pressure (38%) and distance travelled in the YoYo test (13%).

Who can help?

Physiotherapists with a special interest in the field of cardiorespiratory and with the necessary post-graduate qualifications, are equipped to assess and treat altered breathing patterns and respiratory muscle weakness.

By improving breathing efficiency through supervised breathing re-training sessions, strengthening the breathing muscles and sufficiently down-

Case study: Jess Carter*

"I've always been an active person and am fortunate enough to be a professional athlete performing at a national and international level. Fitness training and testing was always an important component but I often found my efforts in training didn't always produce the outcomes I expected because my breathing was holding me back. It felt like my lungs were working overtime but not achieving anything. I struggled in particular with wheezing and air hunger, and went to see a pulmonologist.

"After numerous tests I was diagnosed with exercise-induced asthma and prescribed chronic medication. There was an improvement but I felt my breathing could be better.

"I was referred to Sam (the champion!) Holtzhausen for Respiratory Physiotherapy and the results were immediately noticeable. Within a few weeks, my fitness test results improved dramatically and I've been able to stay consistent with these since I started, using the tools and skills Sam taught me. The wheezing has decreased substantially and I'm not huffing and puffing anymore. With correct breathing, training feels easier, which means I can push myself harder. I'm enjoying the sport that I love so much even more.

"My breathing training has now become a part of my daily routine and I see it as a vital component to my performance."

*Name changed at her request.

regulating the sympathetic nervous system when appropriate, you could enhance your performance and quality of life.

Another advantage of learning to breathe more efficiently is the positive effect it has on post-training recovery, performance during training, improved sleep, improved stress management, and pre-race nerves.

Following The COVID-19 pandemic, there are a lot of people who have taken an interest in the world of breathing. While the enhanced awareness is great, it is really important to seek out a qualified healthcare professional or cardiorespiratory physiotherapist if you feel you have an issue with your breathing. Changing the way you breathe can be big deal and the experience is different for everyone.

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