Tackling Poor Sleep & Insomnia

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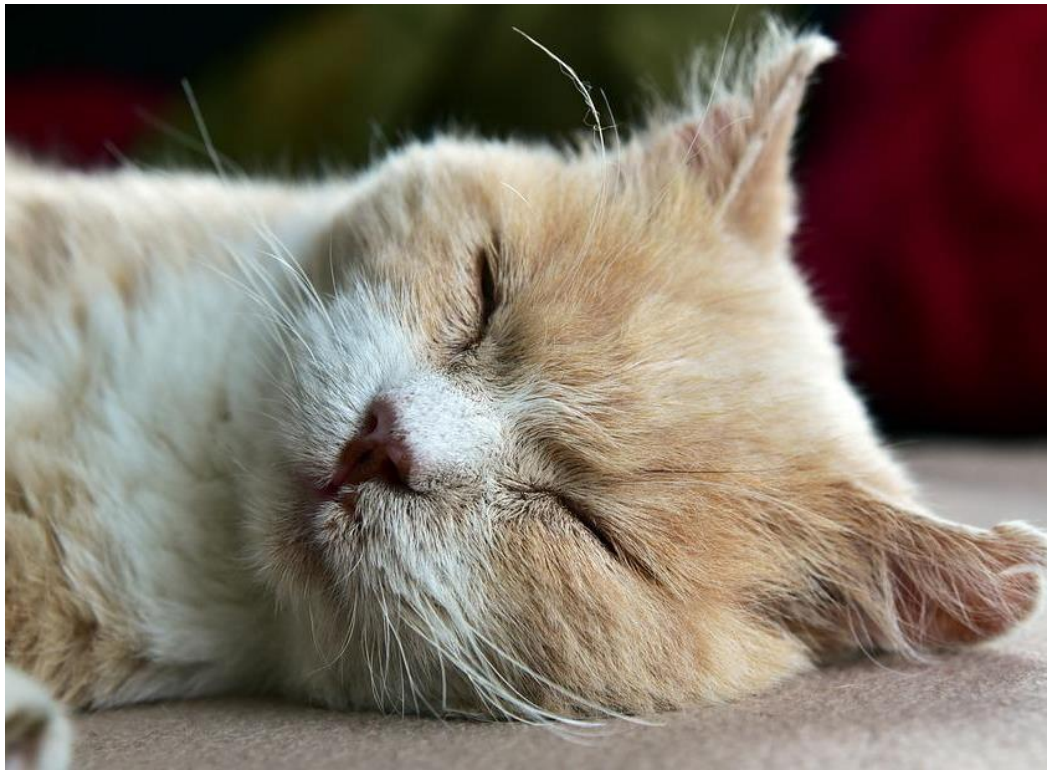
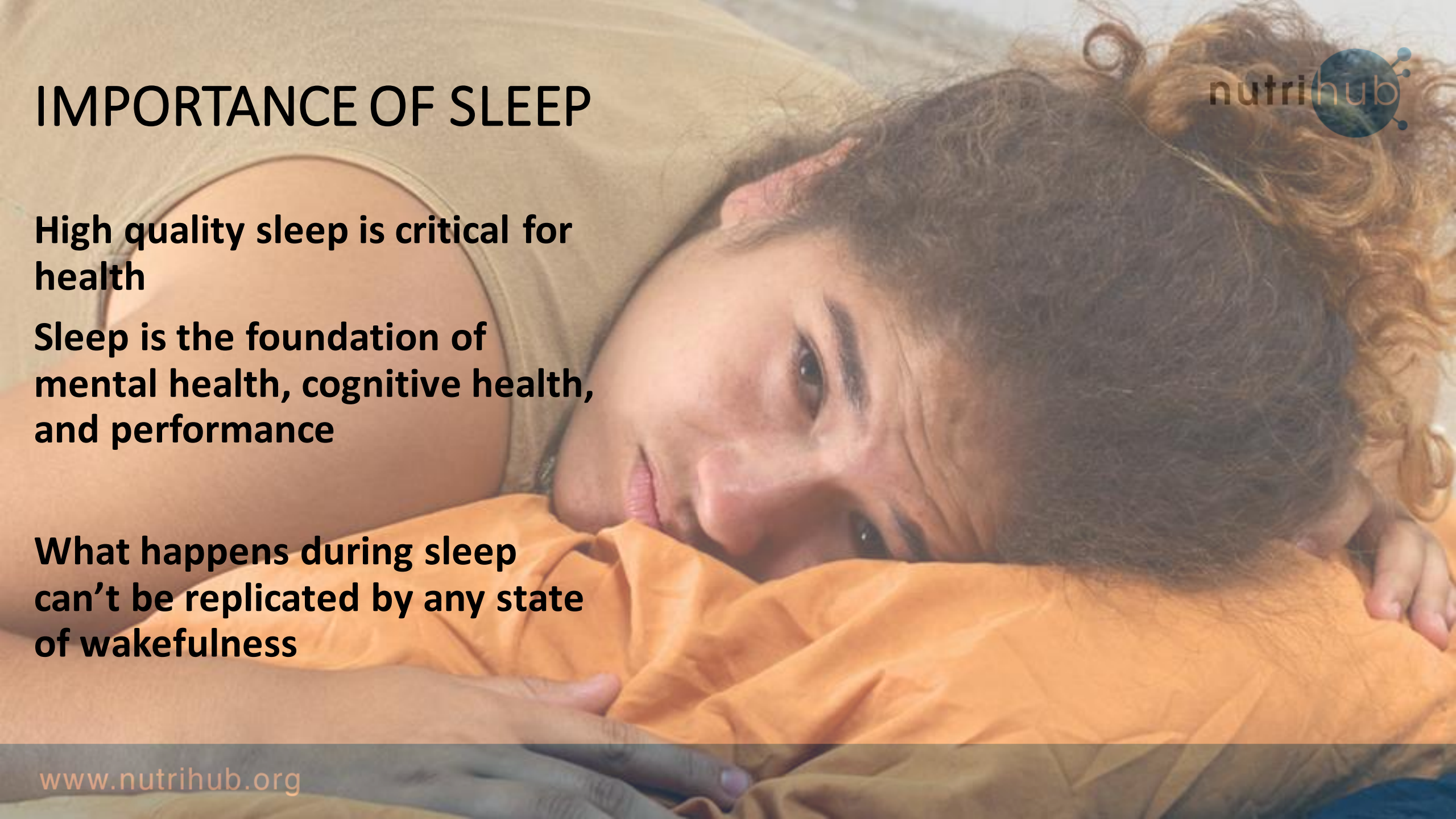
WHAT WE WILL COVER



- The importance of sleep and circadian rhythms
- Stages of sleep & health benefits
- How much sleep do we need?
- Dietary, Lifestyle & Behavioural solutions
- Key nutrients to consider

