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Beyond the Diet: Impact of Night-Shift Work on Obesity Risk

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Abstract

Background: In contemporary society, an increase in the demand for night-shift workers is anticipated. However, this mode of employment entails potential health hazards.

Aim: To demonstrate the correlation between night-shift work and obesity, with a particular emphasis on the link between sleep deprivation and obesity occurring among night-shift employees. Furthermore, this paper describes the mechanisms contributing to the emergence of these dependencies.

Methodology: A systematic review of scientific literature was conducted. A systematic search was carried out in PubMed,Google Scholar using keywords. The review examined various populations and age groups, focusing on night shift work, sleep deprevation, hormones and obesity.

Results: Night-shift work is positively correlated with an increased risk of high BMI, overweight, and obesity; specifically, the risk of developing central obesity is nearly three times higher compared to day-shift workers. Simultaneously, it has been observed that the specific nature of night work adversely affects sleep quality, rendering it shorter, less restorative, and overall poorer in quality. These physiological sleep disturbances lead to the dysregulation of the HPA axis, the orexin system, and the synchronization between central and peripheral clocks. Furthermore, they disrupt the secretion patterns of various hormones—including cortisol, growth hormone, and melatonin—which collectively impair the metabolic profile and drive the progression of obesity.

Conclusions: Poor sleep quality induced by night-shift work contributes to the development of obesity and disturbances in lipid profiles, HbA1c levels, and inflammatory markers among night-shift employees. The increased prevalence of obesity in this population is associated with a higher potential risk of cardiovascular diseases, type 2 diabetes, and other life-threatening conditions. Emerging research on the modulation of light intensity during

both working hours and subsequent sleep offers hope that the negative consequences of nocturnal labor can be mitigated. However, it is essential to expand research in this field to develop effective preventative strategies.

Key words: obesity, night shift, suprachiasmatic nucleus, melatonin, sleep deprevation

1. Introduction

Occupations that extend beyond the traditional 9-to-5 working hours are becoming increasingly indispensable. Since the late 20th century, sociologists have described the emergence of the "24-hour society," a concept in which temporal boundaries are becoming obsolete. This phenomenon is driven by the globalization of services across different time zones, unrestricted access to online services, and the pervasive influence of technology, which effectively blurs the biological distinction between day and night. Certain sectors, such as healthcare and public safety, cannot operate solely on a daytime schedule and require continuous, 24-hour functionality.

According to data from the 2017 European Working Conditions Survey, in 2015, 19% of employees were engaged in night-shift work, while 21% worked in shift systems, with the rotational system being the most prevalent (49%). It is projected that the prevalence of work performed during atypical hours will either continue to rise or remain at these elevated levels. Consequently, it is imperative to examine the impact of such work patterns on human health and overall well-being.

In recent years, an extensive body of research has provided evidence regarding nutritional and metabolic disorders—including both abdominal and generalized obesity—among night-shift workers. These conditions may be precipitated by sleep disturbances, circadian misalignment, the impact of late-night working hours on the gastrointestinal tract, as well as social behaviors and altered dietary patterns (Lowden et al., 2010). Most studies evaluating weight gain leading to overweight status induced by shift or night work consistently highlight the role of sleep. The disruption of physiological sleep directly influences weight gain, a phenomenon that remains a focal point of ongoing global scientific inquiry.

In the context of night-shift work, sleep hygiene is of paramount importance, as employees frequently consume coffee or other readily available caffeinated beverages to enhance alertness during working hours. Such practices lead to sleep dysregulation by reducing total daily sleep duration and further exacerbating circadian rhythm disruption (Chaput et al., 2022).

2. Research materials and methods

Procedure / Instruments. Research materials and methods

The methodology for this comprehensive narrative review involved a structured search of major medical databases, including PubMed, Google Scholar, covering literature published up to April 2026. The primary objective was to synthesize current evidence on the obesity in night shift workers, their correlation to sleep deprevation and to explore the underlying mechanisms.

The search strategy employed combinations of the following keywords: „obesity", „night shift", „medical service", „melatonin", „sleep", „sleep deprevation".

