# DNAfit

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Your crash course in healthy living & life-long healthy habits

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# Understanding Stress

Stress is something we all experience at some point in our lives, in fact, the American Institute of Stress found that a third of Americans in 2014 were living with extreme stress. With a highpressure world that's now compounded by the impact of Covid-19, complete removal of all stress is unavoidable, but there are things we can do to lower the negative effects of stress.

This guide will help you understand the types of stress we encounter, the long term effects of stress, and how the stress process works in our body. We'll also provide insights into positive changes that will allow you to feel fit.

### Acute and Chronic Stress

Stress can be classified according to its duration (how long it lasts). Acute stress is short in duration, lasting from a few minutes to a couple of hours. Chronic stress on the other hand tends to have a longer effect, lasting from days to weeks. The most common sources of chronic stress in our modern life, including job pressures, money, chronic health conditions, and relationship problems.

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These modern-day stressors were completely unknown to our ancestors where the stress response allowed them to escape danger and adapt to new situations. In our modern-day life, acute stress can also promote adaptation, helping us become stronger and fitter. In the long run, however, chronic stress can cause changes in the brain and body that can lead to disease.



### Psychological and Physiological Stress

Stress is also often classified according to its origin (where the stress is located). Physiological and psychological stress are often closely related and have an impact on each other. Physiological stress is usually used to explain stressors that have a direct effect on how your body feels and functions. For example, pain, illness and chronic inflammation are all physiological stressors as they affect your health and bodily functioning directly.

Psychological stress on the other hand usually occurs as a result of a social threat that requires someone to go past their coping threshold. This could be caused by anything from a financial crisis, to relationship problems, to a poor performance review. Psychological stress affects not only our mental wellbeing but also has similar effects on our health as physiological stress does. Both types of stress threaten our health and have overlapping pathways in our bodies. In both cases, our nervous system is the most important pathway to consider in the stress response. A good understanding of our nervous system and how it works helps us to understand and combat stress more effectively.

The nervous system is involved in receiving information about the environment around us and generating responses to that information. The diagram above explains how our nervous system is broken down, and the most important thing to notice is the two main branches: the central nervous system and the peripheral nervous system. The central nervous system includes the brain and spinal cord, whereas the peripheral nervous system is made up of all the nerves outside of the spinal cord. Both systems are involved in the stress response, and we'll go into more detail about how these systems affect our stress response, and what we can do about it in this guide.



# Part 1: The Autonomic Nervous System

A car has backfired next to you! Before you've even fully taken in the situation and had a chance to startle, your brain has already alerted the autonomic division of your peripheral nervous system. This is the part of your nervous system which is responsible for some of the 'background functions' in your body such as digestion, breathing and blood pressure control, and it has two divisions: the parasympathetic and sympathetic nervous systems.



## Sympathetic and Parasympathetic Functions

As previously mentioned, your autonomic nervous system is made up of two opposing systems, the sympathetic nervous system (SNS) and parasympathetic nervous system (PNS). The SNS is responsible for "fight or flight" functions in the body. This part of the autonomic system is activated during times of stress and promotes body functions that allow us to escape a threatening situation. Once a stressor has been removed, and you no longer feel threatened, the PNS then brings your body back to a balanced state known as "rest and digest".

When your SNS kicks in, your body activates areas that would help you escape or fight the threat and switches off areas that are not necessary for the situation. For example, functions related to digestion and urination are not a priority when you are being stared down by a bear. On the other hand, many functions are activated to assist your body. Better vision (dilated pupils), improved oxygen intake (relaxed airways), and improved blood supply to your muscles (increased heartbeat) will all help you escape that bear. The sympathetic nervous system also causes the release of two stress hormones, epinephrine and norepinephrine - but more about that later.

You may be familiar with the feeling of a dry mouth and racing heartbeat before you deliver an important presentation, that's your SNS kicking in. If you look at the diagram below, you will notice that you have definitely felt some of the symptoms caused by the sympathetic nervous system at some point or another. You will also notice that some of them occur in the background.