IMPORTANCE OF SLEEP



High quality sleep is critical for health

Sleep is the foundation of mental health, cognitive health, and performance

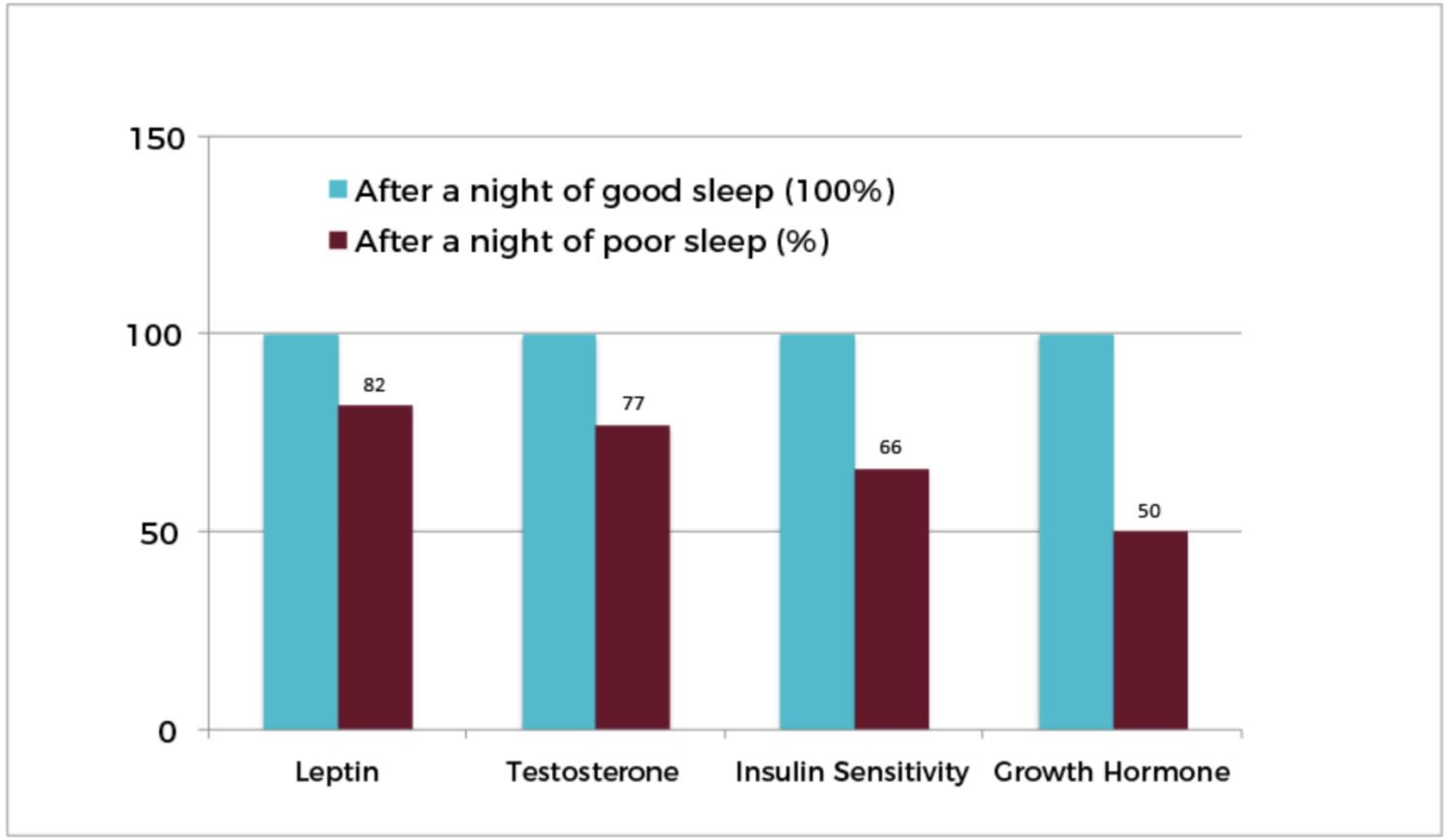
What happens during sleep can’t be replicated by any state of wakefulness

IMPORTANCE OF QUALITY SLEEP

- Sleep is a cyclically occurring, transient, and functional state that is controlled primarily by neurobiological processes.
- Sleep is associated with a reduction in the perception of external stimuli and the cessation of motor activity
- It occurs in 90-110 minute cycles divided into non-REM and REM (rapid eye movement) sleep
- Normal sleep-wake cycles controlled by circadian rhythms
- Sleep has a multifactorial effect on the body: it reduces energy consumption and increases the recovery of the energy storage in the brain, it regulates the adaptive and innate immune response, and it contributes to memory consolidation (the fixing of acquired information in the brain)
- Sleep disorders are associated with the onset and progression of many different diseases, which include cardiovascular disease, depression, and cancer. Sleep disorders also increase the risk of infectious diseases

Prather A.A., Janicki-Deverts D., Hall M.H., Cohen S. Behaviorally assessed sleep and susceptibility to the common cold. *Sleep.* 2015;38:1353–1359. doi: 10.5665/sleep.4968.

Yu J., Rawtaer I., Fam J., Jiang M.-J., Feng L., Kua E.H., Mahendran R. Sleep correlates of depression and anxiety in an elderly Asian population. Psychogeriatrics. 2016;16:191–195. doi: 10.1111/psyg.12138.



What Happens after A bad night of Sleep

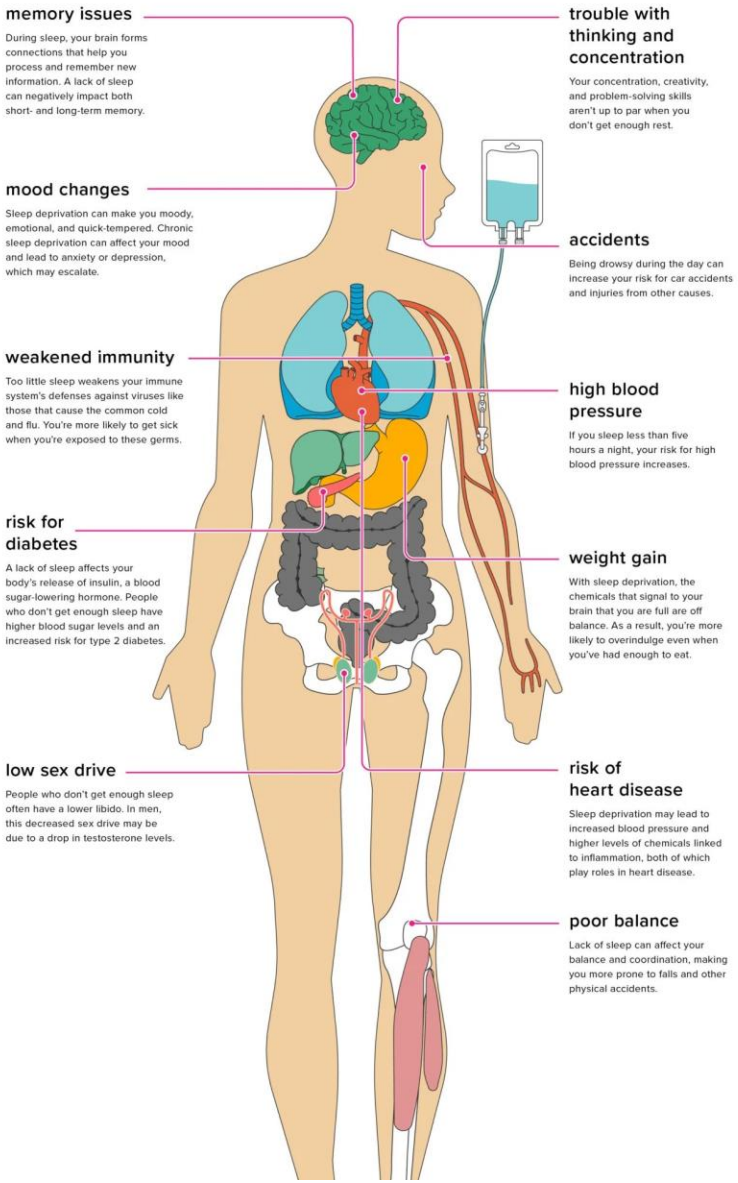
Beneficial hormones like testosterone and growth hormone plummet. Hunger hormones like ghrelin go up while leptin and insulin sensitivity go down.

https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3242827/
https://www.ncbi.nlm.nih.gov/books/NBK279071/

