



# Exploring the Effects of Yoga and Mindfulness Meditation Practice on Modulating Stress Responses and Long-Term Health Outcomes

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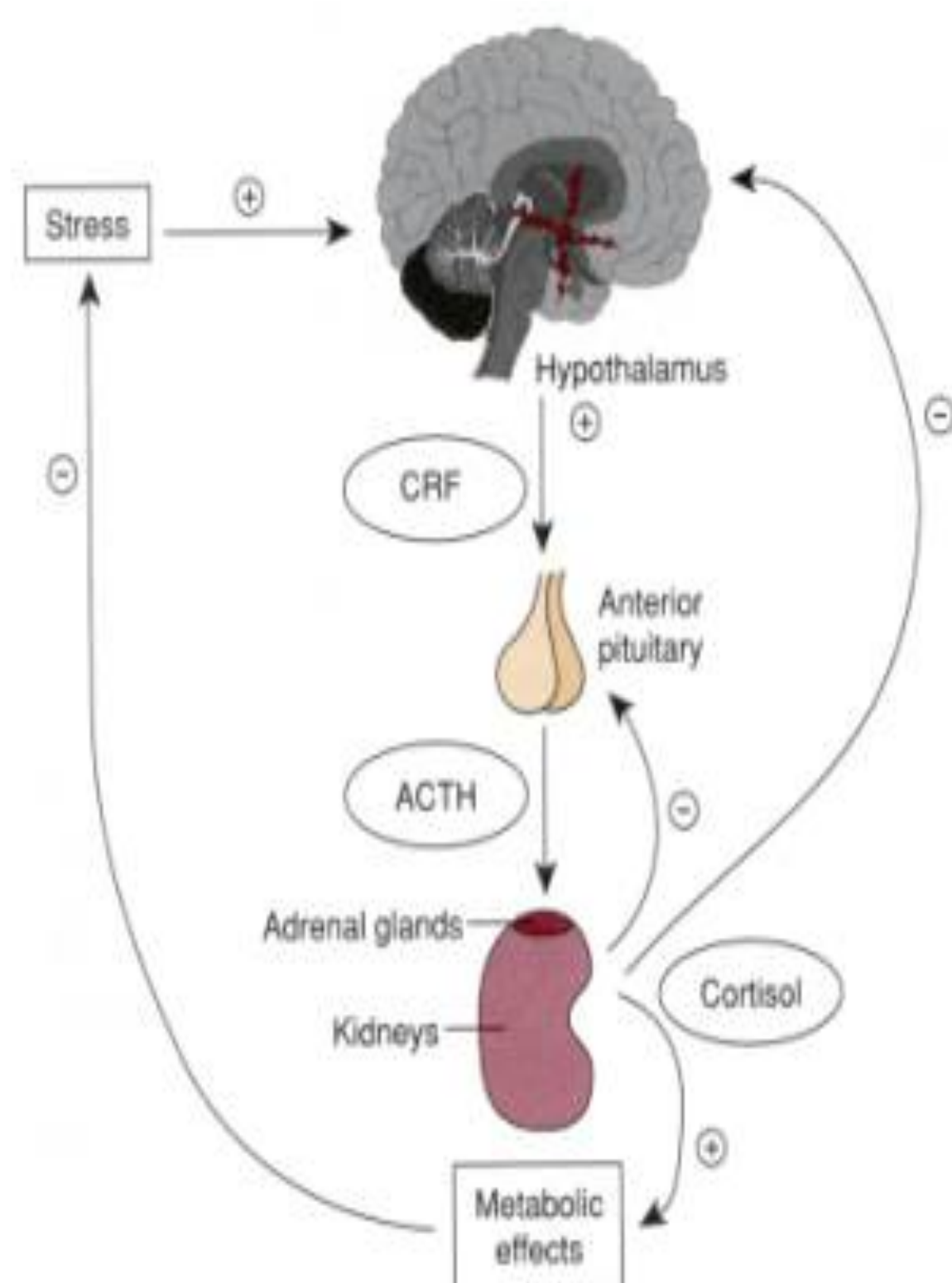
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## Stress Mechanisms

### Introduction

The body responds to stressful experiences through multiple signaling systems that have evolved to manage perceived threats to survival. However, in human society the “fight or flight” response may be engaged in situations non-threatening to life [1]. Some stressful activation of these response mechanisms, which include the HPA axis and inflammatory pathways—may be *positive or tolerable*. Through *allostasis*—the process of achieving stability or homeostasis through physiological or behavioral change—these mechanisms respond to manage these non-acute, short-term stressors. The experience of *toxic stress*, however, places acute and often chronic demands on stress signaling and includes such stressors as discrimination, emotional and physical abuse, and living with a chronic illness. All these have been linked to major causes of adult morbidity and mortality, including cardiovascular disease, obesity, cancer, and anxiety-related disorders [2,3,4].



