A Review of Sleep Process and Influencing Factors

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Abstract. In modern society, people often have difficulty in sleeping because of various reasons including psychological or physiological factors, environment, life rhythm and diet. This paper illustrates this effect by integrating various surveys. According to clinical trials, insomniacs normally share common characteristics such as poor sleep habits. In this essay, the main structure of sleep will be first introduced in detail, namely NREM and REM. Then it will discuss certain elements that affect sleep patterns, together with proper improvement methods. While these statistics are based on the majority of people, they don't necessarily apply to everyone. If the phenomenon that the sleep quality is poor exists for a long time, it is advisable to seek medical assistance. Additionally, the importance of both the number of awakenings and the quality of breathing in assessing sleep quality together with some reasonable advice will be put after description of sleep process.

Keywords: sleep, REM, NREM

1. Introduction

Many studies have shown that, in the modern society, there is a growing number of people suffering from insufficient sleep. Jean M. Twenge and his team (2017) draw a conclusion that sleep duration among adolescents in 2015 has been decreased compared with 2009 after contrasting feedback from different years. And it is reported that the sleep patterns of Chinese college students are generally characterized by late falling asleep, long sleep delay time, insufficient sleep and low sleep efficiency (Chen, J., & Wu, R. 2021). Sleep problems occur frequently, and sleep quality is related to depression and anxiety. With the development of technology, increasing electronic devices have also been applied to monitor several indicators to estimate sleep quality more accurately.

Generally speaking, sleeping structure consists of REM (rapid eye movement) and NREM(non rapid eye movement). According to Jerome (2017), REM is a period when electroencephalogram (EEG) of the neocortex is low. While NREM sleep, including light and deep NREM sleep, is characterized by frequent occurrence of sleep spindle and delta waves in EEG activity (Hong et al., 2019). During the sleep process REM alternates with NREM and an alternate is called one sleep cycle, which may appear 4-6 times throughout one night. In addition, the number of awakenings and the quality of breathing should also be taken seriously by people, especially insomniacs. For most people, it's common to wake up less than 2 times at night with a good respiratory quality.

Additionally, people have tended to focus on the methods of promoting sleep quality. This essay will first demonstrate the different stages in detail, and then analyze factors beneficial or harmful to sleep with the purpose of getting people acquaint with what they can do to enhance the sleep quality.

2. The basic description of sleep process

Basically, sleep structure is divided into REM sleep and NREM sleep, and NREM includes light and deep sleep. During the sleep process REM alternates with NREM and an alternate is called one sleep cycle, which may appear 4-6 times throughout one night. Every single circle is not simply the repetition of previous one but with typically equal 90-100 minutes (Anil et al., 2005). Normally in the later sleep cycle, REM sleep time increases while NREM sleep time goes down. For most people, different processes transfer in the following order: awakening → light sleep → deep sleep → rapid eye movement. However, in the actual sleep process, not all sleep states will be experienced and the transition between states may not be completely regular. For example, people could wake up from any one of light sleep, deep sleep and REM state.

In the deep sleep stage, there is a significantly slow brainwave frequency along with a measurable reduction in the respiratory rate and blood pressure, thus deep sleep is also known as low-wave sleep (Le Bon, 2020). People have the deepest sleep in this period when the threshold of awakening is the highest; if awakened at deep sleep stage, people might be symptomatic of dizzy and upset. A research revealed that in this period brain could be fully rested coupled with the best effect of eliminating fatigue. Meanwhile, deep sleep is of significance to stabilize the moods, balance the mentality and refresh energy. Generally speaking, the longer people have in this period, the better their sleep quality is. Nonetheless, a chronically high percentage of deep sleep can be a sign of an onset of some illnesses, and it is advisable to seek professional guidance.

During light sleep stage, electrical activity in the brain slows, as well as heart rate and breathing, which causes the phenomenon that though people fall asleep they are easily aroused. In essence, waking from sleep is a protective mechanism and necessary for health and survival, so light sleep is a normal physiological need. If light sleep occurs a high proportion of the whole sleep time, however, the quality of sleep will be poor with a tendency not to wake up and unable to relieve from exhaustion.

Different from the NREM, REM is a period when eyeballs roll rapidly back and forth under the eyelids (Siegel, 2005), which usually indicates sleeper is dreaming. In REM sleep, when muscles are really paralyzed (Blumberg et al., 2020), there is an arousal threshold higher than that in light sleep but lower than in deep sleep. This is a safety mechanism that prevents us from acting out when dreaming, which explains why people often dream of not being able to run or holler.