Sleep & Weight Management

- Sleep loss is associated with decreased leptin and increased ghrelin levels, leading to an increased appetite
- Unhealthy sleep is associated with obesity and eating problems
- In one study people who slept only 5.5 hours per night lost 55% less body fat and 60% more fat-free mass (e.g bones and muscles) compared to people who slept 8.5 hours per night
- Poor sleep reduces insulin sensitivity

https://pubmed.ncbi.nlm.nih.gov/20921542/



Poor Sleep affects All body systems

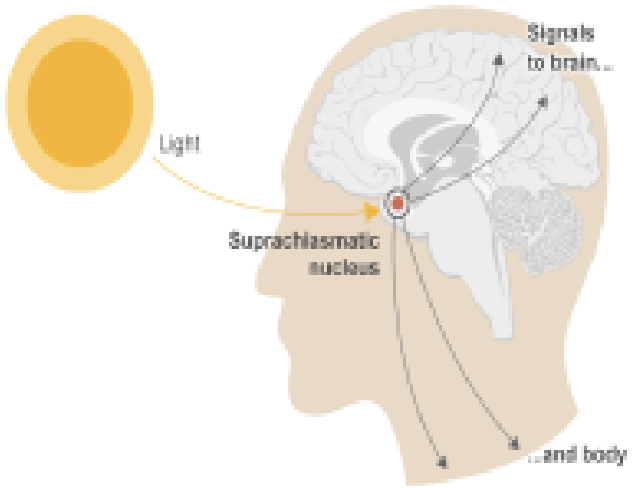
- Immune function – allergies, increased risk of infections and autoimmune
- Memory and Cognition
- Mood – depression and anxiety
- Blood sugar imbalances - diabetes / insulin resistance
- Low sex drive
- Risk of heart disease
- Weight gain / loss of muscle mass / poor recovery
- Increase risk of accidents
- Digestive disturbances
- Endocrine disturbances

POOR SLEEP AND INFLAMMATION

- High blood pressure is affected by the length of sleep. Studies in humans show that sleep deprivation (≤5 h/day) and insomnia increase the risk of high blood pressure by a factor of five. The risk of high blood pressure is also higher in people who wake up early in the morning (e.g., going to bed late) and who have difficulty maintaining sleep
- The greatest risk of developing cardiovascular disease is in people who sleep for less than 5 h per day. People who sleep for less than 7 h are also at an increased risk of cardiovascular diseases and mortality that are caused by a disturbance of the functioning of this system.
- Insufficient sleep leads to increased concentrations of inflammatory markers, such as C-reactive protein (CRP), while inflammation is thought to be related to the incidence of breast cancer and lung tumors. People who work long hours on night shifts have an increased risk of cancers, such as breast cancer, colon cancer, and non-Hodgkin's lymphoma

Gobbi G., Comai S. Differential function of melatonin MT1 and MT2 receptors in REM and NREM sleep. *Front. Endocrinol.* 2019;10:87. doi: 10.3389/fendo.2019.00087
Khan M.S., Aouad R. The effects of insomnia and sleep loss on cardiovascular disease. *Sleep Med. Clin.* 2017;12:167–177. doi: 10.1016/j.jsmc.2017.01.005.

WHY WE SLEEP - YOUR CIRCADIAN RHYTHM



Circadian rhythms are physical, mental and behavioural changes that follow a 24 hour cycle – responds to light and darkness

Suprachiasmatic Nucleus controls sleep –wake cycle

SCN influences the pineal gland which is responsible for melatonin secretion (in response to darkness)

The combination of a low core temperature in the circadian cycle coupled with high levels of adenosine leads to the feeling of sleepiness

Brown R.E., Basheer R., McKenna J.T., Strecker R.E., McCarley R.W. Control of sleep and wakefulness. Physiol. Rev. 2012;92:1087–1187.
doi: 10.1152/physrev.00032.2011.

SLEEP PHASES

Sleep continuity is assessed by the **total time of sleep**, **the delay in falling asleep** (i.e., the time between switching off the lights and falling asleep), and by the type and amount of sleep throughout the duration of sleep

Physiological sleep consists of two main phases—the REM (rapid eye movements) phase and the NREM (non-REM) phase—which are repeated during sleep.

The REM phase is associated with the activation of the sympathetic nervous system, and it leads to an increase in temperature and blood pressure and to an accelerated heart rate. During the REM sleep phase, there is also a decrease in muscle tone, and activation in the limbic regions, which suggests that REM plays a role in emotional regulation.

The NREM phases are longer and are associated with the function of the parasympathetic nervous system and, in contrast to the REM phase, with decreases in body temperature, blood pressure, and pulse.

The NREM sleep phase also supports memory consolidation, metabolic regulation, and brain regeneration.

Phases of sleep

Two Main phases of sleep: non-rapid eye movement (non-REM) and rapid eye movement (REM)

Within non-REM sleep there are three phases:

- Phase I: dozing when you first fall asleep
- Phase II: transient state between wakefulness and slow wave sleep, almost a relaxation or hallucination state
- Phase III: deep slow wave sleep (delta waves, breathing rate lowest)

Phase IV: REM sleep – your brain is linking things conceptually during this stage and your body is paralyzed to prevent injury and acting out dreams (uncoupling of emotions from experiences)

Adults generally spend about 20–25% of their total sleep time in the REM phase, 75–80% in the NREM phase, and they have between four and five NREM cycles

PHASES THROUGH THE NIGHT

- The first 4 hours of sleep are critical for **memory processing**, particularly if you learned something new that day – whether motor skills (dancing) or specific details of something

- **Sleep washout period:** first 20 minutes - cleaning out misfolded proteins to leave the brain in a state of preparedness for action the next day

- The second half of the night: **REM sleep periods are longer** sleep is deeper.. **REM is like therapy (uncoupling from emotions / experiences)**

FUNCTIONS OF SLEEP: Immune

- Two effector systems are responsible for regulating the immune response (inborn and adaptive): the sympathetic nervous system and the hypothalamic–pituitary–adrenal axis, which are both influenced by sleep.
- When you sleep too little, the immune system produces a reduced number of antibodies, which are involved in the body's defensive reactions

Scammell T.E., Arrigoni E., Lipton J.O. Neural circuitry of wakefulness and sleep. *Neuron.* 2017;93:747–765. doi: 10.1016/j.neuron.2017.01.014.

Functions of Sleep : Hormones

- During sleep, there is a decrease in the release of cortisol, norepinephrine, and adrenaline.
- The concentration of hormones that affect cell growth, such as growth hormones, melatonin, and prolactin, increases.
- Prolactin and growth hormone influence the differentiation and formation of new T cells and stimulate the function of type 1 cytokines that control the antigenic response of lymphocytes – important for overall immne function

Jessen N.A., Munk A.S.F., Lundgaard I., Nedergaard M. The glymphatic system: A beginner's guide. *Neurochem. Res.* 2015;40:2583–2599. doi: 10.1007/s11064-015-1581-6

CLEARING OUT THE BRAIN

- The glymphatic system is a macroscopic system that uses perivascular canal systems to remove certain substances from the central nervous system.
- The function of the glymphatic system is to remove toxins from the brain that are produced during cellular respiration.
- During sleep, there is an increased mass flow in which toxins are excreted from the brain.
- The glymphatic system also contributes to the distribution of glucose, amino acids, lipids, and certain neurotransmitters
- As the body becomes older, or if it does not procure enough sleep, the toxin removal may be reduced, which leads to the formation of amyloid plaques, which can be seen in many neurodegenerative diseases, such as Alzheimer's disease

Jessen N.A., Munk A.S.F., Lundgaard I., Nedergaard M. The glymphatic system: A beginner's guide. *Neurochem. Res.* 2015;40:2583–2599. doi: 10.1007/s11064-015-1581-6.
Rasmussen M.K., Mestre H., Nedergaard M. The glymphatic pathway in neurological disorders. *Lancet Neurol.* 2018;17:1016–1024. doi: 10.1016/S1474-4422(18)30318-1.

FORMING NEW CONNECTIONS

- Sleep and insomnia influence the different connections of the brain.
- During sleep, there is a spontaneous fusion of the glia and the neurons by the synapses, which leads to the formation of cell networks.
- The properties of the network are altered by synapses and signal molecules.
- During sleep, old superfluous memories are erased, new ones are strengthened, and the neuromuscular cycles are strengthened

DO GENES INFLUENCE OUR SLEEP?

- There are large inter- and intraindividual differences in the duration of sleep between people.
- A study in monozygotic and bizygotic twins indicates the inheritance of sleep duration. The duration of sleep is influenced between 31 and 55%, which shows a significant influence of genetics on the duration of sleep. This study also shows that, not only can the duration be inherited, but also insomnia, habitual sleep time, midday sleep, and the subjective quality of sleep between identical and fraternal twins.
- In addition to genetic factors, environmental factors, such as the duration and type of work, the distance between home and work, commuting, professional and family responsibilities, and social relationships, also influence sleep needs.
- Health conditions and age also influence sleep. The length of sleep of healthy people decreases with aging: a newborn needs 14–17 h of sleep per day, while adults sleep 7–9 h, and older people sleep for 7–8 h

Watson N.F., Buchwald D., Vitiello M., Noonan C., Goldberg J. A twin study of sleep duration and body mass Index. *J. Clin. Sleep Med.* 2010;6:11–17. doi: 10.5664/jcsm.27704.