### Getting the balance right

Some degree of both SNS and PNS activity is required for us to be healthy and active. The problem comes in during times of chronic stress when the SNS completely takes over and the PNS is chronically repressed. This is why one of the key elements in reducing stress is to activate the PNS-this counteracts the effects of SNS symptoms. Methods to activate the parasympathetic functions have been extensively studied and can lead to some real reductions in stress levels. Mindfulness, for example, is an effective tool for enhancing the PNS, especially in those who frequently experience anxiety. Research has also shown that just five days of meditation results in improved regulation of the autonomic nervous system. A long-term yoga program and spending time in nature also enhance the activity of the PNS which improves stress adaptation. Interestingly, chronic low-level noise exposure increases the SNS functions, worsening the effects of stress.

Classical music on the other hand shifts the autonomic nervous system towards to the PNS side, improving stress.

Incorporating some of these PNS activating techniques into your week will help to reduce your stress levels. Once you've found what works for you, remember that consistency is key! Once off practice will have very little effect.

Mindfulness and Meditation

Try techniques such as deep breathing, body scanning or progressive muscle relaxation Music Therapy

Specifically give classical music a try

Reduced Stress: PNS Activation

Yoga

Especially restorative styles such as hatha or yin yoga Nature

Take time to immerse yourself in green spaces such as parks, gardens or forests

# Part 2: Hormones

A discussion about stress would not be complete without taking a look at the stress hormones. The most important stress hormones are released from the adrenal glands, two pyramid-shaped glands found above your kidneys. The innermost part of the adrenal gland, known as the medulla is responsible for creating and releasing adrenalinetype hormones called catecholamines. The outer part, the cortex, is responsible for releasing cortisol and other similar hormones. One of the major differences between these hormones is the duration they last in your body.

### Short-term stress hormones

Catecholamines (adrenaline and noradrenaline) are known as short-term stress hormones. We met these hormones briefly in the previous section as they are closely related to the sympathetic nervous system. These hormones are usually released from the adrenal glands when instructed to do so during "fight or flight" (sympathetic nervous system). These hormones are responsible for many of the effects discussed in the previous section, such as increased heart rate, and increased heartbeat. Because these hormones are under the control of the autonomic nervous system, using strategies that reduce sympathetic and enhance parasympathetic nervous system activity are the best way to counteract these effects.





### Long-term stress hormones

The well-known stress hormone, cortisol, is a long-term stress hormone. It is released in response to a complex pathway that starts in the hypothalamus, moves through the pituitary gland, and ends up at the adrenal cortex. A certain amount of cortisol is required for dayto-day functions and this is regulated mostly by circadian rhythms (we'll learn more about this in the sleep section). During times of stress, particularly chronic stress, however, too much cortisol is released. The main function of cortisol is to increase blood pressure for better nutrient delivery to muscles and alter metabolism for more efficient energy production. While these effects may be useful for stressful situations, chronically raised cortisol levels have been linked with negative health implications such as insulin resistance, obesity and high blood pressure.

# **Controlling Cortisol**

Chronically raised cortisol levels have been linked with some serious negative health effects. We all know that prevention is better than cure, so reducing stress is the first step. Practicing some of the stress reduction and mindfulness tips discussed earlier is a good place to start. Because stress is unavoidable in our daily lives, however, it's also a good idea to change our environment to reduce the risks of high cortisol levels and help prevent excess cortisol production. Diet changes can be particularly helpful. Chronic inflammation has been linked to increased cortisol levels, so if you are stressed and eating a proinflammatory diet, you are at an even higher risk of the negative effects of cortisol. This is where an anti-inflammatory diet comes in. By eating in a way that reduces inflammation, you are also reducing your cortisol levels. The ideal anti-inflammatory diet is made up of whole, unprocessed foods that are rich in phytonutrients and omega 3, and promote stable blood sugar levels.

Chronic sleep deprivation also leads to overproduction of cortisol, and high cortisol levels in turn affect the body's ability to fall asleep. We'll go into a lot more detail and explain how you can break this cycle in the sleep section. Interestingly, cortisol is also raised during exercise, and this is normal and important for adaptation to training. The problem comes in when you over-train. Not allowing enough rest between hard training sessions results in consistently high cortisol levels and a reduction in growth and repair hormones such as testosterone, therefore affecting performance.