The selection criteria focused on systematic reviews, meta-analyses, cross-sectional studies, observational studies, prospective cohort studies, experimental studies, interventional studies, clinical trials, narrative reviews, population-based studies, chronobiological studies, survey studies, qualitative studies, institutional reports.

Language: English and Polish peer-reviewed publications.

3. Research results

3.1. Epidemiology of Obesity in Night Shift Workers

In a meta-analysis from 2018 (Liu et al., 2018), data from 26 studies involving a total of 311,334 participants worldwide were analyzed. Despite varying definitions of overweight and obesity based on BMI and significant study heterogeneity, the findings remained consistent. The researchers demonstrated that night-shift work was associated with a higher risk of being overweight (RR: 1.38; 95% CI: 1.06–1.80). Shift work also showed a positive correlation with the risk of overweight (RR: 1.25; 95% CI: 1.08–1.44) and obesity (RR: 1.17; 95% CI: 1.12–1.22).

A substantial discrepancy was observed between the results of studies analyzing overweight and obesity among shift workers, attributed to the diverse nature of shift-work arrangements. According to the analysis by Liu et al. (Liu et al., 2018), shift workers may face an increased risk of overweight and obesity by 25% and 17%, respectively. This meta-analysis further emphasized the poorer quality and shorter duration of sleep among night workers. Similar conclusions were reached by researchers in 2017; they additionally noted in their meta-analysis that the risk of developing abdominal obesity is 29% higher in permanent night-shift workers compared to those in rotating shift systems (Odds Ratio: 1.43 vs. 1.14) (Sun et al., 2017).

Furthermore, a review study (Brum et al., 2020) examined the results of a cross-sectional study involving 200 university hospital employees. The findings indicated that night-shift workers had a 2.3-fold higher association with abdominal obesity compared to day-shift workers, independent of age and gender [OR = 2.27; 95% CI: 1.20–4.26; p = 0.011]. Additionally, they exhibited a 2.8 times higher likelihood of being overweight than their daytime counterparts [OR = 2.81; 95% CI: 1.50–5.25; p = 0.001].

The study once again highlighted the significance of sleep duration; parameters obtained via the Munich ChronoType Questionnaire (MCTQ) revealed that night-shift employees had shorter total weekly sleep duration—both on workdays and free days—a trend exacerbated by, among other factors, social jetlag. In this study, short sleepers (<6h) constituted a significantly larger proportion of night-shift workers compared to day-shift workers (p = 0.003) (Brum et al., 2020).

The consequences of sleep deprivation were found to be reversible; the probability of developing overweight or obesity was lower when sleep patterns were more regular (i.e., consistent sleep hours between workdays and free days) and when sleep duration was longer. Each additional hour of sleep reduced the likelihood of overweight by 25% [OR = 0.75; 95% CI: 0.60–0.94; p = 0.014]. Conversely, for each one-unit increase in social jetlag—calculated based on the discrepancy between sleep timing on workdays and free days—the risk of overweight increased by 14% [OR = 0.86; 95% CI: 0.76–0.98; p = 0.026] (Brum et al., 2020).

3.2.Sleep Quality and Metabolic Outcomes

An analysis conducted by Sang Baek Ko (Sang Baek Ko,2013) utilized data from the MIDUS II and MIDUS II Biomarker Projects, yielding a final sample of 883 individuals, of whom 110 were identified as night-shift workers. In this study, a night-shift worker was defined as an individual working during night hours (specifically between 21:30 and 04:30) for more than one night per month. The study investigated the association between shift work and sleep quality, employing, among other tools, the Pittsburgh Sleep Quality Index (PSQI). Simultaneously, various biomarkers—which will be discussed below—were analyzed in the context of sleep quality as contributing factors to the development of obesity.

The analysis specified that night-shift workers achieved higher PSQI scores compared to those on the day shift. The findings suggested lower sleep quality and chronic fatigue among the surveyed night workers, which translated into a higher probability of obesity; specifically, each one-unit decrease in sleep quality (reflected by an increase in the PSQI score) was associated with a 10% increase in obesity risk (OR: 1.10; 95% CI: 1.03–1.18).