Insomnia

- Insomnia is a clinical condition that is characterized by difficulty in maintaining sleep or falling asleep, and tiredness and irritability during the day
- Spending too long in bed and in trying to fall asleep is one of the main problems of people who struggle with insomnia. Sleep disorders influence the development of anxiety during and before falling asleep, which also affects the development of insomnia.
- According to the current state of the knowledge, insomnia disorders are found in about 10–20% of the adult population.
- They are influenced by factors such as a longer duration of sleep, being awake after sleep, respiratory disturbances during sleep, a shortened sleep duration, and sleep fragmentation.
- Insomnia leads to arousal in the waking state, sleep with an increased metabolic rate, and increased levels of the adrenocorticotropic hormone and cortisol during the early sleep phase.
- The malposition of the hypothalamic pituitary axis in chronic insomnia influences the fluctuations of the thyroid hormones by increasing the concentrations of cortisol, corticotropin-releasing hormone, and thyrotropin

Buysse D.J. Insomnia. *JAMA.* 2013;309:706–716. doi: 10.1001/jama.2013.193.
Bollu P.C., Kaur H. Sleep medicine: Insomnia and sleep. *Mo. Med.* 2019;116:68–75.
Reed D.L., Sacco W.P. Measuring sleep efficiency: What should the denominator be? *J. Clin. Sleep Med.* 2016;12:263–266. doi: 10.5664/jcsm.5498.

RISK FACTORS

- The deterioration in the quality of sleep and the incidence of insomnia occur in the general population, but they more often affect women and older people (65 years and over).
- There are many factors that influence the development and occurrence of insomnia, such as caffeine abuse, stress at work, the loss of a loved one, divorce, domestic violence, and shiftwork.
- People who have perfectionism, neuroses, a suppressed personality, or an increased susceptibility to anxiety are more susceptible to sleep disorders.
- The sleep–wake cycle may be affected by stimulants (such as alcohol, caffeine, and tobacco) and the use of electronic devices. The use of electronics in the bedroom reduces the sleep time and leads to permanent exposure to external stimuli (the sound of a ringing telephone) and a reduction in melatonin release (bright screen light)

Klingelhoefer L., Bhattacharya K., Reichmann H. Restless legs syndrome. *Clin. Med.* 2016;16:379–382. doi: 10.7861/clinmedicine.16-4-379.
Besedovsky L., Lange T., Born J. Sleep and immune function. *Pflügers Arch. Eur. J. Physiol.* 2012;463:121–137. doi: 10.1007/s00424-011-1044-0.

HOW MUCH SLEEP DO YOU REALLY NEED?

Adults generally need 7-8 hours with about 5 sleep cycles

Those who sleep 4.5-5 hours or less regularly experience cognitive deficits

Sleep trackers are at best 70% accurate at tracking sleep cycles

People will bias how they feel about their night of sleep based on what their score says; for example if you slept well but your score says otherwise, you will think you're more tired

CHILDREN & TEENS – THE SLEEP DURATION DEBATE

In the Journal SLEEP, Matricciani and colleagues, conclude

"there is insufficient evidence to support recommendations for optimal sleep durations in children and adolescents. … despite long standing concerns that children are not getting "sufficient" sleep, recommendations for longer sleep durations (i.e., time in bed) were not demonstrably evidence-based"

Despite recommendations from organisations like National Sleep Foundation, and Harvard University for time in bed to be aournd 8.5-10 h for 10 to 18 year olds – "there is little experimental data that justify these recommendations"

Matricciani L, Blunden S, Rigney G, Williams MT, Olds TS. Children's sleep needs: is there sufficient evidence to recommend optimal sleep for children? Sleep. 2013 Apr 1;36(4):527-34. doi: 10.5665/sleep.2538. PMID: 23564999; PMCID: PMC3612266.

Sleepiness in Teens

Daytime sleepiness is a prominent aspect of adolescent behaviour but not children's behaviour – there is a biological component and not entirely the result of insufficient time in bed.

Linked to maturation of the brain – the human brain

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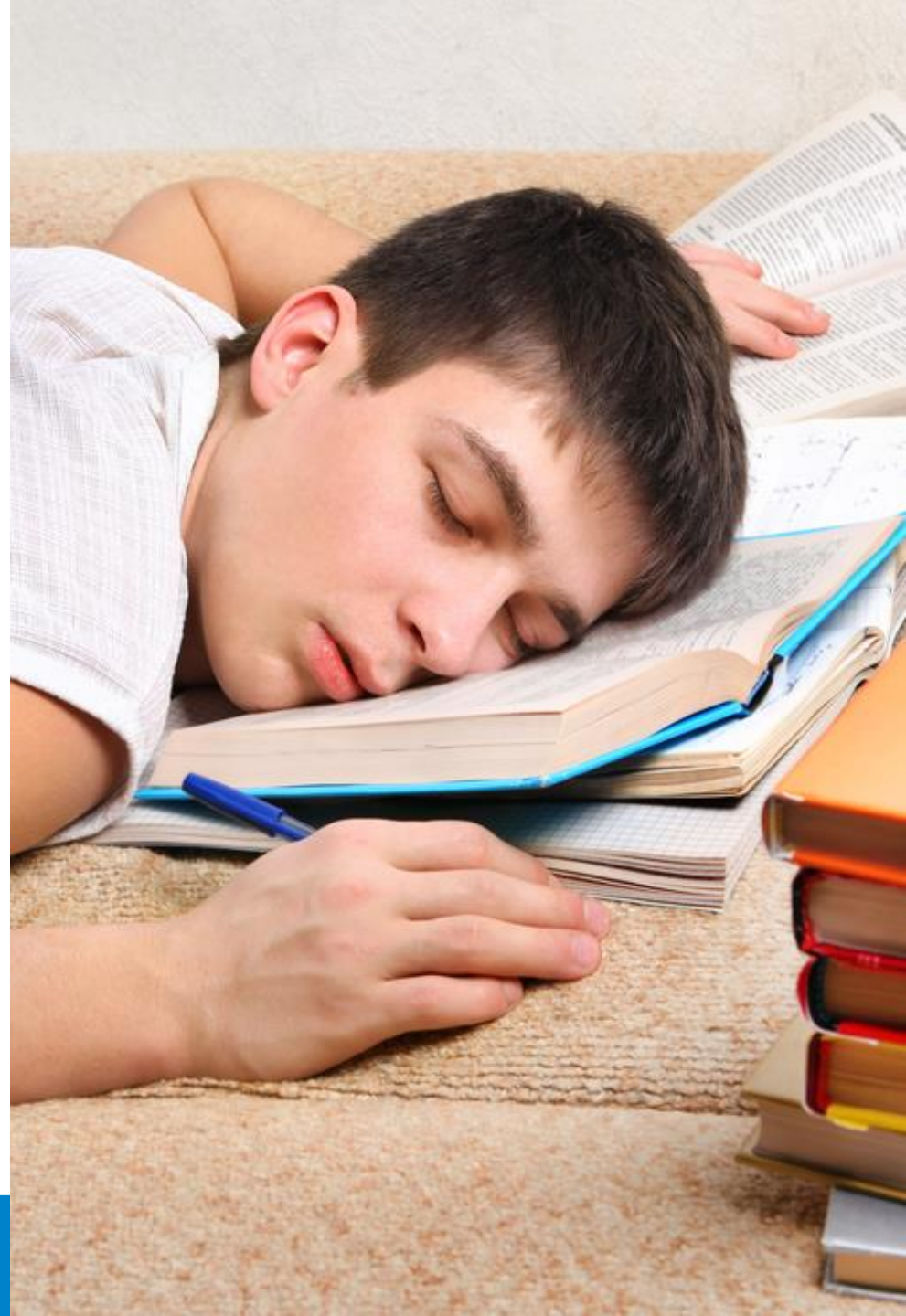
There is no doubt sleep is crucial for children and short duration is associated with a wide range of negative physical, social, emotional, and cognitive outcomes including poor concentration, impaired academic achievement, an increased risk of obesity, depression and mood disorders



Feinberg I. Recommended sleep durations for children and adolescents: the dearth of empirical evidence. Sleep. 2013 Apr 1;36(4):461-2. doi: 10.5665/sleep.2520. PMID: 23564992; PMCID: PMC3612242.

