



#### 4. CIRCADIAN RHYTHM DISTURBANCES AND IMMUNE SYSTEM

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**Introduction.** The intricate dance between the immune system (IS) and circadian rhythm (CR) orchestrates a finely tuned symphony within the human body. IS is the body's vigilant defender against pathogens, relying on innate and adaptive components for immediate and targeted responses. The study aims to investigate the impact of circadian rhythm disturbances on immune system dynamics.

**Aim of study.** CR driven by the master circadian clock, regulates the rhythmic oscillations of physiological and behavioral processes over 24 hours and synchronizes various bodily functions, including sleep-wake cycles, hormone secretion, and metabolic activity. Also, immune cells exhibit circadian oscillations, influencing the body's susceptibility to infections, and conversely, immune challenges can disrupt CR. Understanding the nuances of this reciprocal relationship opens avenues for exploring how CR disturbances may impact immune responses and vice versa, shedding light on potential implications for human health and innovative therapeutic interventions.

**Methods and materials.** This systematic review synthesizes data from publications over the last decade, sourced from PubMed, PMC, and Google Scholar, focusing on the intricate relationship between normal and disturbed and the innate and adaptive ISN by analyzing approximately 51 relevant studies. The following keywords were used for the search: circadian rhythm, immune system, sleep disruption, clock genes, cytokines, melatonin, cortisol, shift work, immune regulation, and inflammatory response

**Results.** CR influences the innate and adaptive IS. It has been demonstrated that circadian clock proteins play a significant role in T cell differentiation. For example, CD4<sup>+</sup> T exhibits a rhythmic expression of clock genes, and the circulation of B and T cells increases at night and decreases throughout the day as they undergo extravasation. Cortisol, which peaks in the morning, stimulates wakefulness but, when chronically high, can inhibit the immune system. Melatonin, which rises in the evening, regulates the circadian rhythm and has anti-inflammatory properties, helping to maintain a healthy immune response during sleep. Sleep disruptions reduce the immune system's response by boosting cortisol and decreasing melatonin, increasing susceptibility to infections, encouraging inflammation, and limiting wound healing. Prioritizing healthy sleep patterns is critical for overall immune function support.

**Conclusion.** The circadian rhythm controls immunological responses by affecting clock gene expression, cytokine production, immune cell activity and levels of hormones like cortisol and melatonin. Coordination like this ensures an efficient and effective immunological response. Immune modulation may be impacted by disruptions to the circadian rhythm, emphasizing the significance of preserving a normal sleep-wake cycle.