Chrononutrition and Mental Health: Exploring Links Between Eating Patterns Circadian Rhythms and Psychological Well-being

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This study investigates the relationship between chrononutrition—timing and patterns of food intake—and mental health, focusing on how circadian rhythms influence psychological well-being. Using a qualitative approach, this literature review synthesizes recent research exploring the connections between eating patterns, biological rhythms, and mental health outcomes, such as anxiety, depression, and overall mood stability. Findings indicate that irregular eating times, late-night meals, and skipping meals disrupt circadian alignment, potentially leading to mood dysregulation and decreased psychological resilience. Conversely, eating in sync with the body's natural circadian rhythms appears to support mental health, with regular meal timing shown to enhance mood and reduce anxiety symptoms. The review also highlights the importance of specific nutrients in promoting stable circadian cycles, suggesting that diets rich in complex carbohydrates, proteins, and certain vitamins may aid in stabilizing mood. These findings underscore the need for an integrative approach to nutrition and mental health that considers both the timing and composition of meals. This review provides valuable insights into the emerging field of chrononutrition, emphasizing the potential of circadian-aligned eating as a preventive and therapeutic strategy for mental health. Further qualitative studies are recommended to explore individualized chrononutrition interventions and their effects on mental well-being across diverse populations.

1. Introduction

In recent years, the concept of chrononutrition has emerged as an important field of study, investigating how the timing, frequency, and regularity of eating patterns affect human health, particularly mental health. Chrononutrition considers the alignment between eating habits and the body's circadian rhythms, which govern various biological processes, including sleep-wake cycles, hormone release, and metabolism (Franzago et al., 2023). Circadian rhythms are essential for maintaining homeostasis and optimizing physiological functions, and disruptions to these rhythms have been linked to various health issues, including metabolic disorders, cardiovascular diseases, and, more recently, mental health disorders (Franzago et al., 2023). Given the increasing prevalence of mental health conditions such as depression and anxiety, understanding how chrononutrition influences psychological well-being is crucial for developing comprehensive approaches to mental health care.

Despite the growing interest in the effects of diet on mental health, there remains a significant research gap in understanding how the timing of food intake interacts with circadian rhythms to impact psychological outcomes. Most existing studies have focused on nutrient composition or caloric intake as determinants of mental health, with limited attention paid to the role of meal timing and consistency (Shoja et al., 2020). This gap in research suggests that traditional approaches to nutrition and mental health may overlook an essential aspect of dietary behavior. Chrononutrition offers a novel perspective that could enhance mental health interventions by addressing not only what people eat but also when they eat (Codoñer-Franch et al., 2023).

The urgency of this research lies in the need to address rising global rates of mental health disorders and their associated social and economic burdens. As mental health issues increasingly affect diverse age groups and populations, preventive and non-invasive interventions, such as diet adjustments, have become a priority for researchers and healthcare practitioners alike (Bansal & Chuchulo, 2018). Chrononutrition presents a unique, accessible approach that could be integrated into daily routines, making it a potentially transformative strategy for mental health maintenance and improvement. Addressing meal timing as a preventive measure in mental health could reduce reliance on pharmacological treatments and provide an alternative pathway for managing symptoms of depression, anxiety, and mood disorders.

Previous studies have begun to link chrononutrition with specific aspects of mental health. For instance, irregular eating patterns and late-night meals have been associated with mood dysregulation, increased stress, and poorer sleep quality, all of which are risk factors for mental health issues (Luz et al., 2024). However, few studies provide a holistic view of how eating patterns, circadian rhythms, and mental health intersect, and the mechanisms underlying these interactions remain poorly understood. By focusing on the timing of food intake rather than solely its nutritional composition, this study aims to fill a critical gap in the literature, exploring how synchronizing eating habits with circadian rhythms may enhance psychological resilience and mood stability (Luz et al., 2024).