POOR SLEEP?

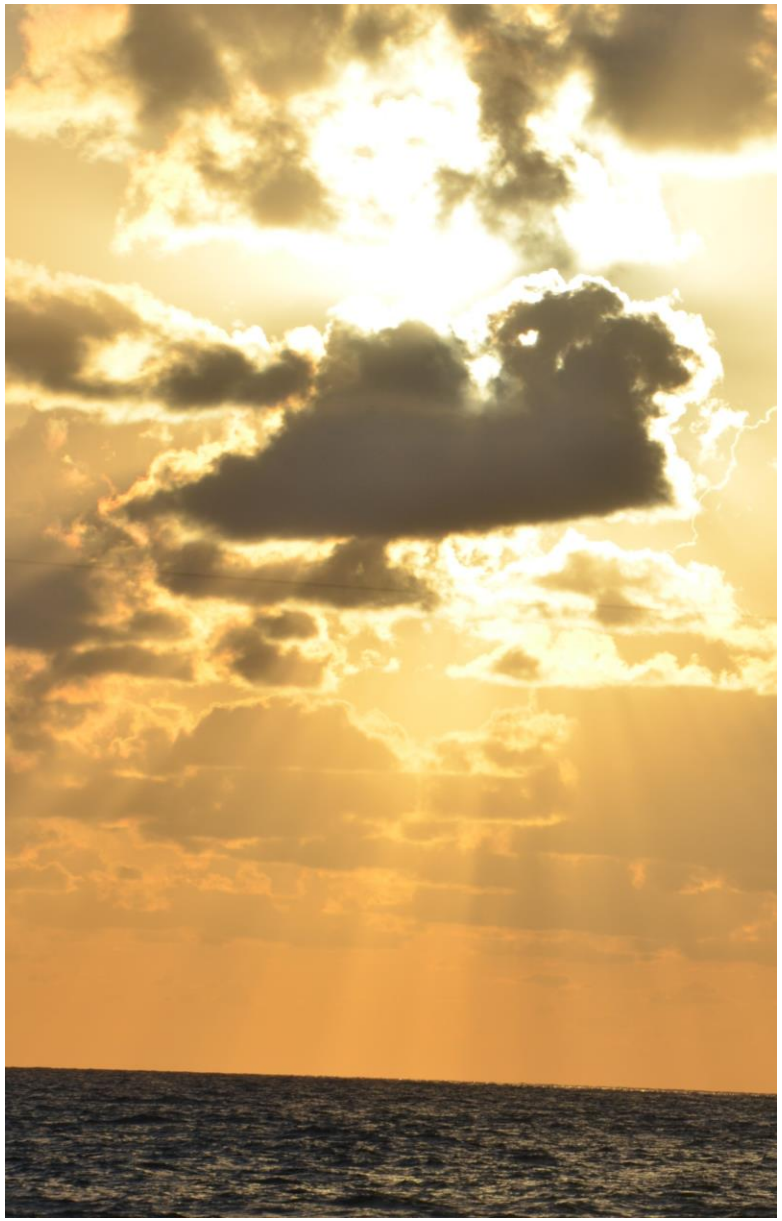
Check underlying imbalances

- **Check thyroid function** - If your thyroid hormones are low, your metabolism will slow and you will build up less **adenosine**, which will make it harder to fall asleep.
- **Adrenal Health** - If cortisol is too high (stress) you will struggle to get to sleep.
- **Address inflammation** –high histamine promotes wakefulness, inflammatory cytokines interfere with sleep cycle so address underlying issues
- **Bladder issues**
- **Restless leg syndrome, leg cramps**
- **Hormone levels –** falling hormone levels have been shown to affect sleep patterns / circadian rhythm (e.g menopause)
- **Blood sugar imbalances** – poor blood sugar control can spike cortisol at night waking you up
- **Allergies** - It is worth considering that food allergies and intolerance can affect your sleep: you might not realise that certain foods give you rashes or makes you sweat. If you suspect this might be the case, consider having an allergy test.

HOW TO SLEEP BETTER

BRAIN AND BODY CUES

- **Light /dark**
- **Temperature**
- **Food and when we eat**
- **Exercise**
- **Caffeine**
- **Supplements**
- **Digital / Behavioural tools**



Morning Waking

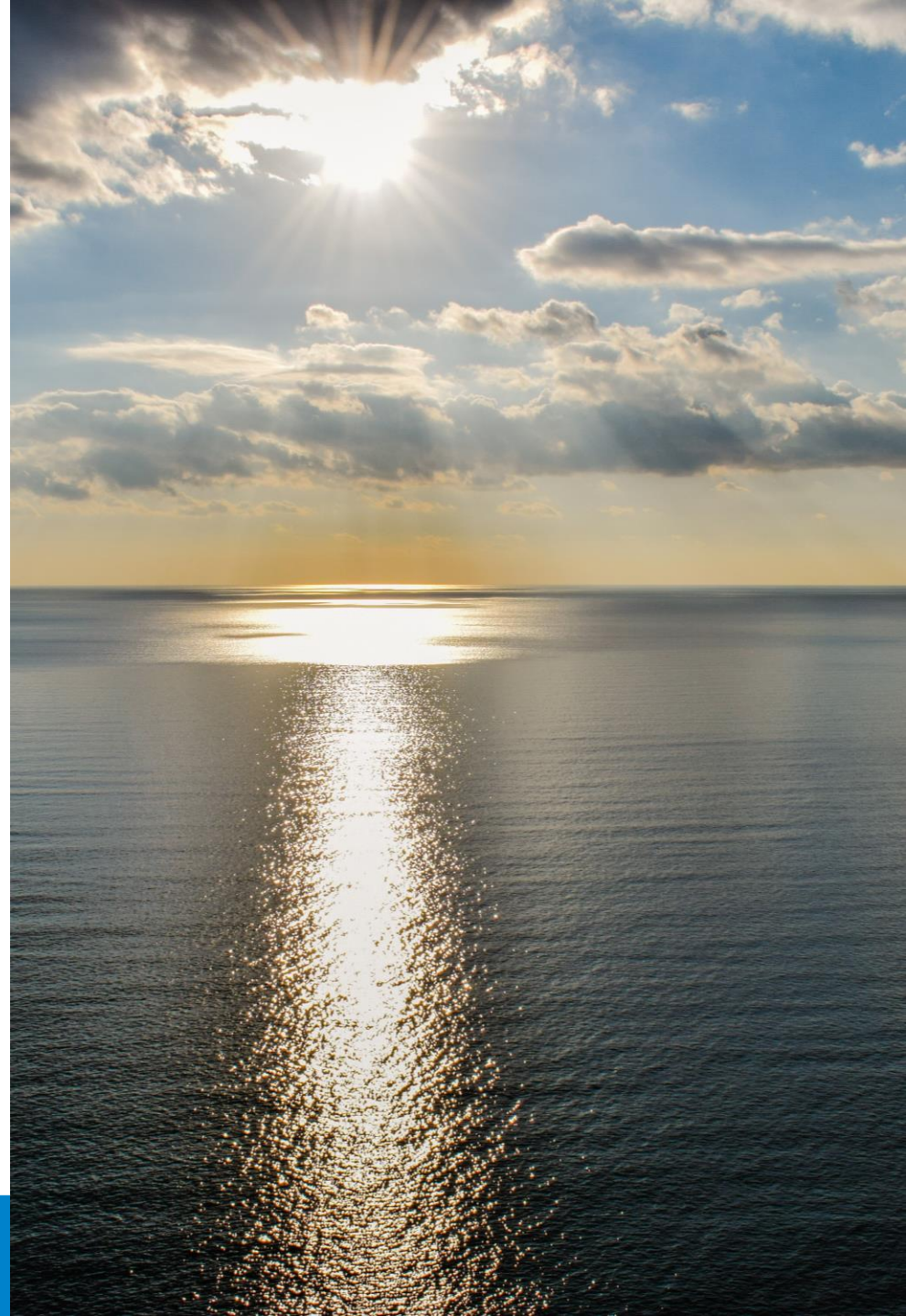
An increase in body temperature triggers waking up and is accompanied by an increase in cortisol

