



NUTRITIONALLY SOUND SLEEP

PATIENT HANDOUT

SLEEP, NUTRITION, AND OUR HEALTH

Quality sleep plays a fundamental role in our total health, with approximately one-third of our life spent sleeping we want to ensure that our sleep is optimal and restorative.¹

There is a highly important relationship between diet, nutrition, and sleep, meaning diet and nutrition can impact sleep and sleep or lack thereof may impact our dietary choices.^{2,3} Sleep is also a major modulator of hormones, blood sugar regulation and cardiovascular function.⁴

POOR SLEEP QUALITY AND DURATION MAY BE LINKED TO:^{3,5-9}

- High blood pressure
- Blood sugar imbalance
- High triglycerides
- Inflammation locally within the gut and systemically
- Oxidative stress
- Food intolerances
- Weight gain and obesity
- Reduced day time alertness, lack of energy and motivation
- Increased risk for accidents and motor vehicle accidents
- Increased snacking and poorer food choices
- Increased alcohol consumption
- Higher incidence of mood disorders and depression
- Altered immune and stress responses

Our food choices and certain eating patterns can both positively and negatively impact our sleep. A diet that is abundant in nutrient dense wholefoods, like a Mediterranean style diet provides our body with essential vitamins, minerals and sleep-promoting compounds such as tryptophan, which are required to make the chemical messengers (neurotransmitters) serotonin, and melatonin.

Diets that are full of processed foods and simple carbohydrates lack the required nutrients and minerals needed to make these sleep promoting neurotransmitters and have been shown to negatively impact sleep and create inflammation throughout the body.

Lack of sleep also creates further inflammation, highlighting the bi-directional inflammatory process between diet habits and sleep and its impact on our total health and wellbeing. An unbalanced diet full of processed foods and simple carbohydrates has additional negative health effects that are discussed further on.^{4,10,11,23}

NEUROTRANSMITTERS INVOLVED WITH SLEEP^{4,5,12}

There are multiple neurotransmitters that are involved in the regulation of the sleep wake cycle, two key neurotransmitters include serotonin, and melatonin, which are reliant on an amino acid (protein) called tryptophan. Tryptophan acts as a precursor for serotonin and then subsequently melatonin synthesis. There are also other key nutrients obtained from food that assist the creation of neurotransmitters, which are discussed below.

SEROTONIN^{5,13,14,15}

Commonly referred to as the feel-good neurotransmitter, it is involved in the sleep wake cycle and is used to form melatonin as well as helping to regulate appetite and eating behaviour.⁵ For the optimal manufacture of serotonin specific nutrients and minerals are required, these include zinc, magnesium, pyridoxine (B6) and vitamin C.¹³

MELATONIN

Melatonin is slowly released from cues of darkness and from the tryptophan / serotonin pathway. One of its main roles is to help to prepare the body for sleep and regulate circadian rhythms. Generally, the increased desire to sleep is felt approximately 2 hours after peak blood levels of melatonin have been achieved.¹⁴ Sunlight or artificial blue light inhibits the production of melatonin and increases the release of cortisol, which makes us feel awake and alert. Too much screen time and artificial blue light at night-time impedes the release of melatonin and reduces signals of tiredness and the ability to fall asleep in a timely manner.¹³ For the optimal manufacture of melatonin specific nutrients and minerals are required, these include folate, pyridoxine (B6), vitamin C and iron.

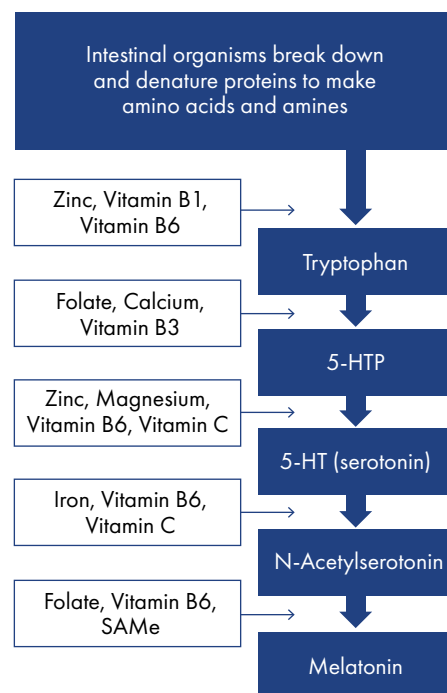


FIGURE 1. NEUROTRANSMITTER AMINO ACID PRECURSORS AND MAJOR NUTRIENT ENZYME COFACTORS

IMPACT OF CARBOHYDRATES AND HIGH GLYCAEMIC INDEX (GI) FOODS ON SLEEP

Carbohydrates are an essential macronutrient to provide energy for all cells in the body and they also act as fuel for sleep related hormonal regulation. However, not all carbohydrates are made equal nor are they utilised by the body in the same way. Simple carbohydrates which are high GI foods and are generally nutritionally lacking, they are rapidly broken down into glucose to be utilised by the body, creating a rapid spike in insulin and a subsequent rapid drop in blood sugar levels. The rapid drop in blood sugar levels may cause the release of adrenaline and cortisol, both are involved in feelings of alertness, which may impact the sleep wake cycle and sleep quality.^{27,28}