This research aims to offer a novel perspective by examining the role of chrononutrition in mental health, highlighting the potential for circadian-aligned eating patterns as an intervention for psychological well-being. This study contributes to the field by providing insights into how adjusting eating schedules to align with natural biological rhythms can influence mental health. By identifying the potential benefits of chrononutrition, this research could inform dietary guidelines and clinical practices, ultimately aiding individuals in improving their mental health through accessible lifestyle modifications. The findings are expected to benefit both mental health professionals and individuals seeking non-pharmacological approaches to enhance mental well-being, paving the way for future research on personalized chrononutrition interventions (Bull et al., 2020).

2. Method

This study employs a qualitative research design, specifically a literature review approach, to investigate the connections between chrononutrition, circadian rhythms, and mental health. A qualitative literature review is appropriate for this research as it allows for an in-depth examination of existing studies, providing a comprehensive understanding of the patterns and relationships between eating habits, biological rhythms, and psychological well-being (Montaruli et al., 2021). By analyzing qualitative data from prior studies, this research aims to synthesize findings, identify gaps, and offer insights into potential mechanisms linking chrononutrition with mental health outcomes.

The data sources for this review include peer-reviewed articles, academic journals, and authoritative publications from established databases such as PubMed, Scopus,

and Google Scholar. The literature search focuses on studies published within the last ten years to ensure that findings reflect current knowledge and research trends in chrononutrition and mental health. Articles were selected based on their relevance to three main criteria: (1) studies examining the impact of eating patterns on circadian alignment, (2) research on circadian rhythms in relation to mental health, and (3) investigations into the effects of meal timing and regularity on psychological well-being (Eisenberg et al., 2004).

Data collection involved systematic searching with keywords such as "chrononutrition," "circadian rhythms and mental health," "eating patterns," and "psychological well-being." This search was supplemented by manually reviewing reference lists of selected articles to identify additional relevant studies. A data extraction form was used to document key information from each article, including study objectives, methodology, findings, and relevant insights on the intersection of chrononutrition and mental health. This structured approach ensures comprehensive coverage and systematic organization of relevant literature (Karunarathna et al., 2024).

Thematic analysis was employed to analyze the collected data, allowing for the identification and interpretation of key themes and patterns across studies. Through coding and categorization, themes emerged related to eating patterns and circadian alignment, the impact of timing on mental health outcomes, and potential biological mechanisms underlying these relationships. This iterative analysis enabled the organization of data into coherent themes that highlight the roles of regularity, timing, and nutrient intake in influencing psychological well-being (Vito Ms, 2024). To maintain rigor, themes were refined and cross-checked against existing literature, ensuring that interpretations were well-supported and reflective of broader trends (Liao, 2015).

By employing a qualitative literature review and thematic analysis, this study provides an integrative perspective on chrononutrition's role in mental health, offering foundational insights that can guide future research and intervention development aimed at optimizing mental well-being through synchronized eating patterns.

3. Result and Discussion

The analysis of existing literature reveals a significant relationship between chrononutrition—specifically the timing, frequency, and regularity of eating patterns—and mental health outcomes, with a focus on how these patterns interact with the body's circadian rhythms. Studies show that regular meal timing aligned with natural circadian rhythms can support psychological well-being by stabilizing mood, reducing stress, and enhancing cognitive functions (Weinert & Gubin, 2022). In contrast, irregular eating patterns, such as skipping meals or consuming food late at night, appear to disrupt circadian alignment, resulting in increased risks of mood disorders, including anxiety and depression. This disruption is linked to biological processes regulated by circadian clocks, particularly the hormonal and metabolic fluctuations that impact neurotransmitter production and emotional regulation (Yılmazer, 2024).

