Fisiologi dari Tidur dan Klasifikasi Gangguan Tidur

Physiology of Sleep and Classification of Sleep Disorders

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ABSTRAK *Tidur merupakan fungsi biologis manusia, yang menghabiskan waktu hingga 1/3 masa hidup manusia. Gangguan tidur dapat berupa kurang tidur, persepsi tidur berlebihan, atau gerakan abnormal saat tidur. Gangguan tidur seringkali merupakan gejala awal dari penyakit jiwa yang akan terjadi; Gangguan jiwa juga menyebabkan perubahan fisiologi tidur. Tujuan dari naratif review berikut untuk mengumpulkan beberapa literatur review. Berdasarkan hasil naratif review didapatkan bahwa terdapat hubungan antara gangguan tidur dengan kesehatan mental, khususnya dengan depresi*

ABSTRACT *Sleep is a human biological function, with a ratio of 1/3 of human life. Sleep disturbances can include lack of sleep, excessive sleep perceptions, or abnormal movements during sleep. Sleep disturbances are often an early symptom of mental illness that will occur; mental disorders also cause changes in sleep physiology. The purpose of the following review narrative is to collect some of the review literature. Based on the narrative results, the review found that there is a relationship between sleep disorders and mental health, especially depression*

INTRODUCTION

The need for sleep is a basic human need. Sleep structure, duration, and quality of sleep can change a person's condition. Sleep onset latency and wake after sleep onset, non-rapid eye movement is influential in fulfilling human sleep needs (Luca et. all., 2015). Everyone's sleep needs are different. Some people need to sleep (long sleeper) for 9 to 10 hours at night. Some people need short sleepers who only need less than 6 hours of sleep. Length of sleep is not always associated with sleep disturbances (Sadock et. all., 2015). Long sleepers tend to experience mild depression, anxiety, and social withdrawal.

Meanwhile, short sleepers tend to be efficient, ambitious, adaptable, fun, and fun. The need for sleep can increase due to strong psychological stimuli, such as

learning situations, stress, the use of chemicals / drugs that can reduce brain catecholamines (Sadock et. all., 2015). Sleep disorders that occur in individuals are essential for evaluation. The causal factors are known because they will affect physical and mental health (Becker et. all., 2017; Wu et. all., 2012). Mental health is also related to the quality of sleep. In depression, it is found that the quality of sleep decreases which will result in decreased body health (Wu et. all., 2012). There is also a link between sleep disorders and mood disorders. Symptoms, disturbances, and lack of sleep can contribute to mood disorders development (Ng et. all., 2015).

EPIDEMIOLOGY

As many as 1 in 3 individuals found to have experienced insomnia during their lifetime. Sleep disturbances are shared among the elderly. It is found that 40% of cases of insomnia can develop into chronic and persistent conditions (Pavlova & Latreille, 2019). Sleep disturbance is a pervasive disorder, found that at least 10% of the population of the country experience sleep disorders that are evident clinically and functionally (Ram et. all., 2010).

Based on the National Sleep Foundation, 59% of susceptible adults aged 18-29 years describe themselves as night owls, which means they cannot sleep at night. They do not get enough sleep when they are required to wake up in the morning (Gaultney, 2010).

ELECTROPHYSIOLOGY OF SLEEP

Sleep consists of two physiological states: nonrapid eye movement (NREM) and rapid eye movement (REM). In NREM, sleep consists of 4 stages; most physiological functions are significantly reduced compared to the awake state. REM sleep is characterized by a high level of brain activity and a level of physiological activity that mimics the level of activity during wakefulness, REM sleep about 90 minutes after sleep onset. Ninety minutes REM latency is a consistent finding in normal adults. Shortening REM latency often occurs in people with depression and narcolepsy conditions (Sadock et. all., 2015)

NREM sleep is when the heart rate slows from five to ten beats per minute below the level when awake is resting, and the heart rate is also very regular. The potential for resting muscles in the body's muscles is lower in REM sleep than in the wakeful state. Episodic and involuntary body movements are present in NREM sleep. Stage 3 and stage 4 are the deepest parts of NREM sleep. The occurrence of disturbances in people in stages 3 and 4 of their sleep can produce enuresis, somnambulism, nightmare disorders (Sadock et. all., 2015).