# Part 3: Neuroplasticity

Neuroplasticity is the last concept to consider when looking at stress is the brain - it looks at the changes that occur in your brain in response to chronic stress, and how efficiently your brain can return to its previous state after a stressful event. Circuits in your brain that control the balance between anxiety, mood, memory, and decision making can change according to your environment. While these changes can be beneficial in some situations, the changes brought about by chronic stress can be irreversible as we get older, and that can increase your risk of longterm health implications, including brain-related health and dementia risk. Long-term activation of stress pathways in your body can result in slight changes in the structure and functioning of parts of the brain such as the hippocampus, amygdala, and prefrontal cortex.



## Mastering Neuroplasticity

How well your brain 'bounces back' from a stressful period depends on various factors such as age, genetics, and childhood experiences, but there are things that we can do to improve this effect. One of the focus areas with neuroplasticity is to find techniques that help the brain to change itself in a way that allows for positive adaptation to stress. Regular physical activity, mindfulness, and social support have been identified as techniques that can support neuroplasticity.

Because stress can affect the parts of the brain in a similar manner to ageing, research on brain health in the elderly gives clues on how we can protect our brains from the effects of stress. Social support and regular exercise have been shown to increase blood flow to the prefrontal cortex, and aerobic exercise specifically has been shown to improve the volume of the hippocampus. Mindfulness on the other hand leads to a reduction in anxiety which in turn improves the amygdala structure. These changes in the brain lead to improved emotional and cognitive functioning which ultimately counteracts the negative effects of stress.



Stress is unavoidable in our modernday lives, but that doesn't mean we have to suffer the negative effects of it. By using the strategies discussed to improve the autonomic nervous system, stress hormones, and neuroplasticity, you can reduce your stress levels, improve the risks associated with stress, and increase your brain's resilience to stress.

# Stage 1: Take it one step at a time

All this information can be overwhelming but don't fear, you don't need to make all of these changes in one go. Small steps are easier to achieve and lead to sustained long-term changes. Start by dedicating a small part of each day to de-stress, and then move on to longer weekly activities and dietary changes.

Take time out every day	Choose at least one wind-down activity every day: • Meditate for at least 10 minutes per day (use an app, podcast, or video if you need guidance) • Be mindful for 5 minutes per day (e.g. 10 minutes of deep mindful breathing) • Listen to classical music for at least 5 minutes per day • Do yoga for at least 15 minutes per day
De-stress weekly	<ul> <li>Take at least 1 hour out of your weekend or week- day to improve your stress:</li> <li>Exercise vigorously. Whether you run, cycle, or walk is up to you but do enough to break a sweat</li> <li>Get out into nature. Go for a hike, or have a picnic in the park on the weekend</li> <li>Schedule social time. Make time to chat with friends and family to catch up</li> </ul>
Slowly change your diet	<ul> <li>Take small steps to change your diet in a way that reduces the effects of stress on your body:</li> <li>Make a concerted effort to cut down on sugary foods</li> <li>Up your omega 3 (try to eat oily fish a few times a week and include some flaxseeds, walnuts, and chia seeds in your diet)</li> <li>Focus on anti-inflammatory diet, high in fruits, vegetables, legumes and wholegrains</li> </ul>



Parasympathetic

Nervous System and neuroplasticity

Parasympathetic

Nervous System

Cortisol

reduction

As you begin to make changes and include more stress-reduction techniques, document how you feel. This will help keep you motivated and show you just how far you've come. It can also help you identify which de-stressing techniques work best for you. You can use the template below as a starting point:



Sunday	Monday	Tuesday	Wednesday
Wind-down technique: <b>Yoga</b>	Wind-down technique: Breathing meditation	Wind-down technique: Classical music	Wind-down technique: Breathing meditation
Other activity: Park walk and picnic with friends	Other activity: None	Other activity: <b>None</b>	Other activity: <b>Gym session</b>
Stress level today: 0/5	Stress level today: 3/5	Stress level today: 4/5	Stress level today: <b>3/5</b>
Thursday	Friday	Saturday	Weekly summary
Wind-down technique: Yoga and classical music	Wind-down technique: None	Wind-down technique: <b>Yoga</b>	Weekly stress level: 2/5
Other activity: <b>None</b>	Other activity: Dinner with family	Other activity: <b>Park run</b>	Number of wind-downs completed this week: 6/7
Stress level today: 3/5	Stress level today: 2/5	Stress level today: 0/5	How was your diet this week? Good



# Understanding Sleep

Sleeping is a fundamental need for everyone at any life stage. While humans cannot voluntarily stay awake for more than two to three days, scientists are still unsure of the exact functions of sleep. The current theories of sleep function centre around three main themes:

- A restorative function for the brain and body
- A role in reinforcement and consolidation of memory
- Functions as a thermoregulatory (temperature control) mechanism

Too much or too little sleep has been associated with negative impacts on health and wellbeing. And while sleep duration is an important measure of sleep, it does not give the full picture. The restorative properties of sleep also depend largely on sleep quality. The National Sleep Foundation has set out various measures of sleep quality, three of which include sleep latency (falling asleep), sleep duration and the number of waking (staying asleep), and sleep efficiency (how well you sleep).