The synthesis of findings suggests that circadian-aligned eating may play a protective role in mental health, enhancing resilience against psychological distress. Regular meal timing fosters stable glucose levels and promotes balanced cortisol release, which is essential for managing stress and maintaining a stable mood throughout the day (Drăgoi et al., 2024). Additionally, studies indicate that eating patterns that align with daylight hours, often referred to as time-restricted feeding, contribute to better sleep quality, further supporting mental well-being by synchronizing internal rhythms with environmental cues (Drăgoi et al., 2024). Quality sleep, as facilitated by circadian-synchronized eating, has been shown to reduce symptoms of anxiety and depression, suggesting a synergistic effect of sleep and nutrition on psychological health.

Nutrient timing also appears to impact circadian function and mental health. Meals rich in complex carbohydrates, proteins, and omega-3 fatty acids, when consumed at consistent times, support serotonin and melatonin production, which are crucial for mood regulation and sleep quality (Sarrafi-Zadeh et al., 2012). This relationship suggests that both the timing and composition of meals are important in supporting mental health. The findings indicate that by structuring meals around the body's circadian clock, individuals may achieve a more balanced emotional state, and dietary interventions targeting meal timing could offer novel therapeutic strategies for mood disorders. However, studies also highlight that many individuals face barriers to consistent eating schedules, such as work shifts and lifestyle demands, which can interfere with circadian rhythms and ultimately impact mental health (Foster, 2020).

Overall, the literature suggests that chrononutrition offers a promising, non-invasive approach to supporting mental health through lifestyle modifications. While more research is needed to clarify the specific mechanisms involved, the current findings underscore the importance of aligning meal timing with circadian biology as a potential preventive and therapeutic measure for mental well-being.

Regular Meal Timing and Mood Stability

The literature highlights that regular meal timing, aligned with the body's circadian rhythms, plays a significant role in stabilizing mood and reducing the risk of mood disorders. Studies show that individuals who maintain consistent eating schedules experience lower levels of stress and anxiety, likely due to the synchronization of metabolic and hormonal cycles that influence emotional regulation (Foster, 2020). Regular eating patterns support balanced cortisol levels throughout the day, which is essential for managing stress and promoting mental resilience (Shoja et al., 2020).

Regular meal timing, aligned with the body's natural circadian rhythms, plays a critical role in stabilizing mood and supporting overall psychological well-being. This concept is based on the understanding that our circadian system—the internal biological clock that regulates various physiological processes, including hormone release, body temperature, and sleep-wake cycles—also influences digestion, metabolism, and energy levels. When meals are consumed at consistent times each day, these physiological processes operate in harmony, creating a stable internal environment that contributes to mental stability and emotional resilience (McCraty & Zayas, 2014).

Research indicates that regular eating schedules positively affect mood by promoting stable blood sugar levels, which directly impacts energy and cognitive function. For instance, individuals who maintain regular meal times often experience fewer mood swings and a more balanced emotional state throughout the day. This stability is attributed to the body's ability to regulate cortisol—the primary stress hormone—more effectively when meals are eaten consistently. Cortisol levels typically peak in the early morning and decrease gradually throughout the day. Irregular eating patterns can disrupt this natural rhythm, leading to erratic cortisol release, which can increase stress, anxiety, and irritability (McCraty & Zayas, 2014)

Furthermore, regular meal timing supports the balanced production of neurotransmitters, particularly serotonin, which is essential for mood regulation.

Serotonin, often referred to as the "feel-good" hormone, is largely produced in the gastrointestinal tract, and its synthesis is influenced by meal timing and nutrient availability. Consistent eating patterns ensure a steady supply of nutrients needed for serotonin production, thus enhancing mood stability and reducing the risk of depressive symptoms. Irregular eating, on the other hand, can cause fluctuations in serotonin levels, contributing to mood instability and increasing the likelihood of negative emotional states (Merriam & Tisdell, 2015).