REM sleep is also known as paradoxical sleep: heart rate, respiration, and blood pressure. We obtained high during REM sleep. Brain oxygen use also increases during REM sleep, the ventilatory response to increasing carbon dioxide levels (CO2) decreases. The physiological change during REM sleep is almost total paralysis of the skeletal (postural) muscles. This motor inhibition is due to the absence of body movement during REM sleep. It is found that 60% -90% of people who wake up during REM sleep report that they have dreams (Sadock dkk., 2015).

The cyclic nature of sleep is regular and reliable, with REM periods occurring approximately every 90-100 minutes throughout the night (Figure 1).

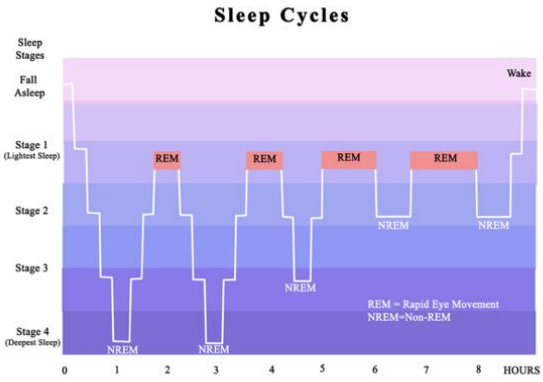


Figure 1 Pattern

The first REM period tends to be short, lasting about 10 minutes, with the subsequent REM periods lasting 15 to 40 minutes. REM periods occur in the final two-thirds of the night, whereas most stage 4 sleep occurs in the first third. As a young adult, the distribution of sleep stages is as follows

NREM (74 percent)

Stage 1: 5%

Stage 2: 45%

Stage 3: 12%

Stage 4: 13%

REM (25 percent)

This distribution is relatively constrained through old age. There is a reduction in short wave sleep and REM sleep (Sadock et. all., 2015). Wakefulness and REM sleep, current clinical guidelines for scoring PSGs identify three progressively deepening NREM sleep (Stages N1-N3). These stages are recognized and scored based on characteristic rhythms and events observed in the PSG waveforms. However, a detailed presentation of the scoring process is beyond the scope of this article. Alert wakefulness is associated with a low-amplitude mixed frequency EEG pattern. Drowsy wakefulness is associated with alpha waves seen as a rhythm with peaks in the 8-13 Hz range, as illustrated in Figure 2. Drowsiness is associated with slow-rolling eye movement that may persist in a light sleep. The lightest stage of NREM sleep (N1) is characterized by a loss of alpha rhythm and the presence of theta waves with a frequency of 4-7 Hz. Stage N2 sleep is marked by the expression of spindles (burst-like trains of waves in the 11-16 Hz range with a total duration $\geq$ 0.5s) and K-complexes (well-defined biphasic waves lasting $\geq$ 0.5s and usually maximal over the frontal cortex). Deep NREM sleep (stage N3) is associated with large ($\geq$74μV) slow (0.5-3Hz) waves known as delta waves. Typically, skeletal muscle activity exhibits progressively decreasing amplitude with wakefulness transitions to N1, N2, and N3 sleep. REM sleep is associated with the lowest skeletal muscle tone and with r sharp theta waves (sawtooth waves) or wake-like EEG patterns (Figure 2). During a nor atypical, the sleep process is cyclical, with sleep onset followed by a rapid

descent to deep stage N3 sleep within the first hour. This is followed by cyclical alternations between NREM and REM sleep occurring every 60-90 minutes throughout the rest of the night. Most N3 sleep occurs during the first half night, whereas most REM sleep occurs during the second half night, illustrated in Figure 2 (Carley & Farabi, 2016).

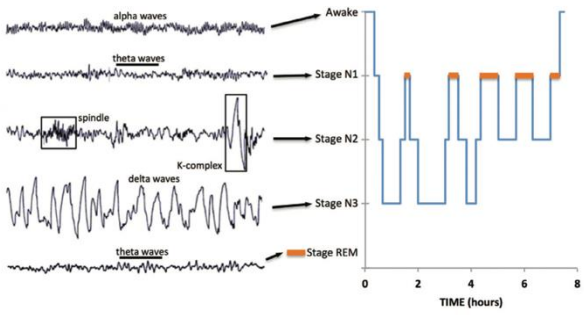


Figure 2 EEG features of sleep/wake stages (left) and typical temporal organization of healthy nocturnal sleep-in adult (right)

SLEEP REGULATION

Serotonin is known to have a role in human sleep. Prevention of serotonin synthesis or destruction of the dorsal nucleus rafe, which consists of almost all serotonergic cell bodies of the brain, reduces sleep for a long time.