When elevated at the right time (first thing in the morning) cortisol enhances your immune system, metabolism, ability to focus, ability to move your body

You want cortisol to reach its peak right about the time when you wake up

VIEWING BRIGHT LIGHT

- Viewing in the first 30-60 minutes of waking has a powerful impact on the ability to fall asleep and stay asleep at night;
- If it's dark because of cloudiness or time of day you wake up, flip on artificial lights in your house (but go outside as soon as the sun it out);
- Get outside on cloudy days – you need even more light than a clear day
- **GOAL - 100,000 lux of light before 9:00 or 10:00 AM to effectively set your circadian clock, preferably from sunlight.**



TEMPERATURE

- Remember to sleep your body needs to drop temperature by 1-3C
- To leverage temperature for wakefulness: increase core body temperature quickly by taking a cold shower
- Exercise (any movement, doesn't have to be full-blown exercise) will increase core body temperature early in the day
- If you workout in the afternoon / evening - take a hot shower or bath after exercise to decrease body temperature and help prepare your body for sleep

ROLE OF DIET

- The foods that people consume can not only influence their wakefulness during the day, but also their quality of sleep. Sleep is not only influenced by the energy efficiency of the diet, but also by the content of macronutrients, such as proteins, carbohydrates, and fats
- An important relationship has been identified between the quality of carbohydrates ingested (fiber content of the products and the degree of processing of the food) and the quality of sleep
- The high consumption of noodles, sweets, and sugary drinks, as well as the omission of breakfast and irregular meals, are associated with poor sleep, while a diet that is rich in fish, seafood, and vegetables contributes to good sleep.
- The inadequate intake of macronutrients, excessive calorie intake, and late meals contribute to a reduction in sleep quality and may influence the development of insomnia

Binks H., Vincent G.E., Gupta C., Irwin C., Khalesi S. Effects of diet on sleep: A narrative review. *Nutrients.* 2020;12:936. doi: 10.3390/nu12040936.

TIMING AND TYPE OF MEALS

- Eating first thing in the morning helps set & train a circadian clock. Similarly eating at the same time every day helps regulate your clock
- Drinking lots of water, juice, tea, or other fluids may result in frequent bathroom trips throughout the night. Sip don't gulp fluid in the evening
- Eating foods that are rich in tryptophan, melatonin, and serotonin particularly in the evening improves sleep quality.
- In adults, after consuming foods rich in tryptophan, a longer downtime, increased performance, and an increased total sleep time have been observed.
- Vitamins and minerals (e.g., B vitamins, zinc) influence sleep quality, and when a deficiency was compensated for, an improvement in the sleep rate and the overall sleep quality was observed

Martínez-Rodríguez A., Rubio-Arias J., Ramos-Campo D.J., Reche-García C., Leyva-Vela B., Nadal-Nicolás Y. Psychological and sleep effects of tryptophan and magnesium-enriched mediterranean diet in women with fibromyalgia. Int. J. Environ. Res. Public Health. 2020;17:2227

Type of Carbohydrates Matters

- While Carbohydrates can support an increase in Tryptophan high glycemic index and glycemic load diets is a risk factor for insomnia
- A study on postmenopausal women population demonstrated that high-GI diet was associated with increased insomnia incidence over 3 years, and higher intakes of dietary added sugars, starch, and nonwhole/refined grains each were associated with higher incidence of insomnia. Moreover, they found higher fibre content in food as well as nonjuice fruit were associated with a lower prevalence and incidence of insomnia.
- Supporting this concept, a study on short-term consumption of a very low-carbohydrate (VLC) diet over 48 h comparing to a control mixed diet on sleep indices suggested promotes SWS (deep sleep stage) and reduces the percentage of REM sleep ("dreaming" sleep)

Gangwisch J. E., Hale L., St-Onge M.-P., et al. High glycemic index and glycemic load diets as risk factors for insomnia: analyses from the Women's Health Initiative. *The American Journal of Clinical Nutrition.* 2020;111(2):429–439.
Afaghi A., O'Connor H., Chow C. M. Acute effects of the very low carbohydrate diet on sleep indices. Nutritional Neuroscience. 2013;11(4):146–154. doi: 10.1179/147683008x301540.

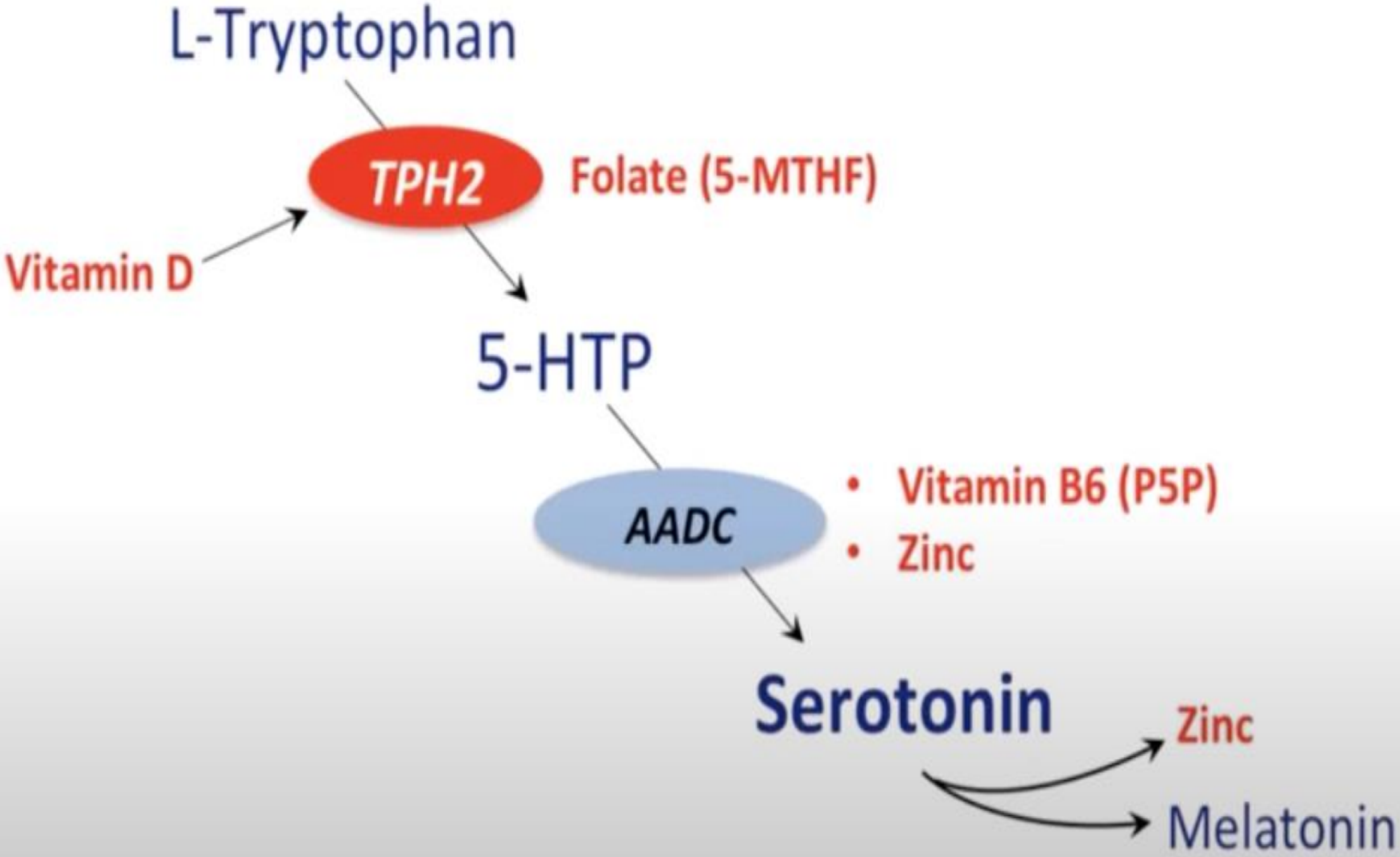
Tryptophan and the brain – previous theory