Poor sleep quality was positively correlated with biomarkers such as HbA1c, total cholesterol, and triglycerides (Sang Baek Ko,2013)(Karsslon et al.,2001), as well as inflammatory markers (the elevation of which is associated with a higher probability of obesity). Conversely, a negative correlation was observed with antioxidant levels, where a decline is linked to a greater likelihood of developing obesity. Notably, the study identified a negative correlation between deteriorating sleep quality and levels of Dehydroepiandrosterone (DHEA) (Sang Baek Ko, 2013). DHEA serves as a neuroendocrine marker; according to review paper from 2004, it exerts an inhibitory effect on the development of obesity and hepatic steatosis (Tchernof and Labrie ,2004).

The strongest correlations were observed with Interleukin-6 (IL-6), C-reactive protein (CRP), and Intercellular Adhesion Molecule (ICAM). Specifically, the odds ratios (OR) were 1.12 (95% CI: 1.04–1.21) for CRP and 1.02 (95% CI: 1.01–1.04) for IL-6 (Tchernof and Labrie, 2004). Similar conclusions regarding these biomarkers were reached by Karlsson et al. (Karsslon et al.,2001).

In a cross-sectional study (Griep et al., 2014), which included 2,371 nurses with long-term exposure to night-shift work, a significant association was established between a history of such employment and elevated BMI. The researchers demonstrated a dose-response relationship: a greater number of years worked on night shifts correlated with a higher average BMI among the nurses. Furthermore, it was noted that men were more susceptible to shift-work-related weight gain than women.

3.3. Dietary Determinants and Patterns in Shift Work

3.3.1. Socio-Behavioral Aspects of Obesity Development

Beyond the biological disturbances, the analysis of social and behavioral patterns among night-shift workers is critical in understanding the pathways to obesity. Eating is a social activity that strengthens bonds with family members and peers. Night-shift workers frequently prioritize sharing a meal with their household or community in the evening before departing for work. The inherent discrepancy between their professional routine and the family's schedule often leads to overeating during evening hours as a means of maintaining social cohesion (Lowden et al.,2010).

Conversely, when considering individuals who do not consume meals in a communal setting, there is a higher tendency to opt for time-efficient, simplified food choices. These meals often possess lower nutritional value, are typically prepared in haste before leaving home, and are consumed either cold or quickly reheated (Lowden et al., 2010).

3.3.2. Dietary Patterns and Workplace Constraints

During night-shift hours, both the regularity of meal consumption and their nutritional complexity are frequently disrupted. In a 2014 survey conducted among 700 employees, 66% of respondents admitted that shift work hindered their ability to maintain regular meal times. Furthermore, 68.2% stated that this type of work altered their dietary habits, and 46.3% perceived their eating habits as inadequate (Strzemecka et al., 2014).

Several factors contribute to this irregularity. The most pragmatic of these, independent of biological drivers, is the tendency to eat only when the work schedule permits a break. In a study by Waterhouse et al., it was observed that nurses consumed meals based on the availability of breaks rather than in response to hunger cues or circadian rhythms (Waterhouse et al., 2003).

Some researchers observe that employees tend to eat more frequently, favoring readily available snacks over full meals. Conversely, Nyberg notes that subjects may consume fewer meals, but those consumed are characterized by high caloric density (Nyberg, 2009). Interestingly, certain studies suggest that total 24-hour energy intake remains unchanged compared to day-shift workers (Lowden et al.,2010). However, an analysis of 66 garbage workers demonstrated that despite this stability in total calories, a higher percentage of the daily caloric intake was consumed during working hours (de Assis et al., 2003).

Numerous studies indicate a shift in macronutrient ratios, specifically toward a higher consumption of simple substances. A cohort study **(**Knutson et al., 1990) followed by observational study (Linseisen et al.1994) demonstrated that night-shift workers consume less dietary fiber, which is essential for gastrointestinal health. Furthermore, some studies (Debre et al.,1967) (Lennernäs et al., 1994) found an increased intake of saturated fats, while other (Reinberg et al., 1979) observed a rise in carbohydrate consumption from snacks. A consistent pattern emerges: employees prefer less complex meals that fail to provide prolonged satiety, consequently leading to a rapid return of hunger and frequent snacking.

