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What anxiety does to our breathing

Stressful situations can cause anxiety, our body's natural response to stress. But feelings of apprehension can also be accompanied by physical effects such as rapid breathing, increased heart rate and nausea. How our brain perceives these physical changes – in particular, breathing – could be key to better understanding anxiety disorders and treating them.

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Anxiety disorders are the most common mental health problem in Europe, affecting about 25 million people across the region.

Whereas anxiety is a normal reaction to difficult times, enabling us to take precautions, people with disorders can have high levels of dread that come out of nowhere and affect their daily life.

'Having an anxiety disorder is when anxiety levels are both elevated and are causing problems,' said Dr Olivia Faull, a neuroscientist at the University of Zurich in Switzerland. 'It can stop (people) from doing things that they would like to do or things that they need to do like going out to the shops or visiting friends.'

Although existing treatments can help, they aren't ideal for everyone. Drugs such as serotonin reuptake inhibitors can alleviate symptoms but may also be accompanied by negative side effects. Exercise is recommended since it can activate the frontal part of the brain which helps control our reactions to real or

imagined threats. But it's not appropriate for people with certain types of anxiety. 'It might be far too much for someone who has severe social anxiety,' said Dr Faull. 'They don't want to go to an exercise class or have a personal trainer.'

New treatments for anxiety are therefore needed and could be developed using a new approach. Dr Faull and other researchers are now investigating the link between anxiety and our ability to perceive what's going on inside our body, called interoception.

'It's a novel research domain and we don't know much about it yet,' said Dr Omer Van den Bergh, a health psychology researcher at the University of Leuven in Belgium.

Signals

Interoception involves sensing signals from internal organs, such as changes in heart rate or how hard you're breathing. When running, for example, most people are aware that their heart is beating faster and that it's more difficult to breathe. Feelings of hunger also stem from gauging sensations in the gut.

Research, however, suggests that people with high anxiety levels may not accurately perceive what's going on inside their body. Early work on this found anxiety disorder sufferers to be less sensitive to changes in their breathing compared to healthy individuals. A recent study found that there seem to be differences in how anxious individuals perceive different bodily signals. Heart signals were typically gauged more accurately compared to breathing.

Dysfunctional interoception is thought to be both a cause and effect of anxiety. For example, an anxious person may not notice changes in breathing until they become extreme and they suddenly feel lightheaded. The physical symptoms then add to their initial worry and make them even more anxious. 'If you aren't able to dissociate the symptoms and your thoughts as to what's making you anxious, they can just feed off each other,' said Dr Faull.

Some anxiety sufferers may also misinterpret interoceptive signals from their body. Dr Van den Bergh and his colleagues are particularly interested in how health anxiety and somatic symptom disorders, which involve physical symptoms that can't be medically explained, affect a person's perception of their internal state.

Someone may be constantly scared that they have a brain tumour, for example. If they become stressed and their breathing and heart rate change, they may wrongly interpret the physical symptoms. 'They might receive evidence for a brain tumour even if there is very little discriminative input from the body,' said Dr Van den Bergh.

Mistaking a benign symptom for a sign of disease has advantages. If you're feeling breathless during exercise, for example, your brain has to decide if it's simply a normal side effect or if you are ill. Assuming you are ill may be a false alarm but it ensures that you don't miss a threat that could kill you.

'Better safe than sorry is a very important survival mechanism,' said Dr Van den Bergh. 'Some people are more tuned than others to apply this strategy depending on how you grew up and adverse experiences in childhood, for example.'

Dr Van den Bergh and his colleagues hypothesise that anxious people and particularly those with somatic disorders are guided by their fears rather than actual symptoms. They developed a paradigm to test their theory which was used in a project called CIP (see box)

'If you are chronically concerned about having somatic symptoms, you put your brain in a state of readiness to perceive the things you are afraid of,' said Dr Van den Bergh.

A better understanding of how interoception differs in anxious people could lead to new treatments. Dr Van den Bergh thinks that anxious people could be trained in interoceptive differentiation while adopting an attitude to 'let information come' rather than anxiously anticipate a threat. 'We believe that this might be a

new route,' he said.

Breathing

Breathing tests themselves could also give more insight into how sensitive anxiety sufferers are to respiratory signals. Dr Faull and her colleagues are investigating how anxiety changes the brain's perception of interoceptive information from breathing as part of the ILBAB project. As a first step, they are examining healthy volunteers who experience either mild or moderate anxiety to establish if there are any differences. In a follow-up project, Dr Faull wants to tackle clinical anxiety.

In one experiment, thirty people from each anxiety level group were asked to inhale though a tube and report whether they thought a resistance had been added and if so by how much. They were also asked how confident they were about their answer. 'It's like your ability to judge how well you did in an exam before you got the results back,' said Dr Faull.

Preliminary results suggest that people with higher levels of anxiety are slightly less sensitive to changes in breathing, which was expected from previous work using different techniques. Their early findings also suggest that higher anxiety impairs awareness of interoception or what Dr Faull refers to as insight.

A different study, however, has shown that anxiety has no effect on insight, but it involved a visual task, which requires taking in signals from one's environment rather than inside the body. Dr Faull thinks this makes sense given an anxious person could be capable of helping a friend navigate a crisis, but may not be logical about a personal problem.

'When it turns to themselves, and the signals are from themself, then that insight is impaired,' she said.

The team's ultimate goal is to come up with targeted treatments involving breathing exercises for a range of psychiatric disorders including clinical anxiety and depression based on their findings. But if patients have a better understanding of the link between anxiety and perception of breathing it could help too.

Once they have more concrete results, Dr Faull and her colleagues plan to talk to the public about them as it could help patients to better manage their anxiety. Recognising how anxiety changes insight could be particularly helpful.

'When (someone) is in a very big state of anxiety, they need to remember that their insight is probably quite compromised,' said Dr Faull. 'That's why it maybe feels so overwhelming.'

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Rating the effort of breathing

In a series of tests to study anxiety and breathing, researchers manipulated participants' breath by making them inhale from a breathing system where resistance is applied, changing the effort it takes to breathe. In one experiment with healthy individuals, the resistances were presented randomly and participants rated them based on several factors such as intensity and unpleasantness. In another task, the same resistances were categorised into two groups, A or B, based on their intensity. The lowest four resistances formed category A while the highest four were part of category B. The participants were told the category of a stimulus when it was presented and asked to rate it again.

The team found that there were differences in how the stimuli were perceived when presented without and with a category. Participants would find stimuli from the same category to be more similar than when they were presented uncategorised. Differences between stimuli from different categories became more pronounced.

The idea behind the tests was that using categories, such as low and high intensity, creates expectations and can prime a person to anticipate a certain type of breathing stimulus. This priming effect is similar to how the

fears of an anxious person can influence their interoception. The effect of categorisation is expected to be more extreme in anxious people since they place more importance on their expectations.

However, one study revealed that the relationship isn't that simple. The team found that anxious individuals only misinterpreted stimuli that were at the boundary of two categories and therefore more ambiguous. Only a stimulus that is unclear may therefore be perceived as a threat. It shows that interoceptive abilities in anxious people are flexible and depend on the stimulus, says Dr Van den Bergh.

More info

CIP

ILBAB