While sleep may seem a passive state of relaxation, there is a lot going on in the background. Sleep is induced and maintained by an organised circuit through our central nervous system and our brain, and it occurs in cycles. These cycles last for about 90 to 120 minutes and are made up of two main types of sleep: rapid eye movement (REM) and non-rapid eye movement (NREM) sleep.



# The Sleep Cycle

The sleep process starts in NREM sleep. This type of sleep makes up about 75% of our sleep time and is divided into three phases. The sleep process starts at N1, also known as stage 1 sleep. This stage lasts only a few minutes, and is seen as the transition from awake to asleep initially and then later the transition between REM and NREM sleep. This period of light sleep makes up only 1 to 5% of our total sleep time. The body then enters N2 or stage 2 sleep. This is a deeper sleep that lasts for about 10 to 20 minutes. This is where we spend the majority (45 to 55%) of our sleep time. The final stage of NREM sleep, stage 3 (N3) is the deepest sleep and contributes to 15% of our total sleep time.

Stage 3 or N3 is followed by REM sleep. About 80% of dreams occur during REM sleep and these dreams tend to be more complex, emotional, bizarre and easier to recall than those that happen during NREM sleep. The first time during the night the body enters REM sleep is about 90 minutes after falling asleep, and the time spent in REM is brief. As the night goes on, REM is entered every 90 to 120 minutes and REM periods get longer as the night progresses. The longest REM periods are seen during the last third of the night, and overall REM sleep accounts for 20 to 25% of our total sleep time.

The sleep cycle repeats about five to six times per night and each stage has an important function. The deep sleep experienced in the NREM stage is important for recuperating energy for the next day and repairing tissues throughout the body. REM sleep on the other hand is important for long-term memory formation and emotion processing.



# Part 1: Falling asleep (initiation)

The time taken to fall asleep is known as sleep latency and is an indicator of sleep quality. The time taken to fall asleep should be less than 15 minutes, however, the National Sleep Foundation considers anything less than 30 minutes to be acceptable. For most age groups, taking more than 45 minutes to fall asleep and for older adults, more than 60 minutes contributes to poor sleep quality. Take a look at the diagram below to determine if your sleep latency measures up:



## How do we fall asleep?

The timing of sleep in humans is not yet fully understood, however, it is believed to be controlled by two systems that are interlinked: sleep-wake homeostasis and circadian rhythms. Understanding how these systems work gives us clues as to what might be keeping us up at night. When these two processes are aligned and functioning optimally, they allow us to achieve long, active wakefulness throughout the day and good quality sleep during the night. Changes to either process or a change in how the two processes interact can result in an inability to fall asleep at the desired time.



### Sleep-wake homeostasis

The sleep-wake homeostasis system keeps track of your biological need for sleep and reminds your body to sleep after a certain time. The signals for you to sleep get more intense every hour you are awake and may cause you to sleep longer after a period of sleep deprivation. Sleep-wake homeostasis can be compared to an hourglass. As time goes on, the sand at the bottom fills up, and the top half empties until it eventually needs to be turned over. Turning the hourglass can be compared to sleep - and this can occur at any time of the day necessary. In the simplest terms possible, your brain falls asleep when the activity in the waking areas of the brain decreases and the sleep-promoting areas are activated. This process is caused by a number of sleep-promoting substances, the most well-known of which is called adenosine. Adenosine is a chemical that accumulates in the brain during the course of the day. When enough adenosine has collected, it binds to receptors in the brain, which makes us feel sleepy and helps with the initiation of sleep. Caffeine and day time naps can affect this process. Caffeine, for example, can disrupt the binding process of adenosine to its receptor, making the process of falling asleep difficult.