- Original theory was that food with high GI could alter the ratio of tryptophan relative to other large neutral amino acids (LNAAs including tyrosine, phenylalanine, leucine, isoleucine, valine, and methionine) in the circulation.
- It does so through the effect of insulin which increased following consumption of high-GI food. Insulin promotes the selective uptake of LNAAs by the muscles leading to higher tryptophan to LNAA ratio.
- Since tryptophan competes with LNAA for transportation into the brain, this change in ratio may lead to increased tryptophan in the brain

NEW INSIGHTS

- This theory has been challenged by the recent publication by Gangwisch et al. who suggested that this theory may not be realistic as it required the meal to contain only carbohydrate. If the meal contains as little as 5% protein, this can prevent the increase of tryptophan concentrations
- They proposed that hyperglycemia induced after high-GI diet and resulting compensatory hyperinsulinemia could induce the release of autonomic counterregulatory hormones including adrenaline, cortisol, glucagon, and growth hormone which contributed to insomnia.
- Moreover, high-GI diets have also been shown to stimulate inflammatory immune responses and lead to alternations in intestinal microbiome which may also profoundly affect sleep quality

Gangwisch J. E., Hale L., St-Onge M.-P., et al. High glycemic index and glycemic load diets as risk factors for insomnia: analyses from the Women's Health Initiative. *The American Journal of Clinical Nutrition.* 2020;**111**(2):429–439.
Gais S., Born J., Peters A., et al. Hypoglycemia counterregulation during sleep. *Sleep.* 2003;**26**(1):55–59. doi: 10.1093/sleep/26.1.55
Kim Y., Chen J., Wirth M. D., Shivappa N., Hebert J. R. Lower dietary inflammatory index scores are associated with lower glycemic index scores among college students. *Nutrients.* 2018;**10**(2):p. 182


L-Tryptophan
TPH2
Folate (5-MTHF)
Vitamin D
5-HTP
AADC
• Vitamin B6 (P5P)
• Zinc
Serotonin
Zinc
Melatonin

Tryptophan Rich Foods

- Dairy products (milk, low-fat yogurt, cheese)
- Poultry (turkey, chicken)
- Seafood (shrimp, salmon, halibut, tuna, sardines, cod)
- Nuts and seeds (flax, sesame, pumpkin, sunflower, cashews, peanuts, almonds, walnuts, peanut butter)
- Legumes (kidney beans, lima beans, black beans split peas, chickpeas)
- Fruits (apples, bananas, peaches, avocado)
- Vegetables (spinach, broccoli, turnip greens, asparagus, onions, seaweed)
- Grains (wheat, rice, barley, corn, oats)

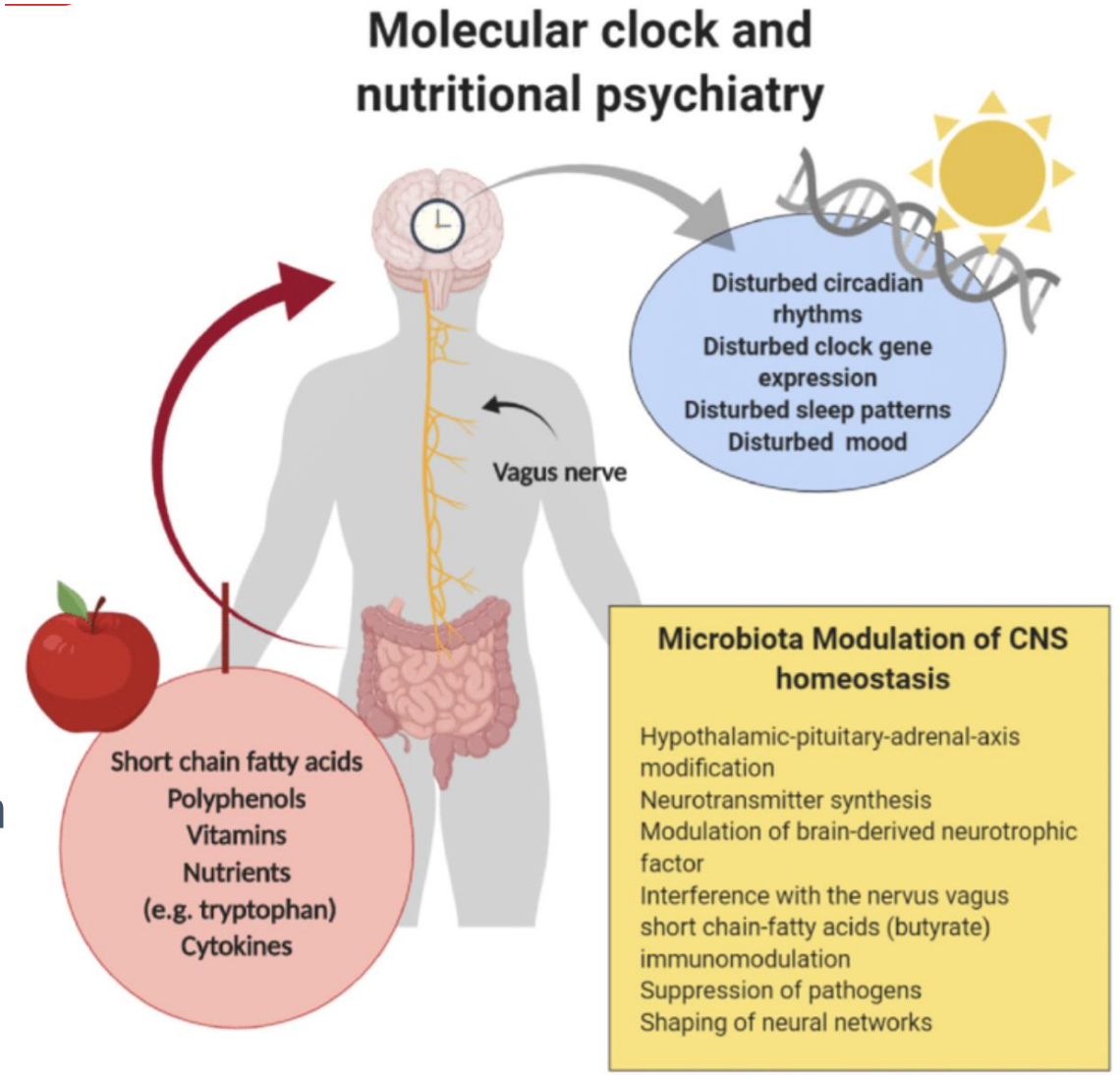
Gut- Brain- Sleep Axis

Our gut microbes interact with our clock genes

Gut microbiome influence GABA and Tryptophan Metabolism and produce metabolites that can influence sleep

Dysbiosis and inflammation can alter sleep

Recent studies suggest that sleep quality can be improved by altering the gut microbiota by consumption of certain probiotics and prebiotics



Li Y, Hao Y, Fan F, Zhang B. The Role of Microbiome in Insomnia, Circadian Disturbance and Depression. Front Psychiatry. 2018 Dec 5;9:669. doi: 10.3389/fpsyt.2018.00669. PMID: 30568608; PMCID: PMC6290721.

