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Circadian Rhythm Effect in Depression Management: A Psychosocial Approach

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A B S T R A C T

Depression is a kind of mental disorder. It is a risk factor for many diseases. Recently, it has been suggested to contribute to the high mortality rate, especially for young-middle ages. The incidence of depression is studied to be associated with sleep-style change that leads to internal circadian rhythm disruption. The circadian rhythm is related to the light-dark cycle of the sun. Dusk and dawn twilight are an important part of internal circadian rhythm synchronization. These moments correlate with the praying time of Muslims. A socio-spiritual approach could be a potential treatment for depressive disorder. At praying time for Muslims, the synchronization process of circadian rhythm is happening so that, hopefully, circadian disruption will resolve. This review aims to understand the impact of circadian rhythm on depression and its potential for depression treatment in the future.

1. Introduction

Depression has been known as a silent epidemic in many countries, including Indonesia. In 1990, depression ranked fourth as a global disease and suggested will be runner-up in the 20th century after coronary heart disease (CHD). Based on data in 2007, the prevalence of emotional disruption among Indonesian aged >15 years old was 11.6%, and global was ±5-10%. WHO said that the mortality of depression is 24 out of 100.000 cases.

Human bodies have an internal regulation system called circadian rhythm. Circadian rhythm is responsible for adapting to light-dark circle changes because of the earth's rotation.[1] This rhythm was characterized by the free run, never appropriate 24 hours (circa=approach), so we should synchronize this rhythm.[2,3] The process of physiology has its biology time, but it always synchronizes with external light-dark circle changes, was called entrainment or zeitgeber. Zeitgeber is an important part of the circadian rhythm. Besides that, the gradation of dawn and dusk twilights was also important for the circadian rhythm setting.[4-6]

Human life was organized by three clocks. It was sun, social, and internal biology clocks. A metabolic dysfunction happens because of internal and external circadian rhythm imbalance. The phase of entrainment in humans was called chronotype.[7,8] Chronotype was classified into larks and night owls. Lark (morningness) woke up and fell asleep earlier than night owls. This classification was important to evaluate people's capabilities starting their activities. Eveningness chronotype is the risk factor for circadian rhythm misalignment. These people also have more chances of getting worse sleep quality and depression.[9,10]

Praying time for Muslims related to the earth rotation phenomenon. Every Muslim start praying at dawn twilight. At this time, the light entrainment process of internal circadian rhythm happened. At the end of the day, Muslims were praying at dusk twilight. At this time, the dark entrainment process of internal circadian rhythm happened. In four-season countries, the entrainment process will be disturbed and stimulate seasonal affective disruption disease. Gradation of dawn and dusk twilight simulation can solve that problem.[11,12] In the current study, the chronotypes of some campers who did their activity in natural light for a week were changed from eveningness become to morningness. Based on that data, we suggest that a socio-spiritual approach can be a solution for the management of depression by doing an intervention to internal circadian rhythm.

Depression, circadian rhythm, and psychospiritual approach

Depression belongs to a common mental disorder. It affects almost 15% of the population in the world. Commonly, depression was connected to sleep style, diet, and body weight changes. Besides that, depression is also identic with mental retardation, concentration disorder, and exhaustion. Depression was treated with medical intervention and psychiatric. Pharmacological treatments were commonly given in 0.3 to 0.5 of the target dose of tricyclic antidepressant, bupropion, venlafaxine, or mirtazapine. A combination of antidepressant and psychiatric treatment was used by the physician to treat depression to increase the therapeutic effect. Depression was often untreated well and increased mood order-disorder risk factor.

Depression was characterized by sleep and eat-style changes. It will cause circadian rhythm disruption and change the chronotype into an eveningness type. Chronotype related to circadian rhythm duration. The morningness chronotype had shorter periods than the eveningness type, amplitude variation, and phase changes. Extreme eveningness type experiences a circadian phase shift to early morning and should be adapting to social clock demand. At this state, sleep, eating, school, or work-time experience misalignment with internal circadian time.[8,13] This desynchronization was called social jetlag, a condition related to smoking, depression, and obesity.