In contrast to the previously cited studies, some researchers report higher energy intake among night-shift workers compared to daytime controls. For instance, in a study involving older workers in a Japanese factory, it was reported that those working on night shifts exhibited higher total 24-hour energy intake and a higher prevalence of obesity (Morikawa, 2008).

3.4. Sleep and Health Outcomes

The previously discussed epidemiological studies (Liu et al., 2018)(Brum et al., 2020)(Ko, 2013)(Sun et al., 2018)(Griep et al., 2014) have highlighted the issue of sleep among night-shift workers and its impact on the development of obesity. It is essential to note that for night-shift employees, the external environment is often not conducive to recuperative sleep after a shift. Workers typically retire to bed one to two hours after finishing work; this interval is influenced by commuting time and, particularly for women, familial obligations, which further extend the period of wakefulness before rest. Sleep is frequently disrupted by noise, ambient light, or other household members. Consequently, such sleep is less restorative, necessitating daytime napping for some individuals.

Furthermore, a significant shift in the internal biological rhythm occurs. Employees are forced to fall asleep precisely when the body is biologically primed for arousal. Ultimately, sleep duration is reduced by 2 to 4 hours per day (Costa, 2010). Despite attempts to "catch up" on sleep during their time off, workers remain unsuccessful in fully compensating for the deficit, experiencing persistent sleep deprivation and shorter total weekly sleep (Ko, 2013). Research indicates that night workers have a shorter duration of deep sleep (N3 stage), which is responsible for regeneration and metabolic regulation (Patel et al., 2024), while frequently experiencing a longer REM phase, during which the body does not regenerate as effectively (Costa, 2010)

In an experimental study (Yook et al.2024), EEG analysis confirmed that night-shift workers experience lower sleep quality compared to those on the day shift. Interestingly, the night-shift workers surveyed concurrently reported a subjective feeling of good sleep quality. The poor sleep quality revealed by EEG was associated, among other factors, with disruptive ambient light. According to the questionnaires, night workers fell asleep faster but experienced more frequent spontaneous awakenings.

The study detected reduced slow-wave and delta activity during the NREM sleep phase in night workers compared to the control group. Furthermore, daytime light exposure additionally decreased sleep spindles in the N2 and N3 stages (deep sleep), primarily during the final sleep cycle. Among day-shift workers, a reduction in the power of slow-wave, delta, and spindle activity was observed during the NREM phase when lights were on, which resulted in shorter nocturnal sleep. No significant differences in slow-wave activity during N3 sleep were observed regarding light intensity (comparing <5 lux to 30 lux, representing typical ambient light levels).

Sleep serves as a fundamental modulator of neuroendocrine functions and glucose metabolism; its disruption leads to impaired glucose tolerance, reduced insulin sensitivity, and elevated evening cortisol levels (Beccuti and Pannain, 2011). Findings from 31 cross-sectional studies and 5 cohort studies indicate a robust and consistent dose-response relationship: the shorter the sleep duration, the stronger the association with both current and future obesity.

Sleep significantly influences metabolic hormones, specifically leptin and ghrelin. A critical factor contributing to the increased risk of obesity among night-shift workers is circadian rhythm disruption and dysregulation of the autonomic nervous system (ANS), accompanied by the activation of the hypothalamic-pituitary-adrenal (HPA) axis. Furthermore, melatonin—the so-called "sleep hormone"—plays a vital role in the development of metabolic dysfunction under conditions of sleep deprivation; its specific impact will be discussed in detail in the following sections of this article (Ko, 2013).

A meta-analysis of 18 studies revealed a pooled odds ratio (OR) for obesity of 1.55 (95% CI: 1.43–1.68; $P < 0.0001$) for sleep durations of less than 5 hours. Furthermore, a dose-response effect for sleep duration was calculated, showing that for every additional hour of sleep, BMI decreased by 0.35 kg/m^2 (Beccuti and Pannain, 2011). Similarly, another meta-analysis of prospective cohort studies found that short sleep duration was associated with a 38% absolute increase in the incidence of obesity compared to those with normal sleep duration (Chaput et al., 2022).

In a separate cross-sectional study involving 400 women, it was found that higher sleep quality was negatively correlated with central obesity, particularly among younger participants. This suggests that it is not only the duration of sleep that is significant, but that sleep quality also plays a crucial role in the development of obesity (Theorell-Haglöw et al., 2010).