Complex carbohydrates take longer to breakdown into glucose as they also contain fibre and starch to provide longer sustained energy for the body. Steady glucose metabolism helps to regulate tryptophan, the precursor of serotonin and melatonin (our sleep neurotransmitters) which impacts our sleep initiation cues and ability to maintain ideal sleep duration.^{27,29,30}

SIMPLE CARBOHYDRATES / HIGH GI FOODS^{5,31}

- White bread, pasta, and rice
- Bakery items such as pastries, slices, cakes, donuts, and cookies
- Fizzy drinks and energy drinks
- Lollies and sugary confectionary
- Sugary breakfast cereals
- Fruit juice especially those made from a concentrate
- Tinned fruit in syrup and dehydrated fruit

COMPLEX CARBOHYDRATES

- Vegetables
- Fresh fruit
- Nuts
- Beans
- Whole grains
- Oats
- Brown rice



KEY SLEEP NUTRIENTS^{13,15-19}

NUTRIENT

FOOD

TRYPTOPHAN

Predominantly found in high protein foods such as turkey, chicken, and meat as well as, oats, bananas, milk, cheese, and peanuts.¹³

MAGNESIUM

Dark leafy greens, beef, salmon, poultry, black beans, kidney beans, legumes, almonds, peanuts, cashew nuts, sunflower and pumpkin seeds, bananas, dark chocolate minimum 70%.

VITAMIN D

Sardines, liver, egg yolk, cod liver oil, salmon, tuna.

VITAMIN C

Cruciferous vegetables such as broccoli, cabbage, cauliflower and brussel sprouts, capsicum, strawberries, tomatoes, kiwi fruit, oranges, lemons, and grapefruit.

CALCIUM

Dairy from cow, goat and sheep such as milk, yoghurt, cheese, leafy green vegetables (collard, kale, bock choy, spinach, mustard greens), broccoli, sardines and canned salmon (with bones), tempeh and tofu, Brazil nuts, almonds and sesame seeds.¹⁹

FOLATE
THAIMIN (B1)
NIACIN (B3)
PYRIDOXINE (B6)

Thiamin (B1) - Red meat, fish and whole grains, beans, lentils, green peas, and sunflower seeds.¹⁸
Niacin (B3)- Red meat, liver, poultry, fish, legumes, nuts, seeds, brown rice, and bananas.
Pyridoxine (B6)- Liver, red meat and chicken, tuna, salmon, chickpeas, dark leafy greens, bananas, papayas, oranges, and rockmelon.
Folate – Dark green leafy vegetables, asparagus, brussel sprouts, broccoli, liver, beans, eggs, seafood, peanuts, sunflower seeds, and wholegrains.

ZINC

Red meat, poultry, and seafood (shellfish, oysters, crab and lobster), legumes, nuts and seeds (sunflower and pumpkin seeds), wholegrains.

IRON

Heme iron – mostly found in red meats, beef, lamb, veal, liver, poultry, fish, shellfish and eggs.
Non-heme iron found in plant foods, legumes, tofu, nuts, dark leafy green vegetables, broccoli, sweet potatoes, and molasses.

BENEFIT

Tryptophan is an essential amino acid that we obtain from the diet, it plays a major role in the production of serotonin and subsequently melatonin and helps regulate the sleep wake cycle (circadian rhythm).
Tryptophan is highly important in the relationship between diet and sleep quality. Opting for quality sources of protein and complex carbohydrates during mealtimes aids in providing the essential building blocks for optimal sleep neurotransmitter production.^{5,20,21}

Plays an essential role in the sleep wake cycle and the synthesis of serotonin. Magnesium supplementation may be associated with increased sleep duration and reduced time to fall asleep as well as helping to support energy levels in fatigued individuals.³

Research has shown that adults with poor vitamin D status may be at higher risk of suffering short sleep.³ While, in the elderly deficiency may be associated with short sleep, multiple waking’s and poorer sleep quality.³

Is a potent antioxidant, frequent reduced sleep duration has been shown to increase oxidative stress and inflammation. Research has shown that short sleep durations have been associated with lower vitamin C levels while good sleepers maintained optimal levels of vitamin C.²²

Low dietary calcium intake may increase the incidence of sleep problems and poor sleep quality.²³ Calcium is also utilised in the synthesis of tryptophan into serotonin which is necessary for optimal sleep wake cycles.