Circadian rhythm system role in physiologic function setting through an external 24-hour cycle.[6] The circadian rhythm was influenced by light intensity. It can be shifted by a single light sign and be synchronized by a set of limited area periodicity.[14,15] Circadian rhythm sets aside time to set behavior, physiologic function, and body metabolism based on the light-dark cycle. Physiologic processes have their biological clock, but always synchronizing with external light-dark change was called entrainment or zeitgeber.[16] There is a transition phase between the dark-light cycle called dawn twilight and dusk twilight that is important in the entrainment process of the internal circadian rhythm.[17]

Praying time, the earth's rotation, and the sun's position relating each other. Subuh time begins when true dawn or the sun at 18° under astronomical twilight. Muslims do their dhuha time when sunrise, duhur time when the sun is shifted from its peak, asar time their shadow is longer than themselves, maghrib time when sunset, and isya time when evening twilight is gone.[18-19] The entrainment process of internal circadian rhythm happened in subah and maghrib times.

Internal circadian rhythm should be set through a sensation as a zeitgeber to suit the external time. In humans, the transition phase is an important zeitgeber in the entrainment process. Many physiologic and biochemistry critical events in the human body happen at dawn twilight, for example, decreasing melatonin plasm concentration. All of the circadian systems will be in the anticipative phase toward the sun intensity change. It will be different from the other part of the earth that undergoes winter.

The transition event between internal and external rhythm didn't happen at once. It increases the risk factor for seasonal affective disorder. Dawn gradation lighting simulation can work against seasonal affective disorder.[20]

Dawn light should be given in gradually (2.2 log10 lux/hours till 250 lux) for 2 hours when dawn twilight intervention. It got seasonal affective disorder lower than other interventions at the same speed to reach 250 lux in 30 minutes (at 5.30 am – 6 am).[21] The other zeitgeber that affects internal circadian is social zeitgeber, such as daily activities, culture, or social interaction. Based on social zeitgeber theory, social zeitgeber disorder was caused by depression. Social rhythm disruption will affect biological rhythms, such as temperature, cortisol, and melatonin.[22,23]

Internal circadian rhythm can be resolved by light-lamp setting in subah and maghrib time. It can happen because the critical process of entrainment onset and offset of internal circadian rhythm was approached at that time. The light-lamp rhythm was suited to the light-dark sun cycle in a sinusoidal pattern. The sinusoidal pattern is like a natural condition where dawn and dusk twilight are included. The transition phase is a timing onset and offsets signal for diurnal or nocturnal organisms.[24]

Wright et al. (2013) studied 8 respondents (2 women) aged 30,3 ± 8,5 years old for 2 weeks in July in the Rocky Mountains of Colorado. All respondent did their daily activity under electric-light was like a sun cycle for a week. After that, all respondents camped under natural light for a week. Based on that study, respondents who were eveningness chronotypes were more sensitive to change into morningness chronotypes.

Stressor leads the hypothalamus to produce corticotrophin-releasing hormone (CRH) so that cortisol hormone production will increase. Stressors also affect nuclei cereleus and stimulate sympathetic activity, so the norepinephrine hormone will increase. Stressors block pineal gland activity and raphe nuclei system of serotonin that produces melatonin and serotonin hormones. Melatonin hormone production was affected by a light-lamp setting for 1-2 hours before onset production. It has been known as dim light melatonin onset (DLMO), 2 hours before melatonin has its effect.[22] Melatonin is a neurohormone that role in the entrainment process. Dull light will be caught by a receptor in the retina and then by SCN, a central pacemaker of the circadian rhythm. The signal will be transmitted by SCN to raphe nuclei and the pineal gland that stimulate serotonin and melatonin production. These hormones will affect the psychological condition.

2. Conclusion

Depression may be treated with a spiritual approach. People will feel peaceful at praying time. This condition will activate parasympathetic and block sympathetic so that the depression feel will decrease. Praying time also affects social zeitgeber. People who wake up earlier will be easier to adapt to social stressors.

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