3.5. Pathogenesis of Obesity

3.5.1. Evolutionary and Circadian Context of Shift Work

Evolution has adapted humans to function between sunrise and sunset; humans are fundamentally diurnal beings (Lowden et al.,2010). During the biological day, the body is programmed for wakefulness, energy intake, nutrient processing, and physical activity. Conversely, the biological night is a period dedicated to sleep, fasting, and cellular regeneration. Both of these periods exert a critical influence on human metabolism (Chaput et al., 2022).

Sleeping during the day and working at night is fundamentally inconsistent with the physiological rhythms developed by our ancestors. Night-shift workers must attempt to adapt to nocturnal functioning, a process that varies in success depending on individual characteristics. Individuals who identify as "night owls" (late chronotypes) generally encounter fewer difficulties adjusting to this work schedule (Karlsson et al., 2001). However, despite better adaptation in certain individuals, night-shift workers typically fall asleep at a time when they should physiologically be in an active phase, effectively inverting the order of the biological day and night. This misalignment results in both shortened sleep duration and diminished sleep quality (Chaput et al., 2022).

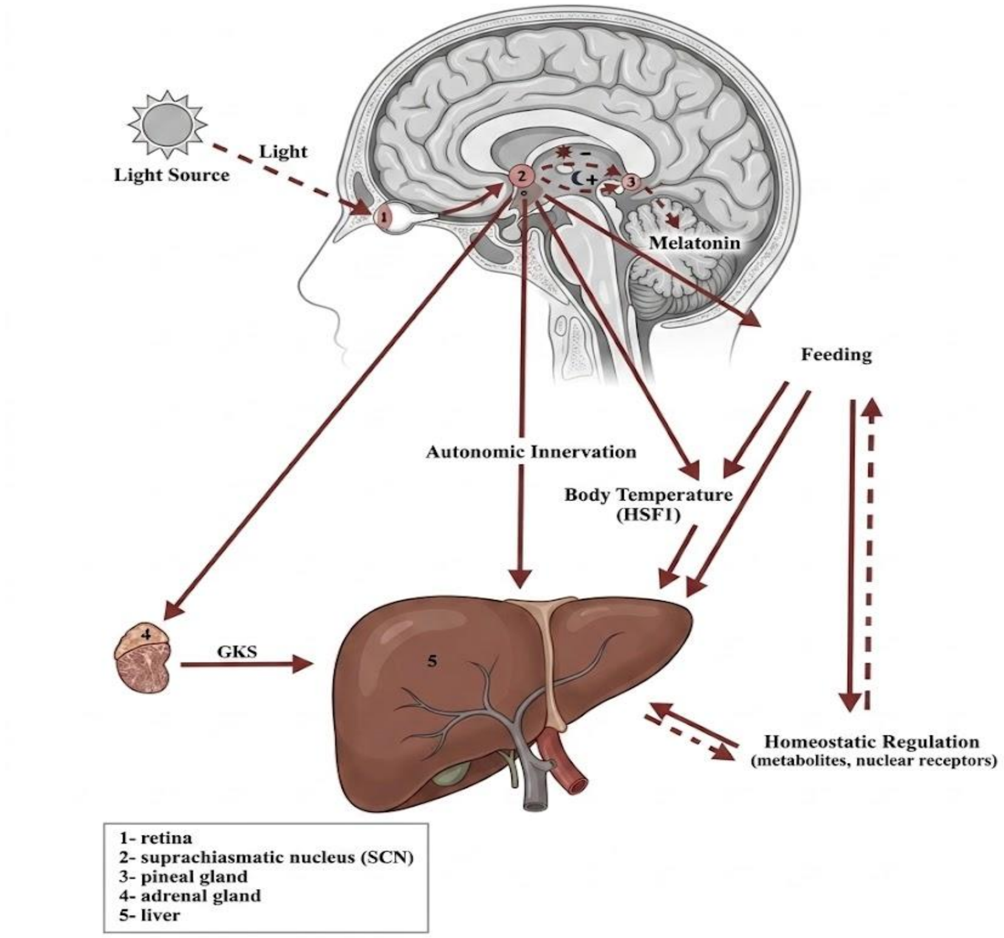
To function at night, the circadian phases—which are typically active during the day and inactive at night—must undergo a phase shift. On average, the circadian rhythm shifts by approximately one hour per day, depending on the type and duration of night shifts performed. It is suspected that exposure to electric light and its subsequent impact on the master circadian clock (described below) is the primary driver of this shift (Chaput et al., 2022).

