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An Introduction to Mindfulness

What is it and how might it be useful to people with diabetes?

Dr David Webb
Pattacus Medical Consulting, Johannesburg

Diabetes and mental health

Diagnosis of chronic disease can be devastating to a patient's psychological health. It is often associated with a sense of loss and for some even the possibility of death, or at least the perception of that. This may challenge beliefs about control, self-efficacy and certainty. Associated emotions may include anxiety, fear, worry and sadness, and, especially where the illness might be perceived as self-imposed by lifestyle or behaviour, feelings of guilt, shame and self-blame.

Depression and anxiety are common comorbidities with chronic disease. In a WHO World Health Survey of 245 404 adults from 60 countries, the overall prevalence of depression alone was 3.2 %, whereas it was 9 % among those with diabetes, and 11 %, 15 % and 18 % among those with arthritis, angina and asthma, respectively.

More than half of all people with diabetes are estimated to suffer emotional distress related specifically to the condition. Stress, in turn, is associated with a range of adverse outcomes, including impaired glycaemic control, impaired physical and mental health and an overall decrease in quality of life. It is estimated that almost 1 in 3 people with diabetes will, at some stage, experience significant depressive symptoms. The course of depression in diabetes is often chronic and severe, with up to 80 % experiencing a relapse of symptoms over a 5-year period. Associated nonadherence to recommended eating plans, medication regimens and blood glucose monitoring may adversely affect clinical outcomes.

Mindfulness

Mindfulness may be defined as "the awareness that emerges through paying attention on purpose, in the present moment, and non-judgmentally, to the unfolding of experience moment by moment." It involves a consciousness of sensations, perceptions, emotions and thoughts and is the attentional state that underlies all forms of meditation.

Mindfulness-based intervention has been shown to assist in recovery from a variety of painful and psychological conditions, especially depression and anxiety. It is believed to work by increasing ability to be attentive to both internal (self) and external environments, increasing self-awareness, improving emotional regulation, reducing cognitive and emotional reactivity to stressful events and thoughts, and promoting resilience and self-compassion. In studies of varying quality, mindfulness has also been

shown to improve symptoms and wellbeing (especially psychological outcomes) in patients with a variety of chronic diseases, including cancer, chronic pain, fibromyalgia, rheumatoid arthritis, cardiovascular disorders and diabetes.

Mindlessness: The naturally wandering, self-centred mind

The natural default state of the undirected mind is to wander. The neuroanatomy of this 'resting' state of mind has been identified to a cluster of brain areas that activate and deactivate together. Activity in these areas increases during rest and decreases during engagement in directed cognitive tasks. Collectively these areas have been termed the default mode network (DMN). The DMN connects cortical and limbic structures, including, among others, medial prefrontal cortex (PFC), medial parietal cortex (including anterior and posterior cingulate cortex/precuneus), medial temporal lobe, hippocampus and amygdala. In contrast, areas of the brain typically functioning together during attention-orientated tasks are anatomically and functionally distinct from the DMN. These cognitive control networks include dorsolateral PFC, medial temporal cortex, parietal lobe, insula bilaterally and supplementary motor area.

In addition to its tendency to mind wandering, the natural state of the DMN is inward and self-focussed, associated with identification of self-salient stimuli and autobiographical search and memory retrieval.

Consequently, the resting state of the undirected mind is a narrative self-centred and sometimes self-judgemental experience involving generation and manipulation of thoughts predominantly centred on the individual's past and future.

From a functional point of view, the DMN is thought to play a role in self-referential processing, goal setting and consolidating past events, anticipating future plans and taking alternative perspectives.

However, DMN activity can be maladaptive. Both spontaneous thought and DMN activity may predict poor performance on a wide range of tasks. Furthermore, various disorders of mood and emotional regulation have been associated with excessive activity of the DMN and/or altered connectivity both within the DMN and between the DMN and other areas of the brain. Thoughts may be extremely introspective, focussing on one's own thoughts, feelings, desires, abilities and physical attributes. In addition, mind wandering may be excessively concerned with the thoughts and mental states of others (mentalising), where interpersonal interactions and social narratives are played out in the mind-wanderer's head.

Abnormalities in the DMN have been associated with stress, depression, anxiety, dementia, schizophrenia, epilepsy, autism, and attention deficit hyperactivity disorder (ADHD).

In healthy individuals, higher perceived stress and low resilience to stressful stimuli have been associated with increased connectivity between the areas of the DMN, including the anterior cingulate cortex and the amygdala.