Essential B vitamins are needed for the synthesis of melatonin. They help to support energy in the day, support mood, and assist with improved sleep patterns. Generally, poor sleepers consume a diet lower in B vitamins.²⁴

An essential trace mineral that is commonly lacking in the modern Western diet. Supplementation with zinc, especially at night can result in increased total sleep duration, reduced sleep onset and improved sleep quality. Zinc may be working via regulation of circadian rhythms, its role in tryptophan and serotonin synthesis and to help heal intestinal barrier inflammation.²⁵

Plays an essential role in the sleep wake cycle and the synthesis of serotonin. Low iron status may also negatively impact sleep onset, duration, and quality. Low dietary intake of iron may increase the incidence of iron deficiency anaemia and developing restless leg syndrome which may result in poor quality sleep and frequent wakings.²⁶

FOODS THAT NEGATIVELY IMPACT SLEEP

CAFFEINE

While caffeine provides us with a boost of energy, which is generally well received after a poor night’s sleep it may actually be a contributing factor to your sleeping troubles.

Caffeine plays a role in blocking adenosine, an important neurotransmitter involved in the sleep wake cycle. As adenosine rises so does our levels of feeling drowsy, however, adenosine needs to slowly build up through the day to exert its effects at night-time. When this is being impeded through caffeine consumption it may be a contributing factor in a poor-quality sleep.⁵

- Caffeine consumption in the late afternoon and evening may been linked with prolonged time to fall asleep and reduced sleep time and quality.⁵
- Aim to consume your last caffeinated beverage at least 6 hours before bed and limit consumption to 1-2 standard cups daily. Alternatively, talk to your health care practitioner for specific recommendations tailored for you.

ALCOHOL

Alcohol is commonly referred to as a sedative however it has been shown to negatively impact rapid-eye movement (REM) sleep in the second half of the night, which may result in frequent waking 4 hours after sleep onset and increased time to fall back to sleep.^{5,31,32}

Aim to have alcohol no later than 3-4 hours before bed to limit the incidence of it potentially disrupting the sleep promoting hormones serotonin and melatonin.³²

*Discuss recommendations specific for you with your health care practitioner.

Did you know

Acute consumption of alcohol, has the potential to reduce tryptophan levels by up to 25% two-hours after consumption. Serotonin and melatonin may be further impacted which may exacerbate symptoms in individuals suffering sleep disturbance.¹³

SUGAR

Quality sleep plays an important role in regulating and maintaining optimal blood sugar levels.

Recent research has found that individuals that consumed predominantly simple carbohydrates throughout the day and before bed had worse sleep initiation, duration and quality compared to individuals who consumed predominantly complex carbohydrates.^{27,33}





OTHER DIET RELATED FACTORS THAT CAN IMPACT SLEEP

EATING BEFORE BED

At night-time our digestive system slows down to prepare the body for sleep, this results in food staying in the stomach for longer before it is digested and passed into the small intestine. Research has found that eating large meals close to bedtime may be associated with less feelings of satiety which may result in over-eating. Eating close to bedtime may result in irregular sleep patterns.³⁴



Aim to consume your last meal approximately 4 hours before bed to allow for optimal digestion and regulation of blood glucose levels. Consuming a meal containing a variety of complex carbohydrates 4 hours before bedtime may help to improve sleep initiation (the time it takes to fall asleep), as carbohydrates are involved in tryptophan metabolism which helps to produce serotonin and melatonin, our sleepy neurotransmitters.⁵

Tip: a one-off meal that is high GI will not have a massive impact on sleep quality, however, if you regularly consume high GI foods especially before bed you may need to evaluate if it's impacting your sleep quality, especially initiation, duration and any blood sugar imbalance issues and weight gain.³⁰ Alternatively, talk to your health care practitioner for specific recommendations tailored for you.

REFLUX AND HEART BURN

Diet is one of the main contributors in the development of reflux, certain eating habits such as eating quickly and irregularly, only consuming 1-2 meals per day, eating large meals, and eating directly before sleep increase the risk for developing reflux symptoms.



Gastric emptying is much slower during sleep, acid clearance is prolonged and the lower oesophageal sphincter that helps to keep our food contents in our stomach is much more relaxed. All these factors and laying down in bed create an optimal environment for reflux to potentially develop.