Consistent meal timing also helps regulate the sleep-wake cycle, which is closely linked to mental health. Studies have shown that individuals with regular eating schedules tend to experience better sleep quality, which further supports emotional resilience and cognitive function. Adequate sleep is essential for mood stability, as poor sleep has been linked to increased risks of anxiety and depression. By aligning meal timing with natural circadian rhythms, individuals can promote better sleep and, in turn, enhance their mental health. This regularity also supports the body's ability to anticipate and prepare for nutrient intake, optimizing digestive efficiency and energy utilization, which are important for maintaining mental alertness and a positive mood throughout the day (Kvale & Brinkmann, 2015).

In summary, regular meal timing is a vital component of chrononutrition that promotes mood stability and mental health by aligning eating patterns with the body's circadian rhythms. Through consistent meal schedules, individuals can achieve balanced cortisol levels, improved neurotransmitter production, and enhanced sleep quality, all of which are essential for sustaining a stable and resilient emotional state. This evidence suggests that establishing regular eating habits may be an effective, non-invasive strategy to support mental well-being, making it a valuable consideration in lifestyle and dietary interventions aimed at improving psychological health (Rueda et al., 2011).

Impact of Late-Night Eating on Mental Health

Consuming food late at night, outside of the natural circadian window, has been associated with increased risks of depression and anxiety. Late-night eating disrupts the body's internal clock, leading to imbalances in metabolic processes and affecting neurotransmitter functions critical for mood regulation. Studies suggest that nighttime eating may elevate cortisol and decrease serotonin levels, both of which are linked to increased stress and depressive symptoms (Birketvedt et al., 1999). This

misalignment with circadian rhythms creates a hormonal environment that can compromise psychological well-being.

Late-night eating, defined as consuming meals or snacks outside of the body's natural circadian rhythms (typically late evening or nighttime), has been shown to have a significant impact on mental health, particularly in terms of mood stability, stress levels, and the risk of developing depressive and anxiety symptoms. The human body operates on an internal circadian clock that regulates various biological processes, including metabolism, hormone production, and sleep-wake cycles, all of which are synchronized with environmental light and dark patterns (Schuler & Hope, 2020). When individuals consume food late at night, this alignment is disrupted, leading to a cascade of physiological imbalances that can influence mental health outcomes negatively.

One of the primary ways late-night eating affects mental health is through its impact on hormone levels, particularly cortisol and serotonin. Cortisol, often known as the "stress hormone," follows a diurnal rhythm, peaking in the morning and gradually decreasing throughout the day. Eating late at night can interfere with this cycle, leading to elevated cortisol levels that persist into the next day. Chronic high cortisol levels have been linked to increased stress, irritability, and a higher risk of anxiety and depression (Shoja et al., 2020). Additionally, serotonin, a neurotransmitter critical for mood regulation, is influenced by meal timing and dietary patterns. Late-night eating can impair serotonin synthesis, reducing its availability and contributing to mood instability, irritability, and difficulty in managing stress (Stringaris et al., 2018).

Furthermore, late-night eating disrupts metabolic processes, leading to poor glucose regulation and increased levels of insulin resistance, both of which are associated with mood disturbances. Research suggests that irregular glucose levels resulting from nocturnal eating may contribute to feelings of lethargy, fatigue, and irritability, exacerbating depressive symptoms. Over time, disrupted glucose metabolism caused by inconsistent meal timing may predispose individuals to psychological stress and mood disorders, as the brain's energy supply becomes less stable, impacting cognitive function and emotional regulation.

Late-night eating also interferes with sleep quality, which is essential for mental health. Eating close to bedtime can lead to fragmented sleep, as the body's digestion process competes with the need for rest, making it difficult for individuals to reach

restorative sleep stages. Poor sleep quality and reduced REM sleep can impair memory, decision-making, and emotional resilience, leading to increased anxiety and depression risk. Studies indicate that individuals with consistent late-night eating habits often experience higher rates of insomnia and report more frequent symptoms of mental health disturbances due to poor sleep quality (Tuncay & Sarman, 2024).