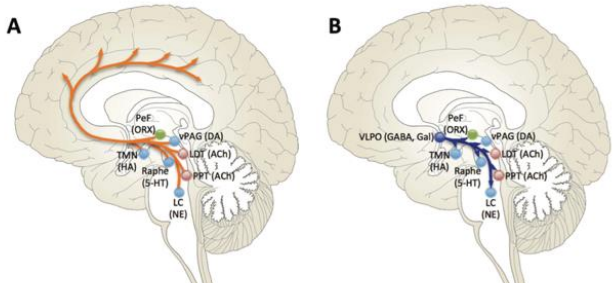
The synthesis and release of serotonin by serotonergic neurons are influenced by the availability of these neurotransmitter amino acid precursors, such as L-tryptophan. Large amounts of L-tryptophan (1-15gram) reduce the latency for sleeping as well as waking up at night. Conversely, L-tryptophan deficiency causes a lack of time for REM sleep. Neurons contain norepinephrine, with cell bodies located at the locus coeruleus playing an essential role in controlling standard sleep patterns. In addition, acetylcholine also has a role, especially in the production of REM sleep (Sadock dkk., 2015)

The cortical activation necessary to maintain wakefulness is supported by an extensive network of subcortical structures and pathways. Major neurochemicals of the "ascending arousal system" include excitatory norepinephrine arising from the locus coeruleus (LC), serotonin from the midline raphe nuclei, histamine from the tuberomammillary nucleus, dopamine from the ventral periaqueductal gray matter, acetylcholine from the pedunculopontine tegmentum, and tegmentum of pons and orexin from the perifornical area (figure 1). Initiation and maintenance of sleep require suppression of activity in the ascending arousal system. This is accomplished by inhibitory neurons of the ventrolateral preoptic area (BLPO; Figure 1B), which remain active through sleep (Carley & Farabi, 2016).

In major depressive disorders, there are sleep disorders due to disruption of central cholinergic activity. This disturbance was evident at REM sleep levels. Administration of muscarinic agonists such as arecoline to depressed patients during the first/second REM periods can result in a

rapid onset of REM sleep. Depression is also caused by super sensitivity to acetylcholine (Sadock et. all., 2015)

In patients with Alzheimer's type dementia experience sleep disturbances with reduced REM sleep and short-wave sleep. The loss of cholinergic neurons in the basal prosencephalon is associated with sleep disturbances in patients with Alzheimer's. The secretion of melatonin from the pineal gland is inhibited by bright light. The lowest serum melatonin concentration is found throughout the day (Sadock et. all., 2015).



Note. Panel A depicts key elements of the ascending arousal systems, with diffuse excitatory projections to the cortex. Panel B shows pathways arising from the hypothalamus that inactivate the ascending arousal system during sleep. Ach, acetylcholine; DA, dopamine; GABA, gamma amino-butyric acid; Gal, galanin; HA, histamine; LDT, laterodorsal tegmentum; NE, norepinephrine; ORX, orexin; PeF, perifornical region; PPT; pedunculopontine tegmentum; TMN, tuberomammillary nucleus; vPAG, ventral periaqueductal gray matter; 5-HT, 5-

CLASSIFICATION OF SLEEP DISORDERS

Insomnia Disorder

Insomnia is difficult starting or maintaining sleep. A brief period of insomnia is most often caused by anxiety. While persistent insomnia is a group of conditions that is quite common, with the most frequent complaints being a lack of sleep and sleeps quality associated with the following symptoms of difficulty starting to sleep (in children, usually the manifestation of the child is having difficulty starting sleep without the help of a caregiver), difficulty in sleeping. They maintain sleep, characterized by easy waking or difficulty returning to sleep after awakening, waking up very early in the morning, and having difficulty returning to sleep. Sleep disorders can cause difficulties or interfere with the individual's social, work, educational, academic, behavioral, and functional. Another diagnosis is that the difficulty appears at least three nights a week, sleep difficulties also appear for three months, sleep difficulties appear even though there is an opportunity to sleep. Insomnia cannot be described or categorized with other sleep disorders, respiratory disorders associated with sleep disorders, circadian rhythm sleep disturbances, parasomnia. A psychological disorder from drug abuse does not cause insomnia. Mental disorders and existing medical conditions do not adequately explain the main complaints of insomnia (K. Pavlova & Latreille, 2019). For three

decades, it has been found that sleep patterns affect depression (Adrien, 2002; Pavlova & Latreille, 2019).