Negative, self-focussed rumination is the hallmark of depression in both healthy individuals and those with major depressive disorder (MDD). Excessive and persistent rumination on negative self-relevant information plays an important role in the development, maintenance and worsening of depression and increased risk of relapse among patients with major depressive disorder (MDD) who have achieved remission. Depression is associated with failure to switch between self-referential and goal-directed cognitive activity, and inability to reduce activity in DMN while performing emotional focussed tasks. Furthermore, in depressed individuals, there is evidence of dysfunctional connection with, and increased activity in, areas of the limbic system responsible for emotion and memory (amygdala and hippocampus) and increased connections with the subgenual PFC, an area of the brain associated with evaluation of the consequences of social behaviour. These variations may contribute to the characteristic symptoms of depression, including self-criticism, pessimistic rumination, emotional reactivity, emotional disinhibition and increased stress.

Mind wandering, of course, does not only occur during times when attention is unfocussed. Regardless of the task at hand, or how hard one might try to pay attention (including experienced meditators), attention states are in constant fluctuation. It is estimated that between 30 % to 50 % of daily life is spent in

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thoughts unrelated to the task at hand, with more time dedicated to spontaneous thought when those tasks are easier or more practiced. One is not always aware that the mind has wandered; as observed by Segal and colleagues, "the mind has a mind of its own".

In a large observational study, more than 2500 individuals were randomly contacted by means of a web application for iPhone and asked to report what they were doing at that moment. At the same time, they rated their level of happiness and indicated whether their mind was wandering (*"Are you thinking about something other than what you are currently doing?"*). Mind wandering was found to be extremely common, occurring in almost half of the samples and, in comparison with focussed attention, was directly associated with lower levels of happiness. The nature of the activity at hand had minimal or no impact on the occurrence of mind wandering or the pleasantness of the topic to which the mind wandered. Reduced happiness occurred regardless of the pleasantness of the topic to which the mind wandered, but mind wandering to neutral or unpleasant topics was associated with considerable declines in happiness.

Interestingly, in healthy subjects living in an urban environment, a 90 minute walk in a natural setting was associated with a decrease in both self-reported rumination and neural activity in the subgenual PFC. In contrast, a 90 minute walk in an urban setting had no effect on either. This suggests that, given the association of increased depression with urbanisation, increasing access to nature within the urban setting might be one means by which to reduce destructive mind wandering and improve mental wellbeing.

In contrast to paying too little attention, paying too much attention may also be detrimental to performance of activities that require implicit processing, such as creativity, sensorimotor skills or implicit learning. A balanced attentional state is one in which the focus of attention is regulated such that minimal effort is applied to those activities that require it, but increased effort is available where explicit processing, such as working memory, is necessary. This requires complex interactions between areas of the brain, including the anterior cingulate cortex, striatum, insula (implicit processing) and frontoparietal cortex (effortful processing), and the sympathetic and autonomic nervous systems to monitor and maintain attentional state and reduce conflict between attentional states. Open awareness to internal and external stimuli and engagement and maintenance of an effortless attentional state with mindfulness meditation has been shown to induce better regulation of these pathways and optimise performance in terms of self-control, attention and efficiency.

What is the mind?

In seeking to understand mindfulness, sooner or later, one has to ask this obvious question! Nevertheless, a straightforward answer is elusive; theory concerning the nature and place of the mind has been debated among philosophers, religious scholars, psychologists and scientists for centuries.

One approach is that of theory of mind (ToM) - the everyday ability to attribute mental states to self and others in order to predict and explain behaviour. Simply stated, in ToM, the *mind* may be regarded as the mental processes that inform behaviour.

Although the anatomical structures and neurophysiological events in the brain, thoughts and emotions are inextricably linked, they also remain distinct in that each may profoundly affect the other. Furthermore, each may be modulated by objective physical experience and, in return modulate that perceived experience. By way of illustration, consider some examples listed in Table 1.

Table 1: Examples of bidirectional relationships between objective experience, brain, thought and emotion

- Ongoing acute nociceptive pain, or lesions of the peripheral nerves as in diabetic peripheral neuropathy, modulate changes in the anatomy and neurochemistry of peripheral and central nervous systems, resulting in chronic, difficult-to-treat neuropathic pain.
- There is a bidirectional relationship between chronic pain and affective symptoms. Emotional distress, depression and anxiety increase with pain severity. Conversely, patients with somatisation, health-seeking behaviours and poor sleep are at high risk of developing chronic widespread pain, where risk increases in tandem with severity of anxiety, depression or sleep problems, and those with multiple predisposing factors are at highest risk.
- Psychosocial adversity, stress and recurrent depressive episodes may be associated with structural and functional abnormalities in the brain, at least some of which may be reversible.
- Ruminating thoughts may predispose to depressed mood and relapse after remission in patients with MDD.
- Imagining or remembering an argument or frightening event (thoughts) may provoke emotions of anger or fear.