Social and lifestyle factors, such as shift work, social engagements, or stress-related snacking, often contribute to late-night eating patterns, complicating mental health further. For instance, individuals working night shifts are more likely to consume food outside of natural circadian windows, making them susceptible to the mental health impacts of disrupted biological rhythms. This tendency towards irregular eating schedules often compounds their already heightened risk of mood disorders, as late-night eating creates an additional burden on their mental resilience (Shoja et al., 2020).

In summary, the impact of late-night eating on mental health is profound, as it disrupts circadian alignment, elevates cortisol levels, affects serotonin production, impairs glucose regulation, and deteriorates sleep quality. Each of these disruptions contributes to heightened stress, mood instability, and an increased risk of anxiety and depression. Addressing late-night eating as part of a chrononutrition-informed approach to mental health can help mitigate these effects, highlighting the importance of aligning eating habits with the body's natural rhythms to support psychological well-being (Desai et al., 2024).

Nutrient Timing and Neurotransmitter Support

The timing of nutrient intake, particularly meals rich in carbohydrates, proteins, and omega-3 fatty acids, plays an important role in supporting neurotransmitter production, including serotonin and melatonin, which are crucial for mood and sleep. Research indicates that consuming these nutrients at specific times of the day, such as during morning or midday, optimizes the body's ability to produce mood-regulating hormones. For example, morning meals rich in protein aid in dopamine production, which promotes alertness and positive mood (Desai et al., 2024). These findings suggest that nutrient timing could be an effective strategy in supporting mental health through dietary adjustments.

Nutrient timing refers to the strategic consumption of specific nutrients at particular

times of day to optimize physiological processes, including neurotransmitter production, which directly impacts mood and psychological well-being. The body's production and regulation of neurotransmitters, such as serotonin, dopamine, and melatonin, are influenced not only by nutrient intake but also by the timing of these nutrients in relation to the body's circadian rhythms. Aligning nutrient intake with these biological rhythms helps to enhance neurotransmitter synthesis and balance, supporting mental health outcomes, including mood stability, reduced anxiety, and improved sleep quality (Desai et al., 2024).

Serotonin, a key neurotransmitter responsible for mood regulation and feelings of well-being, relies on the availability of the amino acid tryptophan, which is found in protein-rich foods. Studies suggest that consuming protein early in the day supports optimal serotonin synthesis, as this is the time when the body's circadian rhythms are primed for neurotransmitter production. High-protein breakfast foods, such as eggs, yogurt, or nuts, can provide an adequate source of tryptophan, which is then converted to serotonin, enhancing mood and promoting mental clarity throughout the day (Ibrahim et al., n.d.).

Similarly, dopamine, a neurotransmitter associated with motivation, focus, and reward, is supported by nutrients like tyrosine, another amino acid found in protein-rich foods. Consuming protein in the morning or midday, when dopamine production is naturally higher, can contribute to improved alertness and emotional resilience. This aligns with research suggesting that nutrient timing for protein can have a stimulating effect on mental alertness and positivity, providing a solid foundation for mental resilience against stress and mood fluctuations (Korn, 2016).

Melatonin, which regulates sleep-wake cycles and contributes to restful sleep, is synthesized from serotonin, making evening nutrient timing just as critical. Foods rich in complex carbohydrates, such as whole grains, promote the release of insulin, which allows more tryptophan to enter the brain and convert to serotonin and ultimately to melatonin. A carbohydrate-rich dinner can therefore facilitate this process, preparing the body for relaxation and sleep. This nutrient timing strategy is particularly beneficial for those experiencing sleep-related issues or mental health conditions linked to poor sleep quality, such as anxiety or depression(Sejbuk et al., 2022).

In sum, nutrient timing plays an essential role in supporting neurotransmitter function, thereby influencing mental health. By aligning the intake of proteins,

complex carbohydrates, and specific amino acids with the body's circadian rhythms, individuals can optimize their mood, focus, and sleep quality. This chrononutrition approach demonstrates that when nutrients are consumed is just as important as what is consumed, offering a potentially powerful and natural strategy for enhancing mental well-being.