### The Hypothalamic-Pituitary-Adrenal (HPA) Axis

- ✦ Responsible for the “fight or flight” response
- ✦ Its hormone signaling cascade suppresses reproductive, digestive and immune system function
- ✦ Chronic over-activation of the HPA axis causes [2]
  - Decreased *immunity* and *digestive* function
  - Increased production of *pro-inflammatory cytokines* (IL-1, IL-6, TNF- $\alpha$ ), which elicit symptoms of anxiety/depression, and may provoke neuroendocrine and neurotransmitter changes that are interpreted by the brain as being stressors (feedback) [5]
  - *High blood pressure* and *obesity*
  - Decreased *hippocampal* volume and function—disruptive of learning, memory and emotional experience
- ✦ *Glucocorticoid cascade hypothesis* [6]
  - Exposure to stress hormones reduces cells’ ability to resist injury and attrition, causing them to be damaged or die at an increased rate
  - Increased rate of *oxidative stress* – process occurring when an imbalance occurs between the production of free radicals and a cell’s antioxidant capabilities
  - Thought to be a risk factor in developing several neurodegenerative diseases, including Parkinson’s and Alzheimer’s disease

## Why Mindful Meditation and Yoga?

Mindfulness Meditation (MM) and Yoga are mind-body disciplinary practices originating in Buddhist and Hindu contemplative traditions and known to modulate autonomic nervous system function, particularly through attention to the breath.

### Integration with Western Medicine

In recent decades, MM and yoga have been popularized in the West as forms of preventative, low-cost, and wellness-based complementary therapies that mitigate the effects of chronic stress. Several studies indicate that these practices offer physiological and psychological benefits including:

- ✦ Self-reported decreases in stress and anxiety
- ✦ Improved cognitive functioning
- ✦ Cardiovascular health

### Future Research

- ✦ Despite burgeoning interest in the stress-reducing effects of MM and yoga, most studies are rife with methodological problems
- ✦ Focus should be placed on: increasing sample size, teasing out variations in quantity and qualities of MM and Yoga practice, standardizing biomarker collection procedures and control groups.

## Mindfulness Meditation as a Path to Stress Reduction

### What is Mindfulness Meditation (MM)?

✦ *Mindfulness* is the *non-judgemental* drawing of one’s attention to experiences/sensations happening in *the present* moment, often beginning with awareness of one’s *breath* [1].

- Mindfulness meditation (MM) is rooted in Buddhist contemplative traditions that cultivate conscious awareness through specific, mind-body techniques valuing non-judgement, acceptance, and compassion.
- This mindfulness framework distinguishes MM from other activities which may modulate stress only through induction of a Relaxation Response [2].

Many clinical [4] and community-based [5] meditation programs derive from **Mindfulness-based stress reduction (MBSR)** [1,3] developed by Dr. Jon Kabat-Zinn at UMass Medical Center.

- ✦ Eight-week program
- ✦ Mindfulness training, seated meditation, mindful yoga and body-scan, home assignments

### Studies: Self-Reported and Bio-indicators of Stress Reduction

✦ **Biomarkers:** A 2007 study [4] investigated the effects of participation in an MBSR program on self-reported stress symptoms, mood, endocrine, immune and autonomic parameters in early stage breast and prostate cancer patients. At 6- and 12-month follow-up, significant improvements in symptoms of stress were found and maintained, including:

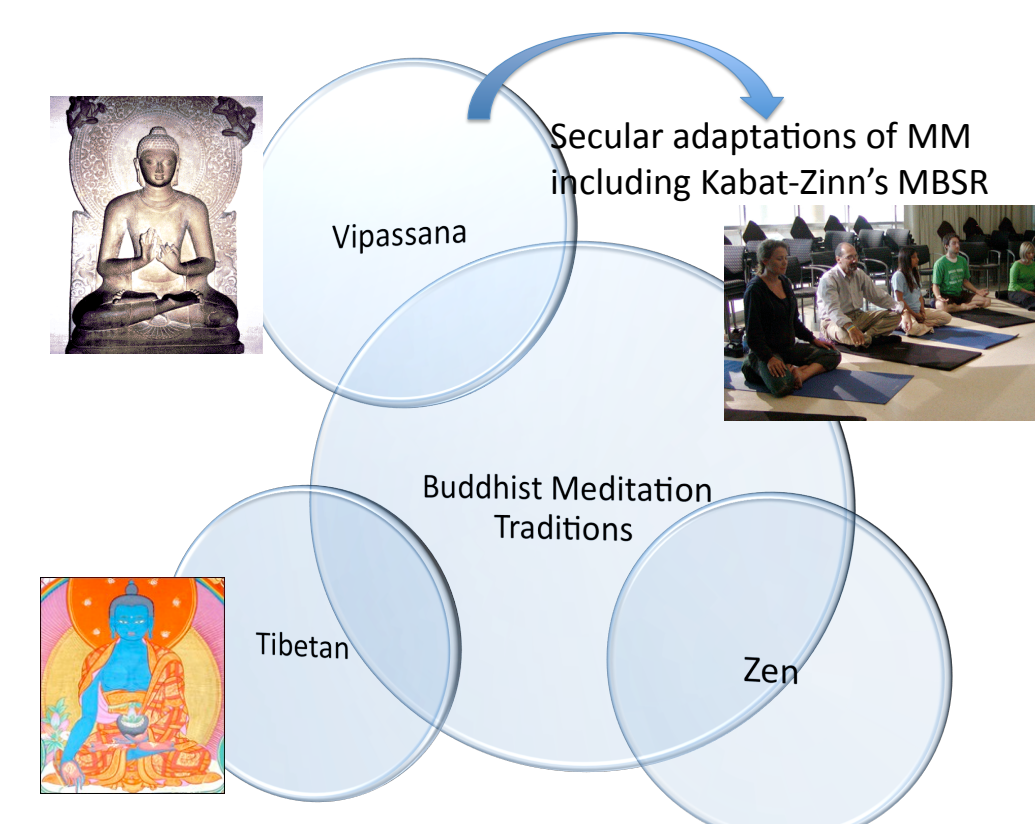
- A reduction in cortisol levels
- A reduction in pro-inflammatory cytokines
- A decrease in systolic blood pressure
- Decreased self-reported symptoms of stress

✦ **Self-reporting:** A 2010 study [5] considering the usefulness of MBSR as a community-based practice for low-income, predominately African American women with history of PTSD and Intimate Partner Violence

- MBSR was much more accessible than psychiatric PTSD treatments
- Women reported that mindfulness practices reduced day-to-day stress, promoted self-care, sleep, attention, and healing from trauma

### Mindfulness Meditation and Brain Morphology

✦ Neuroimaging studies of experienced MM practitioners show increased hippocampal and right anterior insular volume and prefrontal cortical thickness (offsetting age-related cortical thinning) [6,7].



## The Role of Yoga in Stress Relief

### What is Yoga?

- ✦ Means “to unite” or “to unify”
- ✦ Aims to integrate the mind, body and spirit
- ✦ Six main branches – Hatha yoga most popular in the West
  - Places the most focus on balancing mind and body
  - Achieved through physical poses (“asanas”), breathing techniques (“pranayama”), and meditation. [1]

### Studies

The focus on mind-body integration distinguishes yoga practice from other forms of physical exercise and may also explain the wide range of its effects on those with conditions stemming from chronic stress.

1. *Effects on coronary risk factors* (all exacerbated by chronic stress) – 2003 review [2]

- ✦ As effective as controlling blood pressure pharmacologically in hypertensive subjects
- ✦ Helped restore baroreflexes – the homeostatic mechanism to maintain blood pressure – to a normal state
- ✦ Improved serum lipid profiles and weight management
- ✦ Decreased urinary excretion of adrenaline and noradrenaline
- ✦ Increased cortisol excretion

2. *Effects on anxiety* – 2005 study [3]

- ✦ Self-reported distressed women put into three-month Hatha yoga intervention program
- ✦ Depression and anxiety reduced by 50% and 30%, respectively
- ✦ Back pain and frequent headaches completely eliminated

### Proposed Mechanisms of Action

The benefits derived from yogic practice may be due to the repetition of postures and slowed breathing, which both stimulate the relaxation response and other physiological changes. Slowed and metered breathing re-synchronizes inherent cardiovascular rhythms, a phenomenon observed in people reciting *mantras* or the Holy Rosary, and the postures repeatedly occlude and open peripheral vessels, altering blood flow and changing endothelial function. As a result, nitric oxide, a cellular signaling molecule involved in cytokine production, is decreased. The relaxation induced from yoga may also stimulate the production of endogenous opiates and cannabinoids. [4]

## Conclusions

- ✦ Mind-body techniques of Mindfulness Meditation and Yoga have salutary effects being researched with increasing sophistication in relation to self-reported and bio-markers of stress
- ✦ Yoga and MM are unique from regular exercise and practices merely eliciting relaxation, due to breath-centeredness and rigorous mindfulness
- ✦ Many risk factors for stress-related morbidity and mortality can be reversed or minimized through lifestyle changes including MM and yoga
- ✦ Yoga and MM are associated not only with biochemical mechanisms of stress reduction (increasingly), but also with self-reported decreased distress, and with greater sense of control and quality of life

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