In this context, the mind may be regarded as a fifth component of consciousness that monitors and modulates the interactions between objective experience, brain activity, thoughts and emotions

In this context, the *mind* may be regarded as a fifth component of consciousness that monitors and modulates the interactions between objective experience, brain activity, thoughts and emotions. The *mind* determines how one relates to these in terms of relationship to self, and emotional and behavioural responses and is the tangible expression of that.

In unawareness, mind wandering and preoccupation with self, individuals may create self-identity with their thoughts, emotions and circumstances (I *am* depressed; I *am* short tempered; I *am* not creative; I *am* incapable). However, thoughts and emotions are often based on subjective experience, rather than the true nature of reality, and are transient (as so often are circumstances). Segal compares them to clouds in the sky. They arise, they pass over and they go. And, they can be observed doing so. Claiming thoughts and emotions as part of the self, instead of acknowledging them as the transient visitors that they are, can provoke self-judgement and further self-recrimination, in turn contributing to chronic rumination, persistent low mood, low self-efficacy and poor coping skills.

In unawareness, interpretation of objective experience, thoughts and emotions often culminate in impulsive, reactive emotional responses, decisions and behaviour that may be unhelpful. The consequences may be less than desirable, or even detrimental to the individual. Dysfunctional consequences may reinforce negative self-defeating thoughts and emotions, creating a vicious cycle of cause and effect.

Conversely, an aware mind in which monitoring and modifying skills are trained and strengthened is receptive and responsive rather than reactive. By being 'present' to internal experience, emotional and behavioural responses are informed by perspective and insight. The individual is better able to calmly approach difficult situations (equanimity) and make decisions that result in improved outcomes. A proposed schematic representation of the aware and unaware mind is presented in Figure 1.