The inversion of circadian cycles acts as a potent stressor for the regulation of 24-hour biological rhythms (Costa, 2010). Furthermore, once night-shift workers manage to align their internal circadian rhythms with their work schedule, they face a state of misalignment with the surrounding environmental rhythm (Chaput et al., 2022).

3.5.2. The Master Clock and Peripheral Oscillators

Human functioning, including periods of food intake and activity, is organized by master and peripheral circadian clocks (Chaput et al., 2022). The master clock is located in the suprachiasmatic nucleus (SCN), situated directly above the optic chiasm. It is synchronized with the external environment via environmental cues (primarily the light-dark cycle) through light stimuli independent of visual processing. Notably, the proteins that activate this system are also present in adipose tissue, not just the SCN (Ko, 2013)(Costa, 2010).

Peripheral clocks located in various organs (liver, adipose tissue, muscles, intestines) are synchronized by the brain's timing center and control the secretion of glucocorticoids (including cortisol), melatonin, and other mediators. However, the primary synchronizer for peripheral clocks is, above all, food intake. When conflicting information arises between the SCN (e.g., during low light intensity at night) and the receptors in these clocks stimulated by food, a desynchronization occurs between the SCN and peripheral oscillators. In the long term, this leads to metabolic disorders (Ko, 2013)(Beccuti and Pannain, 2011). Researchers have posited that food has a negligible direct effect on the master clock, while exerting a significant influence on peripheral clocks (Lowden et al., 2010).



Description of the Circadian Hierarchy Model- the pathways for peripheral clock synchronization, the activation of the master clock system, and its influence on the endocrine system (*based on Mohawk et al., 2012*).

Light stimulates the retina, generating impulses directed to the suprachiasmatic nucleus (SCN), which houses the primary circadian pacemaker. From the SCN, temporal information is transmitted to peripheral oscillators via autonomic innervation, core body temperature, humoral signals (such as glucocorticoids produced by the stimulated adrenal glands), and nutrition-related cues. Local signaling pathways can also influence peripheral oscillators independently of the SCN. While the liver is depicted in the diagram, peripheral clock cells are distributed throughout the entire organism. Simultaneously, light inhibits the pineal gland from secreting melatonin, whereas the absence of light stimulates its release.

According to an analysis by Chaput et al., circadian disruption is responsible for shifts in hunger and satiety hormone levels, promotes unhealthy dietary choices, and causes a reduction in total 24-hour energy expenditure by approximately 3% (Chaput et al., 2022).. Circadian rhythm disturbances caused by sleep deprivation often lead to the activation of the hypothalamic-pituitary-adrenal (HPA) axis, autonomic nervous system (ANS) dysfunction, and hormonal imbalances. Ultimately, these factors contribute to oxidative stress, increased pro-inflammatory cytokines, and insulin resistance, all of which promote the development of obesity (Ko, 2013).

From the perspective of circadian rhythms, obesity may be perceived as a "chronobiological disease," fundamentally dependent on biological rhythms, as well as a complex interplay of internal and external factors (Beccuti and Pannain, 2011).

3.5.3. Ghrelin and Leptin

In the context of obesity, it is essential to examine two hormones that govern the sensations of hunger and satiety: ghrelin, known as the "hunger hormone," and leptin, the "satiety hormone" (Chaput et al., 2022).

Ghrelin levels are dependent on energy intake and exhibit their own circadian rhythms, which are partially influenced by sleep but also independent of the sleep-wake cycle. It is primarily produced in the P/D1 cells of the stomach. Ghrelin levels rise between meals and increase before and during the initial hours of sleep, subsequently decreasing during the latter half of the sleep episode. Under constant conditions, ghrelin levels rise during the biological day and decline throughout the biological night (Chaput et al., 2022).