3. Certain factors that affect the sleep process with proper suggestions

3.1. In NREM period

Clinical practice has shown that chronic insomnia usually has some poor sleep habits and certain potential causations of poor sleep quality together with suggestions on overmuch light sleep and insufficient deep sleep are as follows. Firstly, insomniacs suffer from psychological factors (Pérusse et al., 2016) and are more negative than healthy people. Secondly, physiological factors such as overfatigue and physical discomfort caused by various diseases may affect the same result as psychological factors (Ferentinos et al., 2009). Thirdly, light, noise, temperature, humidity and other environmental factors can interfere with sleep. For example, blue-light exposure is deemed to have influence in reducing the ratio of deep sleep (Ishizawa et al., 2021). It is recommended to choose suitable pillows and mattresses as well as proper light, which could promote the sleep quality to some degree. Fourth, shift time and irregular sleep patterns can throw the body clock out of whack, thus leading to poor sleep quality (Åkerstedt, 2003). And finally, it is advisable to avoid strenuous exercise close to bed time, as limbs in excitement with high body temperature may make it difficult to fall asleep.

3.2. In REM period

Maintaining normal REM sleep time is vital to mental health as well as the promotion of creation and relief of pressure. Research indicates that after being deprived of REM, subjects will be agitated, nervous and easily exhausted. For example, decreased REM may be associated with epilepsy (Vuong et al., 2021; Sadak et al., 2022).

Dreams mainly occur in REM sleep and those dreams are much more vivid than in NREM (Martin et al., 2020). When REM sleep is inadequate, bodies will automatically compensate by extending REM sleep over the next few nights. If too much or too little REM sleep exists chronically, with symptoms such as irritability and anxiety, there may lie several reasons covering daily routine, psychological factors and diet. Avoiding excessive anxiety and fatigue combined with relieving stress in work and life can help maintain a normal REM sleep ratio. Reducing caffeine, alcohol, nicotine or drugs could also be profitable to sleep quality.

4. Awakening and breathing

In addition to REM and NREM, the number of awakenings and the quality of breathing can be used as criteria for measuring sleep quality. The causes of wakefulness with short micro-awakenings or long awakenings in nighttime sleep are complex. Under normal conditions, the number of awakenings during the night is less than two, and the total wakefulness time is no more than 10% of the total sleep time. If are frequently awakened at night, they may be insomniacs with difficulty in maintaining sleep. Additionally, forced-awakenings are much more annoying than awaking freely. In a research (Ikeda & Hayashi, 2010), participants complained of feeling uncomfortable immediately after forced-awakening, but they did not complain of feeling uncomfortable on those free nights.

If people often wake up during the night, or find it difficult to fall asleep after waking up, accompanied by fatigue, anxiety, irritability and other symptoms, they can refer to the following sleep improvement suggestions. Firstly, developing a regular routine to strengthen the circadian rhythm of body. Secondly, intense mental activities including watching TV or solving puzzles should be avoided before bedtime. Conversely, relaxing mind and calming mood are available to sleep with high quality. Thirdly, there is a proposal that people should recognize sleep properly and not overexaggerate or misestimate the result of poor sleep. If awake during the night, it is advised to relax, rather than overly anxious and frequently stare at the clock. Finally, comfortable environment and proper sports are also advantageous to fall asleep.

When the human body is overtired or has some upper airway pathological conditions (such as nasal obstruction and tonsil hypertrophy), it is easy to cause upper airway stenosis and produce symptoms such as snoring, hypoventilation and apnea, reducing the sleep quality. In addition, the IAQ that people are exposed to is essential to their sleep quality for which the reason is that sleeping environment has low ventilation (Canha et al., 2017). Moreover, obesity, as the strongest phenotypic risk factor in both obstructive sleep apnea (OSA) and non-alcoholic fatty liver disease (NAFLD) (Ji et al., 2022), can also affect sleep breathing quality. Thus, losing weight should be valued. If the phenomenon of poor sleep breathing occurs only after fatigue or alcohol consumption, and the sound of snoring is relatively light and uniform, there is no worry about it. However, if the phenomenon of poor sleep breathing occurs frequently, sleeping on the side, smoking ban, alcohol restriction and exercise can help to improve the sleep breathing quality.

5. Discussion

According to the above paper, whether the deep sleep ratio, the light sleep ratio, or the number of awakenings is more or less related to psychological or physiological factors, environment and daily schedule. Therefore, in order to improve the overall sleep quality, people should develop regular living habits, avoid excessive excitement and anxiety before going to bed; a quiet, comfortable and dark environment is also conducive to high-quality sleep. However, this paper only demonstrates data from various sources and theorizes about sleep recommendations without experiments to investigate whether sleep quality improved or not in patients who followed the recommendations.

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