Hypersomnolence Disorder

The condition in which the patient usually complains of excessive drowsiness. Instantly, somnolence is given because the patient, who may fall asleep suddenly while awake, experiences sleep attacks. The diagnostic criteria for hypersomnolence disorder are self-reported excessive sleepiness despite the main sleep period lasting at least 7 hours followed by symptoms of recurrent periods of sleep/lapses into sleep within the same day, a prolonged main sleep episode of more than 9 hours per day that is nonrestorative, difficulty being fully awake after abruption awakening—the presence of hypersomnolence symptoms at least three times a week and for at least three months. Hypersomnolence is accompanied by significant distress or impairment in cognitive, social occupation, or other important areas of functioning. The hypersomnolence is not better to explain and does not occur exclusively during another sleep disorder. The hypersomnolence is not attributable to the physiological effects (American Psychiatric Association & American Psychiatric Association, 2013).

Narcolepsy

Recurrent period of an irrepressible need to sleep, lapsing into sleep, or napping occurring within the same day. These must have been occurring at least three times per week over the past three months. The presence of at least one of the following episodes of cataplexy is defined as either (a) or (b), occurring at least a few times per month. In individuals with long-standing disease, brief (seconds to minutes) episodes of sudden bilateral loss of muscle tone with maintained consciousness are precipitated by laughter or joking (a). In children or individuals within six months of onset, spontaneous grimaces or jaw-opening episodes with tongue thrusting or global hypotonia without any obvious emotional triggers (b). Hypocretin deficiency, as measured using cerebrospinal fluid (CSF) hypocretin-1 immunoreactivity values (less than or equal to one-third of values obtained in healthy subjects tested using the same assay, or less than or equal to 110 pg/mL). Low CSF levels of hypocretin-1 must not be observed in the context of acute brain injury, inflammation, or infection. Nocturnal sleep polysomnography showing rapid eye movement (REM) sleep latency less than or equal to 15 minutes or multiple sleep latency tests showing a mean sleep latency than or equal to 8 minutes and two or more sleep-onset REM periods (American Psychiatric Association & American Psychiatric Association, 2013).

DISCUSSION

Based on the above explanation, several studies have shown that sleep is a human biological need. Sleep disturbances both in the quality and quantity of sleep can cause health, mental and physical health problems. This is supported by research conducted by (Gaultney, 2010), which states that lack of sleep can cause students to learn to be ineffective compared to students who get enough sleep. In his research also found that women are more prone to insomnia than men. Sleep-deprived students are more prone to experiencing affection disorders, insomnia, nightmares. Meanwhile, nightmares

and short sleep duration are also associated with a high risk of suicidal behavior (Gaultney, 2010).

The average sleep time is 7 hours. In research (Eugene & Masiak, 2015) found that individuals who slept for 4-6 hours for three days had a reduction in reaction times and cognitive dysfunction compared to individuals who got 7 hours of sleep per day. Individuals who get 7 hours of sleep are found to perform optimal performance in their daily lives (Eugene & Masiak, 2015). These sleep disorders interfere with daily performance and school absenteeism and dropout, cognitive functioning, and difficulties maintaining a social relationship (Carskadon et. all., 1998; Dewald et.all., 2010; Lovato & Gradisar, 2014; Smaldone dkk., 2007).

Insomnia is difficult starting or maintaining sleep. Insomnia and depression are related. Adolescents diagnosed with depression experience significant sleep disturbance, including disturbances in sleep quality and symptoms of hypersomnia/hypersomnolence and insomnia. Sleep indicates depression that has disturbed experience in sleep onset latency and decreased sleep efficiency (Lovato & Gradisar, 2014). This is also supported by research on adolescents conducted by (Rao & Poland, 2008) cited by(Lovato & Gradisar, 2014) that individuals with depression experience significantly longer sleep onset latencies, more awake after sleep onset lower sleep efficiency.

CONCLUSION

Sleep is a human biological need. Sleep disturbance can cause functional impairment, is a symptom of mental illness, and can also be a risk factor for disease. Sleep disturbances are often an early symptom of mental illness that will occur; mental disorders also cause changes in sleep physiology. Based on this study, there is a relationship between sleep disorders and mental health, especially depression. Further epidemiological studies are required to ascertain the prevalence of such association among the locals in East Java.

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