Conversely, leptin is derived from white adipocytes, and its circulating levels are correlated with obesity. In healthy adults, leptin levels are lower during the biological day and higher during the biological night. Under physiological conditions, its amplitude gradually increases during the day and falls during the biological night. Leptin reaches its peak during the first few hours of habitual sleep before beginning to decline (Chaput et al., 2022).

Sleep and appetite are interconnected within the hypothalamus via the orexin system. Research has demonstrated that sleep restriction leads to a concomitant increase in ghrelin levels and a decrease in leptin levels. Beyond its role in signaling satiety, leptin directly enhances energy expenditure by increasing thermogenesis, activating the sympathetic nervous system, and stimulating brown adipose tissue (BAT). Consequently, a reduction in leptin secretion is inherently linked to a decrease in overall energy expenditure (Beccuti and Pannain, 2011).

In the Wisconsin Sleep Cohort Study, which involved 1,024 volunteers, researchers examined the correlation between ghrelin levels and sleep duration. Ghrelin levels were found to be 14.9% higher when nocturnal sleep lasted only 5 hours compared to an 8-hour sleep period. Notably, this hormonal shift occurred independently of the participants' BMI, suggesting that sleep loss itself is a primary driver of appetite dysregulation (Taheri et al., 2004).

Sleep deprivation and night-shift work increase appetite while simultaneously reducing caloric expenditure. Chronic fatigue is commonly observed among night workers, leading to a diminished inclination for physical activity, which ultimately results in a positive energy balance (Beccuti and Pannain, 2011). In their study, Chaput et al. point out that insufficient nocturnal sleep increases 24-hour energy expenditure by approximately 100 kcal per day (4–5%), provided these expenditures are not consciously controlled. Experimental studies show that participants with unrestricted access to food under sleep-deficit conditions consumed significantly more calories, typically in the form of snacks. However, when caloric intake was strictly controlled, sleep deprivation led to a negative energy balance (Chaput et al., 2022).

Orexigenic hormones (such as ghrelin, NPY), in addition to influencing centers associated with homeostatic food intake in the arcuate nucleus (ARC) of the hypothalamus (acting on neuropeptide Y (NPY) neurons), also affect the ventral tegmental area (VTA) and the nucleus accumbens. These structures are key components of the reward system and drive non-homeostatic (hedonic) food consumption.

Sleep-promoting neurons in the ventrolateral preoptic nucleus (VLPO) typically inhibit the orexin system. However, during sleep deprivation, this inhibition is lifted, leading to increased neuropeptide Y (NPY) activity and the subsequent stimulation of the nucleus tractus solitarius (NTS), the paraventricular nucleus (PVN), and the "reward centers." The sympathovagal balance shifts toward higher sympathetic activity, which in turn inhibits leptin release and stimulates ghrelin secretion. Through a positive feedback loop, these hormones activate orexin neurons, further increasing both homeostatic and non-homeostatic (hedonic) food demand (Beccuti and Pannain, 2011).

A dysfunctional reward system is the primary reason why sleep deprivation drives the consumption of snacks and "comfort foods" associated with pleasure (Beccuti and Pannain, 2011). When sleep was restricted in volunteers—regardless of whether their energy intake was strictly controlled or if they had ad libitum access to food—exposure to food images (particularly those of high-calorie products) resulted in significantly increased activation of brain regions within the "reward system" (Chaput et al., 2022).

3.5.4. Melatonin

Melatonin is produced by the pineal gland and serves to prepare both the body and the brain for sleep by increasing sleepiness (Chaput et al., 2022). It acts as an endogenous synchronizer of circadian rhythms and energy metabolism [16], being one of the primary mediators of the suprachiasmatic nucleus (SCN). According to Garaulet et al., shift workers experiencing chronodisruption of their melatonin profile exhibit elevated glucose levels, insulin resistance, and an increased postprandial triglyceride response (Garaulet et al., 2009). This is supported by a study involving 27 nurses who were administered melatonin before daytime sleep; this intervention promoted better sleep quality and led to a reduction in body mass (Garaulet et al., 2009).