### Circadian Rhythm

The circadian rhythm regulates a number of body functions, including sleep and wakefulness. This rhythm can be seen as your 'internal clock' which is based more or less on a 24-hour day. This differs from the 'hourglass homeostasis' in that it is based on specific times of day - thus sleep will more likely occur at certain times than others.

An important part of the regulation of circadian rhythm is the synchronisation of your internal clock to environmental cues such as light. For example, an important sleep hormone, melatonin, is not produced when light is available, allowing the body to wake up. When the light is dim, however, melatonin production increases, resulting in increased sleepiness. This makes sense with the natural light cycles of a 24 hour day, however, modern lighting can interfere with this natural process. Bright lights in the evening, especially blue light from electronics can interfere with melatonin production. This is why supplementing melatonin helps shift workers fall asleep at odd times when their sleep schedule does not align with their natural circadian rhythms.

Another well-known hormone associated with circadian rhythms is cortisol. Cortisol should be naturally elevated in the morning when we wake up to allow us to feel alert and should then decrease towards the evening-reaching its lowest point two hours after bed. Activities that raise cortisol levels such as intense exercise or stressful activities are generally best avoided in the evening as an increase in cortisol can interfere with how effectively you fall asleep.

# Why am I struggling to fall asleep?

At some point in our lives, we have all felt the frustration of lying in bed for hours, exhausted, but unable to sleep. This is quite a common occurrence in our modern-day lives and can be caused by a disruption of our circadian rhythms or sleep-wake homeostatic systems. Take a look at the diagram below to identify what may be keeping you up at night:



# Part 2: Staying asleep (duration)

Another good indicator of sleep quality is your ability to stay asleep. The National Sleep Foundation recommends seven to nine hours of sleep for adults between the ages of 18 and 65. Within that sleep duration, one or fewer awakenings per night indicate good sleep quality. For most age groups, between two and three awakenings are acceptable, but four or more awakenings indicates poor sleep quality. Take a look at the diagram below to determine if your sleep latency measures up:



# Why am I waking up during the night?

There are several reasons why you may be waking up during the night, and many of them are closely linked to the factors that affect falling asleep. Caffeine, stress, and a bright or noisy environment can all affect not only your ability to fall asleep but also how long you stay asleep. Another important factor to consider if you are frequently waking up at night is your comfort levels. This comfort can be a combination of your sleeping environment and internal body comfort.

# **Sleeping Environment**

An ideal sleeping environment needs to be carefully selected to improve sleep quality and prevent unnecessary awakenings from sleep. Factors to consider when assessing your sleep environment include temperature, noise, light, and overall comfort.





# Body Comfort

Your sleeping environment is not the only indicator of comfort during sleep. Your internal body comfort also greatly affects your ability to stay asleep. Aches, pains, and discomfort can all lead to a poor night's sleep, so identifying any possible medical condition that could be affecting your sleep is vital. Sleep apnoea, gastro-oesophageal reflux disease and restless leg syndrome are examples of conditions that can affect your sleep. It is best to speak to your doctor about managing medical conditions, but here are some lifestyle changes to consider if you are living with any of these conditions:



Condition	What is it?	Lifestyle change
Sleep apnoea	A common disorder in which the upper airway becomes obstructed during sleep, resulting in breathing difficulties	Lose weight if you are overweight
Restless leg syndrome	A common disorder that is characterised by an urge to move the legs and unpleasant sensations deep in the legs during periods of rest or sleep	Check for nutritional deficiencies, especially iron deficiency
Gastro-oesophageal reflux disease	A chronic disease that occurs when stomach acid or bile flows into the food pipe and irritates the lining. The main symptom is a burning pain in the chest that usually occurs after eating and worsens when lying down	<ul> <li>Lose weight if you are overweight</li> <li>Avoid wearing tight clothes to bed</li> <li>Tilt your bed at an angle</li> <li>Avoid fatty or rich evening meals</li> <li>Avoid very large evening meals, and meals too close to bedtime</li> <li>Avoid spicy or acidic evening meals</li> <li>Avoid aggravating substances such as peppermint, smoking, alcohol and caffeine</li> </ul>

\*See your doctor if you are suffering from any of these conditions. This is not intended to replace medical advice.