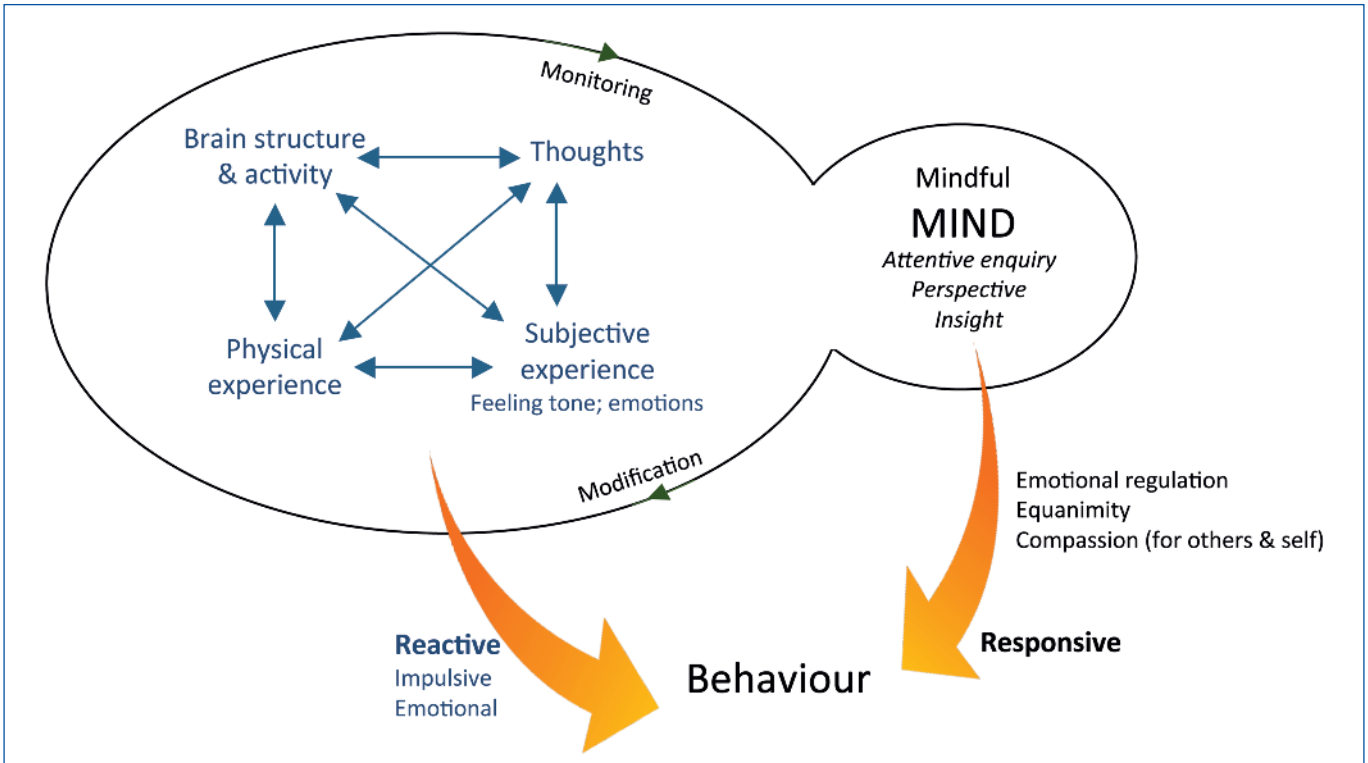

Figure 1: Schematic model of the reactive (unaware) and responsive (aware) natures of the mind. Feeling tone: pleasant, unpleasant.

Mindfulness-based intervention

The most common forms of mindfulness training used in clinical practice are mindfulness-based stress reduction (MBSR) and mindfulness-based cognitive therapy (MBCT). Courses are usually group-based, meeting weekly for 8 weeks, and consist of psychoeducation combined with meditation training and mindful movement.

In clinical studies, mindfulness techniques have been associated with modulation of the stress-immune response and neuroplastic changes in structure (density and volume), connectivity and activity in various domains of the brain associated with attention control, emotional regulation and self-awareness. Some of these areas include the anterior cingulate cortex, PFC, insula, somatosensory cortex, thalamus, hippocampus and amygdala. Mindfulness meditation is associated with enhanced connectivity of the DMN and between the DMN and areas in the PFC known to be important in self-referential mental imagery, reward processing, top-down executive control at rest, and flexibility in context-appropriate switching between networks engaged in external and internal aspects of cognition. Through mindful acceptance and effortless attention, mindfulness can regulate and optimise focus of attention on the activity at hand, allowing for maintenance of a balanced attentive state with minimal effort. This improved ability to switch between attentive states that require more or less effort is likely to impact on performance in cognition, positive emotion, health and quality of life.

Mindfulness training for people with diabetes

In people with diabetes, glycaemic control requires continuous, moment-to-moment self-management and problem solving. In this regard, by promoting insight, acceptance of the condition and self-compassion, mindfulness training can improve coping skills and the patient's sense of control. Emotional regulation can help to reduce psychological distress and stress-mediated variation in glucose regulation. Moderation of negative diabetes-related cognition, depression and anxiety may reduce the impact of these emotions on sleep, nonadherence to healthy food and caloric intake, physical activity, glucose monitoring and pharmacotherapy, and improve self-care. Increased awareness of symptom variability and intensity may facilitate timeous self-management.

Although they are generally small and of short duration, observational and randomised studies have shown positive results of mindfulness-based interventions in diabetes, in terms of reduced depression, anxiety and diabetes-related distress, and improved coping skills. However, only a few have shown associated improvements in glycaemic control. In the long-term observational New England Family study among individuals with type 2 diabetes, greater dispositional mindfulness was associated with better glucose regulation, lower likelihood of obesity and central adiposity and greater sense of control. In two small studies, one of which was randomised, MBCT and MBSR were associated with reduced diabetes-associated distress, improved coping skills and improvement in HbA1c. In a third study, in comparison to control subjects, pregnant women with gestational diabetes mellitus who participated in yoga and mindful eating had a significant reduction in fasting plasma glucose, postprandial glucose and HbA1c.

Who will benefit from mindfulness-based intervention?

Mindfulness-based programmes for diabetes are an adjunct to usual patient care, including pharmacotherapy, lifestyle change and education. Programmes usually run over a period of weeks and require commitment to both attendance and daily practice of mindfulness-based techniques (e.g., meditation). Furthermore, higher expectations of improvement from participation may predict course completion and costs of treatment may be an issue for some patients. Therefore, it is helpful to identify patients who are motivated and to assess expectations of participation before selecting them to embark on a mindfulness-based programme.

Conclusions

Although currently available clinical studies are small and generally of low quality, there is evidence that, in motivated individuals with diabetes, mindfulness-based interventions can be a helpful adjunct to usual treatment to improve emotional regulation, mood, self-efficacy and quality of life. Mindfulness has potential to improve adherence to a healthy lifestyle and treatment, thereby influencing both glycaemic control and clinical outcomes.

Clinically qualified mindfulness practitioners can be located through the Institute for Mindfulness South Africa (IMISA) at www.mindfulness.org.za.

Dr David Webb is a medical writer and an associate at Houghton House Group of drug and alcohol addiction rehabilitation facilities.

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