Researchers have found that melatonin secretion can be manipulated by adjusting workplace lighting or through exposure to therapeutic doses of light before sleep. Such alterations in melatonin levels resulted in improved or diminished sleep quality, which ultimately may translate into changes in BMI (Zhao et al., 2025)(Wang et al., 2023).

3.5.5. Growth Hormone and Cortisol

Growth hormone (GH) is another hormone sleep-dependent hormone with a probable link to obesity. Its secretion primarily depends on the progression of slow-wave sleep (SWS), which, as previously noted, is significantly disrupted in night-shift workers. Similarly, cortisol secretion is governed by the circadian rhythm and the presence of slow-wave sleep (Chaput et al., 2022).

During the night, growth hormone and cortisol stimulate gluconeogenesis from amino acids and induce the release of glucose from hepatic glycogen stores; meanwhile, muscles bind smaller amounts of glucose, sparing it for brain function. The actions of GH and cortisol are antagonistic to insulin. Shorter sleep duration results in lower levels of GH secretion, leading to reduced oxidation of fat stored in the liver, which promotes the development of visceral obesity.

This theory was explored in a cross-sectional study of 400 women, which demonstrated a correlation between visceral obesity and poor sleep quality. In the researchers' opinion, obesity was indirectly caused by disrupted growth hormone secretion. Notably, GH replacement therapy has been shown to reverse visceral obesity (Beccuti and Pannain, 2011).

Furthermore, researchers have identified a connection between the previously described ghrelin and GH; one hypothesis suggests that ghrelin stimulates GHRH (growth hormone-releasing hormone), thereby paradoxically influencing the regulation of GH secretion (Morselli et al., 2012).

At the same time, elevated cortisol levels—acting antagonistically to insulin—increase blood glucose concentrations, which may eventually lead to the development of insulin resistance (Lowden et al., 2010). Higher cortisol levels have been identified as a primary driver of central obesity (Theorell-Haglöw et al., 2010). Desynchronization between the master and peripheral clocks can disrupt the hypothalamic-pituitary-adrenal (HPA) axis, resulting in cortisol secretion at inappropriate times and further exacerbating its detrimental effects.

4. Discussion

Night-shift work is positively correlated with an increased risk of high BMI, overweight, and obesity; specifically, the risk of developing central obesity has been found to be nearly three times higher compared to day-shift workers (Brum et al., 2020). Simultaneously, it has been observed that the specific nature of night work significantly impacts the sleep of these employees, which is typically of poorer quality, less restorative, and shorter in duration.

The physiological sleep disturbances occurring in night-shift workers lead to the dysregulation of the HPA axis, the orexin system, and the alignment between master and peripheral clocks. Furthermore, these disturbances affect various hormones—including cortisol, growth hormone, melatonin, ghrelin, and leptin—which collectively alter the metabolic profile and drive the development of obesity.

5. Conclusions

Night-shift workers are predisposed to profound metabolic dysregulation that occurs independently of their conscious behavioral choices. This phenomenon is a direct consequence of chronic HPA axis activation and pathological desynchronization (chronodisruption) between the master oscillator and peripheral clocks." (Chaput et al., 2022).

Poor sleep quality resulting from night-shift work contributes to the development of obesity and disturbances in lipid profiles, HbA1c levels, and inflammatory markers among night workers (Ko, 2013)(Karlsson et al., 2001) The increased risk of obesity in this population is associated with a higher potential risk of cardiovascular diseases, type 2 diabetes, and other life-threatening conditions that may contribute to premature mortality.

Given these risks and the growing demand for night-shift labor, it is essential to identify measures to mitigate the potential negative consequences of such work. Research regarding the modulation of light intensity during night shifts and subsequent sleep shows promise. However, due to the limited number of such studies, it is necessary to expand research in this area and seek new solutions aimed at preventing negative health outcomes, including obesity and sleep deprivation, among night-shift workers.

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The authors declare that artificial intelligence (AI) tools were used exclusively to support language editing, improving the grammar of the manuscript and to visually enhance the diaghram of the Circadian Hierarchy Model. The AI tools did not influence the selection of literature, the critical analysis and synthesis of sources, the interpretation of findings, or the formulation of conclusions. The authors take full responsibility for the content, originality, and scientific integrity of this narrative review.

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