Metabolites & Inflammation

- Foods may also influence the commensal microbiota, which may lead to the formation of metabolites
- In addition inadequate nutrition in the long term may contribute to inflammation, which is closely related to insomnia. This may explain to some part why obesity can be linked to poor sleep
- Adequate nutrition that is rich in fruits, vegetables, and whole grains has been shown to have a positive effect on sleep

Zhao M., Tuo H., Wang S., Zhao L. The effects of dietary nutrition on sleep and sleep disorders. *Mediat. Inflamm.* 2020;2020:3142874. doi: 10.1155/2020/3142874.
Doherty R., Madigan S., Warrington G., Ellis J. Sleep and nutrition interactions: Implications for athletes. *Nutrients.* 2019;11:822. doi: 10.3390/nu11040822.
Ogilvie R.P., Patel S. The epidemiology of sleep and obesity. *Sleep Health.* 2018;3:383–388. doi: 10.1016/j.sleh.2017.07.013.

Deficiencies in Fatty acids

- Studies have suggested that diet deficient in omega-3 PUFA disturbed nocturnal sleep though affecting the melatonin rhythm and circadian clock functions.
- There is also a positive relation between omega-3 fatty acid composition in gluteal adipose tissue and sleep wellness including slow wave sleep and rapid eye movement sleep among obese patients with obstructive sleep apnoea syndrome.
- A study of healthy children has reported that higher blood DHA level is associated with significantly improved sleep wellness. In their subsequent randomized controlled trial (RCT) of DHA supplementation (with 600 mg/day for 16 weeks), significant group differences were observed including sleep duration increased by 58 min and fewer and shorter night-wakings in the treatment group versus the placebo group

Montgomery P., Burton J. R., Sewell R. P., Spreckelsen T. F., Richardson A. J. Fatty acids and sleep in UK children: subjective and pilot objective sleep results from the DOLAB study--a randomized controlled trial. *Journal of Sleep Research.* 2014;**23**(4):364–388. doi: 10.1111/jsr.12135.

RATIO OF OMEGA 6: 3

- No studies directly supply omega-6 fatty acids to study their role on sleep.
- However, the ratio of omega-6 to omega-3 essential fatty acids (EFA) may be important - this ratio has increased steadily over the past few decades (currently ~15 : 1) whereas 1-4:1 is normally seemed more optimal
- This imbalance is associated with many chronic inflammatory diseases. A 4-week double-blind study including 100 Alzheimer patients indicated supplement of compound comprising a 4 : 1 ratio of omega-6/omega-3 fatty acids improves sleep compared to placebo. The mechanism may be via the regulation of inflammation status.

Yehuda S., Rabinovtz S., Carasso R. L., Mostofsky D. I. Essential fatty acids preparation (SR-3) improves Alzheimer's patients quality of life. *The International Journal of Neuroscience.* 2009;**87**(3-4):141–149.

GABA

- The production of GABA is through the decarboxylation of L-glutamate catalyzed by glutamate decarboxylase. Food fermented by lactic acid bacteria or yeast normally contains an increased level of GABA.
- There are many studies showing the sleep-promoting effect of GABA, for example, Byun et al. reported a study of 40 patients with insomnia receiving 4 weeks of GABA (300 mg/day) have decreased sleep latency and increased sleep efficacy
- Glutamine is also a nonessential amino acid which can be used for the synthesis of GABA, a known inhibitory neurotransmitter and sleep inducer. Thus, it has been hypothesized and sometime taken for granted that the supplement of glutamine can benefit sleep.

Byun J. I., Shin Y. Y., Chung S. E., Shin W. C. Safety and efficacy of gamma-aminobutyric acid from fermented rice germ in patients with insomnia symptoms: a randomized, double-blind trial. *Journal of Clinical Neurology.* 2018;**14**(3):291–295.

Sleepy Fruits

- **Tart cherries:** studies have shown that consuming tart cherry juice can reduce time awake throughout the night and increase minutes of sleep
- **Kiwi fruit:** eating kiwi with skin on seems to decrease the speed of time to fall asleep and increase sleep duration – maybe mediated by the GABA system

CAFFEINE

- It's best to allow natural signals to wake up the body by delaying caffeine intake 90 minutes after rising
- Caffeine increases dopamine and blocks adenosine (which makes us sleepier)
- Caffeine crash: when coming down from caffeine, you lose the effects of caffeine, and the level of adenosine you suppressed comes rushing in
- The half-life of coffee is 5-6 hours depending on liver enzyme – avoid caffeine after 2pm
- Even if you don't feel the effects of late caffeine intake on sleep, cycles will likely be disrupted – particularly deep sleep
- You might fall asleep and stay asleep well, but increase caffeine intake the next day because you don't feel rested

O'Callaghan F., Muurlink O., Reid N. Effects of caffeine on sleep quality and daytime functioning. *Risk Manag. Health Policy.* 2018;11:263–271

ALCOHOL

- Alcohol is a sedative but not a sleep-aid
- You lose consciousness quicker but are not achieving quality sleep
- Alcohol fragments sleep so you will wake up many times throughout and will not have continuous sleep
- Alcohol is a potent REM sleep blocker
- Even one single glass of wine with dinner will reduce REM sleep time and can even cause declines in growth hormone release over time
- Try to allow 3 hours before bed and drink some electrolytes before bed as well. Limited data on dose effects

He S., Hasler B.P., Chakravorty S. Alcohol and sleep-related problems. *Curr. Opin. Psychol.* 2019;30:117–122.

BUILD AN EVENING ROUTINE

- Reduce all lighting at night / black out blinds/ block out blue light (UVEX red glasses) - Blue light is stimulatory and may keep you awake at night
- Take a warming bath esp magnesium salt bath about 1 -2 hours before bed.
- Reduce Your Nervous System Activity – mindfulness / Deep Sigh breathing, NSDR
- Write down anything troubling you
- Bedtime environment – get it right for you (temperature, noise, darkness etc).

SLEEP SUPPORTIVE NUTRIENTS

Nutrient	Sources
Magnesium	Leafy greens, wholegrains, nuts and seeds
Calcium	Dairy, tofu, dried figs, seeds, nuts
Potassium	Avocado, banana, tomato juice
Zinc	Fish and meat, nuts, seeds
Vitamin D	Eggs, liver, oily fish, mushrooms, fortified foods
Glycine	Protein rich foods (3g evening)
Arginine	meat, poultry, nuts and seeds, spirulina, chickpeas
Taurine	Meat, fish, legumes, dairy
B vitamins	Legumes, meat, fish, leafy greens, wholegrains
Glutamine	Eggs, beef, tofu, cabbage, dairy, rice

The mechanism regarding the role of vitamin D in sleep is yet to be confirmed, possibly related with inflammation and oxidative stress

SLEEP SUPPLEMENTS – WHAT TO CONSIDER

- Magnesium Glycinate 200-400mg about 1-2 hours before bed
- Theanine: 200-400mg
- Glycine: 2-3 gram
- Myo-inositol (particularly helpful for falling asleep again if you wake up): 900mg, 30-60 minutes before sleep – may not need this every night
- 5 HTP (not if on anti-depressants) 50-100mg
- CBD oil – can be useful for some people but responses vary

Melatonin USE

- Use of melatonin as a supplement for insomnia is on the rise
- A meta-analysis (2013) demonstrated that ….*melatonin decreases sleep onset latency, increases total sleep time and improves overall sleep quality. The effects of melatonin on sleep are modest but do not appear to dissipate with continued melatonin use. Although the absolute benefit of melatonin compared to placebo is smaller than other pharmacological treatments for insomnia, melatonin may have a role in the treatment of insomnia given its relatively benign side-effect profile compared to these agents*.

Eduardo Ferracioli-Oda, Ahmad Qawasmi, Michael H. Bloch (2013) Meta-Analysis: Melatonin for the Treatment of Primary Sleep Disorders PLOS ONE Published: May 17, 2013
https://doi.org/10.1371/journal.pone.0063773
JAMA. 2022;327(5):483-485. doi:10.1001/jama.2021.23652

SUMMARY

- Quality Sleep is one of our most important health boosters
- Consistency in sleep patterns is more important than being over fixated on each night's sleep
- Address underlying imbalances and optimise nutrient quality
- Consider timing of food and sources of carbohydrates in the evening
- Address inflammation and check omega 6:3 ratio
- Support gut health
- Add in lifestyle factors to reduce stress in the evening

Questions?