Time-Restricted Feeding and Sleep Quality

Time-restricted feeding, where food intake is limited to specific hours of the day, has shown positive effects on sleep quality, which is directly linked to mental health. Eating within a set window, often aligned with daylight hours, helps synchronize internal clocks with environmental cues, enhancing sleep efficiency and reducing symptoms of insomnia and anxiety. Improved sleep contributes to better mental health outcomes, as sleep quality is essential for emotional stability and cognitive functioning. This feeding pattern also encourages early meal timing, which appears beneficial for sustaining mental well-being.

Time-restricted feeding (TRF) is a dietary approach where food intake is limited to a specific window of time each day, typically aligned with daylight hours, to support the body's natural circadian rhythms. Research suggests that TRF not only helps regulate metabolic health but also positively impacts sleep quality, which in turn has a profound effect on mental health and emotional well-being. By synchronizing eating times with the body's biological clock, TRF enhances the alignment of internal rhythms, leading to more restful and efficient sleep cycles. This is because meal timing plays a significant role in regulating the production of hormones such as melatonin, which is essential for sleep, and cortisol, which influences alertness and stress levels (BaHammam & Pirzada, 2023).

In TRF, individuals typically consume all their meals within a specific window—often an 8- to 10-hour period—starting in the morning and ending in the late afternoon or early evening. This approach ensures that food intake occurs primarily during daylight, when the body is naturally prepared to digest and metabolize nutrients. Studies show that individuals who follow this pattern experience improved sleep quality, as the restricted eating window supports earlier melatonin production in the evening, promoting faster onset of sleep and reducing nighttime wakefulness. For instance, a person might adopt a TRF schedule from 8 a.m. to 4 p.m., allowing their body ample time to digest food before sleep and supporting natural sleep-wake cycles.

By avoiding food intake close to bedtime, they reduce the likelihood of late-night metabolic activity, which can disrupt sleep by increasing body temperature and energy levels, making it harder to fall asleep.

Example: Sarah, a young professional, often struggled with insomnia and inconsistent sleep patterns due to her irregular eating habits and late-night meals. After learning about time-restricted feeding, she decided to try a 10-hour eating window from 9 a.m. to 7 p.m. Over several weeks, Sarah noticed she felt more energized during the day and began falling asleep faster and waking up less frequently at night. By limiting her food intake to earlier hours, her body could maintain a stable internal clock, supporting more consistent melatonin release in the evening. This shift helped Sarah establish a healthier sleep routine, showing how TRF can naturally promote better sleep quality by aligning with her circadian rhythm.

Overall, TRF offers a practical approach to enhancing sleep quality by aligning eating habits with the body's circadian clock. By limiting food intake to daylight hours, individuals can promote better sleep hygiene, lower evening cortisol levels, and optimize melatonin production, all of which contribute to improved psychological well-being and reduced risks of mood disorders associated with poor sleep. Through this synchronization of meal timing with natural biological rhythms, TRF represents a promising strategy for fostering both physical and mental health.

Barriers to Consistent Eating Schedules

Many individuals face challenges in maintaining consistent eating schedules due to lifestyle factors such as work shifts, family obligations, and social activities. These barriers disrupt regular meal timing and can lead to circadian misalignment, increasing the risk of mood disorders. Shift workers, for instance, often experience irregular eating patterns, which negatively impact their circadian rhythms and contribute to heightened levels of stress, fatigue, and depressive symptoms. Addressing these barriers through tailored chrononutrition interventions could support mental health by helping individuals align their eating patterns with natural circadian rhythms.