Taking the time to be present at meals, chewing thoroughly, regularly eating 3-5 meals/snacks daily and not eating 3 hours before sleep can reduce the risk of reflux symptoms and reoccurrence.³⁵⁻³⁷

Dietary reflux aggravators^{35,37,38} spicy foods, fast foods, highly fatty meats, tomato and tomato-based meals, citrus fruits, chocolate, peppermint, carbonated beverages, coffee, and alcohol.

THE GUT, FOOD INTOLERANCES AND SLEEP

Often when we are suffering from poor sleep we aim to address or resolve external factors such as sleep hygiene and lack of exercise and while these play a large role in the sleep wake cycle, there is also a dynamic interplay between our digestive system and our sleep quality.⁷



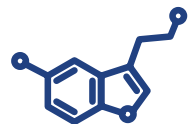
Poor sleep quality may increase inflammation within the gut, this increased inflammation has the potential to inflame intestinal cells which may result in intestinal permeability. Intestinal permeability may cause food intolerance type symptoms and further exacerbate poor sleep quality.³⁹⁻⁴¹ Our diet and our sleep cycle work in conjunction with one another, while diet can impact sleep, sleep can also impact our digestive capacity and how it may respond to certain food choices. This might be a contributing factor to why some individuals develop food intolerances later in life.

Common food intolerances⁴²

- Gluten commonly found in wheat, rye, spelt and barley
- Dairy specifically lactose found in milk, yoghurt, and cheeses
- High histamine foods such as cured meats, cheeses, and seafood
- Monosodium glutamate (MSG), artificial colours and flavours

THE GUT, INFLAMMATION, AND SEROTONIN

Interestingly, our gut bacteria (microbiome) follow a circadian rhythm cycle, it responds to our fasting (while asleep) and feeding cycle, its composition also fluctuates throughout a 24-hour cycle.⁷ Poor sleep quality may alter gut function, increase inflammation, and disrupt the delicate balance of our beneficial gut bacteria. Certain beneficial bacteria strains specifically *lactobacillus* and *clostridium* species are involved in the production of serotonin, this alteration may impact the production of melatonin further disrupting sleep quality.³⁹⁻⁴¹



Did you know: That regular periods of short sleep, less than 6 hours, may disrupt the optimal balance of beneficial gut bacteria and may cause digestive complaints such as bloating, irregular bowel motions and dysbiosis (higher ratios of bad bacteria). Those that are at increased risk include individuals that are shift workers, have early morning starts and late bedtimes.⁷

Tip: Smoking has been found to be associated with increased short sleep duration as well as having the potential to create oxidative stress and deplete the antioxidants vitamin C and vitamin E.³



DIETARY CHOICES THAT CAN IMPACT SLEEP

DIETARY CHOICES THAT NEGATIVELY IMPACT SLEEP QUALITY AND DURATION^{3,27}

- Poor / low daily macronutrient intake (complex carbohydrates, proteins, and healthy fats).
- High simple carbohydrate intake.
- Low-fat food choices, which are generally high in sugar.
- Low intake of vegetables and fruits.
- Reduced vitamin intake through diet especially vitamin D, vitamin C, magnesium, zinc, calcium, vitamin A, thiamin (B1), pyridoxine (B6), niacin (B3) and folate.
- Skipping meals, such as breakfast and eating irregularly.
- High consumption of caffeine, sugary caffeinated energy drinks, alcohol, and spicy foods especially late at night.

DIETARY CHOICES THAT POSITIVELY IMPACT SLEEP QUALITY AND DURATION^{11,30}

- Eating your last meal 3-4 hours before bedtime
- A nutrient dense Mediterranean style eating pattern, as it is abundant in sleep promoting macronutrients, vitamins, and minerals:
 - Eat 4 serves of vegetables a day (a serving is 1 cup raw or ½ cup cooked).
 - Eat 2-3 serves of fruit a day.
 - Eat 4 or more servings of wholegrains a day (a serving is 30 g cereal, 1 slice wholegrain bread, 1 small wrap, ½ cup of cooked rice, oats or brown pasta).
 - Have 2-4 tablespoons of olive oil a day, or include avocado and fresh nut butters.
 - Water should be your main drink – 6-8 250 mL glasses a day.
 - Have 3 or more servings of legumes a week (a serving is 1 cup).
 - Have 3-4 servings of raw nuts and seeds a week (a serving is 30 g).
 - Have 2-3 serves of fish/seafood a week e.g. salmon, sardines, mackerel.
 - Include poultry, eggs, yoghurt and cheese throughout the week (at least twice a week).
 - Have 2 serves a week of red meat (a serve is 80-100 g).
 - Limit sweets/savoury snacks to 2 serves or less a week.

* Talk to your health care practitioner if you need further support for quality sleep.