# Part 3: How well do you sleep (depth)

A final important factor to take into account when addressing sleep and sleep quality is how deeply you sleep. The National Sleep Foundation advises that you should be asleep for more than 80% of the time spent in your bed each night and have very specific criteria for how much of the night should be spent in each of the stages of the sleep cycle.

Non-REM phase 3 (slow-wave sleep) and REM sleep both have vital, but slightly different restorative functions and occur more at different times of the night. During the first two-thirds of the night, most of the slow-wave sleep occurs, whereas the majority of REM sleep occurs during the final third of the night. In order to maximize both phases of the sleep cycle, long, continuous sleep is necessary. In addition to decreasing the time taken to fall asleep, and the number of times awoken per night, you can increase the opportunity for more sleep cycles by allocating more time to this long, continuous sleep. It is also important to consider your body's ability to enter these sleep phases. Certain stimulants such as caffeine make it difficult to fall asleep, increase the light sleep cycle time, and shorten the time spent in deep sleep (slow-wave sleep). In contrast, alcohol makes falling asleep easier, but reduces the time spent in REM sleep and therefore affects sleep quality. Intense exercise during the day and hot therapy such as a sauna or hot bath has been shown to increase the time spent in deep sleep (slow-wave sleep).

The amount of time spent in each stage of the sleep cycle is most accurately measured at a sleep clinic using polysomnography, but can also be roughly measured through apps and smart devices. You can take steps to improve your sleep cycles as shown below:



# Part 4: Putting it into practice

Now that we've discussed how important it is to get enough good quality sleep, let's look at how to put it into practice. If you already know where your problem areas are, look at addressing them directly. For most of us, however, poor quality sleep can be due to a combination of elements, and that's why it is important to address your sleeping environment, sleeping routine and overall lifestyle. We've developed sleeping checklists to make this easier for you.

# Step 1: Address your sleeping environment

Your sleeping environment affects so many aspects of your sleep quality, but especially the time it takes to fall asleep and the number of wakings during the night. Take a moment to check that your bedroom measures up:

# Bedroom checklist

# Comfort

- Comfortable mattress (hard vs. soft is up to you)
- · Comfortable, supportive pillows

### Temperature

- Set thermostat at 18°C (64°F)
- Breathable sheets
- Breathable pajamas

### Noise

- Remove any electronics from the room that cause buzzing
- Turn the YTV off while you sleep
- · Wear earplugs if your neighbourhood is noisy
- · Consider soothing, consistent sounds such as a fan or white noise

## Darkness

- Use blackout curtains
- Remove bright electronics from your room
- Wear an eye mask if necessary
- Dim lights an hour before bed

# Step 2: Fix your sleep routine

What you do in the hours before you sleep can really make a difference, especially with regards to the time taken to fall asleep and the overall sleep depth. Developing a good sleep routine can take some practice and dedication, but the sleep results are worth it! You can use the checklist below to assess if your sleep routine is adequate:

# Sleep routine checklist

# Wind down

- Avoid stressful tasks such as paying bills or emotional conversations before bed
- Use meditation and mindfulness techniques to help reduce stress before bed
- Take a hot bath before bed
- Power-down electronics an hour before bed
- Dim the lights an hour before bed

# Stick to a schedule

- · Allocate 7-9 hours of sleep per night
- Go to bed at the same time, and wake up at the same time every day, even on weekends
- If you can't sleep, go do something else in another room, and then try again





# Step 3: Adopt positive lifestyle changes

We've seen that what you eat and drink, and how much you exercise can affect all aspects of your sleep quality. Using the checklist below, you can determine which lifestyle modifications you would need to make to improve your sleep:

# Lifestyle checklist

# **Diet changes**

- Limit caffeine 6 hours before bedtime
- If you drink alcohol, do so in moderation and avoid alcohol 4 hours before bed
- Adjust your diet if necessary. Avoid large, spicy or rich meals before bed if you suffer from ingestion or reflux
- Lose weight if your weight is contributing to conditions that affect sleep

# Lifestyle changes

- Limit daytime napping and if you nap, keep naps at least under two hours, but preferably under 30 minutes and avoid napping in the late afternoon
- Exercise on a daily basis. Vigorous activity is best, but even light activity is better than nothing. Avoid exercise at night if this affects your sleep
- Avoid smoking altogether, but if you do smoke, avoid cigarettes in the evening

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