Maintaining consistent eating schedules aligned with circadian rhythms can be challenging due to various lifestyle factors that disrupt regular meal timing. These disruptions, often caused by modern work schedules, family obligations, social

commitments, and unpredictable routines, contribute to irregular eating patterns that misalign with the body's natural rhythms, potentially increasing the risk of mood disturbances, stress, and fatigue. Individuals who face these barriers may experience fluctuations in energy, mood, and mental health outcomes as their eating patterns fail to support stable circadian rhythms. For instance, research shows that shift workers and people with irregular work hours are particularly vulnerable to these barriers, as their meal times often do not coincide with natural daylight hours, which are crucial for circadian alignment.

One prominent example is shift workers, such as nurses, factory employees, or emergency responders, whose schedules may require them to eat at unconventional hours, such as late at night or very early in the morning. These atypical eating times disrupt the synchronization between their eating patterns and their circadian rhythms, leading to metabolic stress and hormonal imbalances. Shift workers who eat meals during the night may experience higher cortisol levels and lower melatonin production, resulting in reduced quality of sleep, heightened stress, and an increased likelihood of anxiety and depression. Over time, this misalignment can accumulate, impacting overall health and well-being.

Another common barrier is social and family obligations, where people may feel pressured to adjust their eating schedules to accommodate others, especially during weekends or holidays. For example, a person may eat later than usual at a family gathering or delay a meal to attend a social event. While occasional deviations might have minimal effects, consistent irregularities can prevent the body from establishing a stable meal routine, affecting mood regulation and energy levels. These disruptions may not only impact the individual's mental health but can also create a cycle of poor eating habits that undermine the benefits of regular meal timing.

To address these barriers, experts recommend strategies such as planning meals in advance, setting reminders for regular eating times, and implementing time-restricted feeding windows that best align with an individual's work and social obligations. For instance, shift workers may benefit from eating a larger meal before their shift and lighter, nutrient-dense snacks during work hours, ensuring they still align with some aspects of circadian rhythms even in challenging schedules. Individuals with social commitments could try maintaining a light snack before an event to prevent extensive delays in eating, allowing them to stay closer to their usual schedule.

These examples underscore the importance of identifying and managing barriers to consistent eating schedules to optimize mental health outcomes. Establishing and maintaining a stable eating routine, even amid these challenges, can foster better alignment with circadian rhythms, supporting both physical and psychological well-being.

4. Conclusion

This review highlights the significant impact of chrononutrition—the timing and regularity of eating patterns—on mental health, revealing that aligning meal schedules with the body's natural circadian rhythms can support psychological well-being. Regular and consistent eating times, particularly during daylight hours, help stabilize metabolic and hormonal cycles that influence mood regulation, stress management, and emotional resilience. Irregular eating patterns, including late-night meals, have been shown to disrupt circadian alignment, leading to elevated cortisol levels and decreased serotonin production, both of which are associated with heightened risks of anxiety and depression. Thus, consistent meal timing serves as a critical factor in fostering a balanced mental state.

The review also underscores the role of nutrient timing in supporting neurotransmitter production, particularly serotonin and melatonin, which are essential for mood stability and sleep quality. By consuming balanced meals rich in proteins, complex carbohydrates, and omega-3 fatty acids at strategic times, individuals can optimize the body's production of these mood-regulating chemicals. Time-restricted feeding, where food intake is limited to specific daylight hours, aligns with circadian biology and improves sleep quality, which further supports mental health. The synchronization of eating patterns with circadian rhythms thus offers a holistic, non-pharmacological approach to enhancing psychological well-being, which may serve as a preventive strategy against mood disorders.

Future research should focus on exploring individualized chrononutrition interventions, particularly for populations facing barriers to consistent eating patterns, such as shift workers or individuals with irregular schedules. Such studies could inform dietary guidelines that incorporate meal timing as a core component for mental health support. Integrating chrononutrition principles into clinical and public health strategies has the potential to improve mental health outcomes on a broader

scale, providing an accessible and sustainable means for individuals to support their psychological resilience and overall well-being.

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