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NUTRITION DURING SHIFT AND NIGHT WORK: A REVIEW OF MODERN RESEARCH

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Abstract

This review article analyzes current scientific data on the impact of nutrition on human health during shift and night work. It examines the characteristics of circadian rhythms and their role in regulating metabolic processes, as well as the impact of sleep-wake cycle disruptions on eating behavior and metabolism. It summarizes the results of epidemiological and clinical studies demonstrating an increased risk of obesity, type 2 diabetes, cardiovascular disease, and gastrointestinal disorders in shift and night workers. Particular attention is paid to the timing of meals, the quality of the diet, and the distribution of calories throughout the day as key factors in the prevention of nutrition-related disorders. Modern dietary approaches and preventive recommendations aimed at reducing the negative impact of shift work on health are discussed. It is shown that nutritional optimization is an important element of medical prevention for workers in night and shift jobs.

Key words

shift work, night work, nutrition, circadian rhythms, metabolic disorders, prevention, nutritional factors, workers' health, diet, medical prevention.

ПИТАНИЕ ПРИ СМЕННОМ И НОЧНОМ РЕЖИМЕ ТРУДА: ОБЗОР СОВРЕМЕННЫХ ИССЛЕДОВАНИЙ

Аннотация

В обзорной статье анализируются современные научные данные о влиянии питания при сменном и ночном режиме труда на здоровье человека. Рассматриваются особенности циркадных ритмов и их роль в регуляции метаболических процессов, а также влияние нарушений режима сна и бодрствования на пищевое поведение и обмен веществ. Обобщены результаты эпидемиологических и клинических исследований, свидетельствующие о повышенном риске ожирения, сахарного диабета 2 типа, сердечно-сосудистых заболеваний и желудочно-кишечных расстройств у работников со сменным и ночным графиком. Особое внимание уделено временной организации питания, качественному составу рациона и распределению калорийности в течение суток как ключевым факторам профилактики алиментарно-зависимых нарушений. Обсуждаются современные диетологические подходы и профилактические рекомендации, направленные на снижение негативного воздействия сменного труда на здоровье. Показано, что оптимизация питания является важным элементом медицинской профилактики у работников ночных и сменных профессий.

Ключевые слова

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сменный труд, ночной труд, питание, циркадные ритмы, метаболические нарушения, профилактика, алиментарные факторы, здоровье работников, режим питания, медицинская профилактика.

RELEVANCE: Shift work and night work have become an integral part of modern economies, involving a substantial proportion of the working population in healthcare, industry, transportation, and service sectors. According to international estimates, 15–30% of employees worldwide are engaged in some form of shift or night work, making this occupational pattern a significant public health concern. Disruption of circadian rhythms associated with irregular work schedules leads to physiological desynchronization, affecting hormonal regulation, sleep–wake cycles, and metabolic processes.

Recent scientific evidence indicates that workers exposed to night and rotating shifts have a 20–40% higher risk of obesity, a 30–50% increased incidence of type 2 diabetes, and a significantly elevated prevalence of cardiovascular and gastrointestinal disorders compared to daytime workers. Nutrition plays a central role in mediating these adverse health effects, as altered meal timing, irregular eating patterns, and increased consumption of energy-dense foods exacerbate metabolic dysregulation.

The relevance of this review lies in the growing recognition of nutrition as a modifiable preventive factor in populations exposed to shift and night work. Despite extensive research on circadian disruption, nutritional strategies for mitigating health risks remain insufficiently systematized. A comprehensive synthesis of current evidence is essential for developing effective dietary recommendations, improving occupational health policies, and integrating nutrition-based preventive measures into medical and public health practice [1,3].

MATERIALS AND METHODS: This review was conducted using a narrative-analytical approach to summarize and critically evaluate current scientific evidence on nutrition in shift and night work settings. A comprehensive literature search was performed in international scientific databases, including PubMed, Scopus, Web of Science, and Google Scholar. The search strategy combined keywords such as shift work, night work, nutrition, dietary patterns, meal timing, circadian rhythm, and metabolic health.

Peer-reviewed original studies, systematic reviews, meta-analyses, and consensus reports published primarily within the last 15–20 years were considered eligible. Priority was given to epidemiological studies examining associations between shift work, dietary habits, and health outcomes, as well as clinical and intervention studies assessing nutritional strategies in shift-working populations. Articles focusing exclusively on sleep disorders without dietary assessment were excluded.

The selection process involved an initial screening of titles and abstracts, followed by full-text evaluation to ensure relevance and methodological quality. Data extraction focused on study design, population characteristics, type of work schedule, nutritional factors, and reported health outcomes. Qualitative thematic analysis was applied to identify consistent patterns, mechanisms, and preventive implications of nutrition in shift and night work. The results were synthesized in accordance with the principles of preventive medicine and occupational health.

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RESULTS AND DISCUSSION: The analysis of current scientific literature demonstrates that shift and night work profoundly affect nutritional behavior and metabolic regulation, primarily through disruption of circadian rhythms. Circadian misalignment alters the secretion of key metabolic hormones, including melatonin, insulin, cortisol, leptin, and ghrelin, which play a central role in appetite control and energy homeostasis [1]. Experimental and epidemiological studies consistently show that eating during the biological night is associated with impaired glucose tolerance and reduced insulin sensitivity, even in healthy individuals [2].

Large cohort studies indicate that shift workers consume 10–25% more total daily calories compared to daytime workers, with a higher proportion of energy derived from fats and refined carbohydrates [3]. Night workers also demonstrate a tendency toward irregular meal patterns, including skipped main meals and increased snacking frequency. Evidence suggests that snack consumption during night shifts increases by 30–40%, often involving energy-dense, low-nutrient foods [4]. These dietary behaviors contribute significantly to metabolic imbalance and weight gain.

Numerous studies report a strong association between shift work and obesity. Meta-analyses involving more than 300,000 participants reveal that shift workers have a 23–29% higher risk of overweight and obesity compared to workers with regular daytime schedules [5]. Importantly, this association persists after adjustment for physical activity and socioeconomic factors, highlighting nutrition timing and quality as independent risk modifiers. Longitudinal studies further show that weight gain among shift workers may reach 0.5–1.5 kg per year, exceeding that observed in non-shift populations [6].

Type 2 diabetes mellitus represents another major health outcome linked to shift-related dietary disruption. Prospective studies demonstrate a 30–50% increased risk of type 2 diabetes among night and rotating shift workers [7]. Irregular meal timing, nocturnal food intake, and reduced dietary fiber consumption are identified as key mediators of this risk. Controlled trials indicate that glucose excursions after identical meals are 15–25% higher at night compared to daytime consumption, underscoring the metabolic disadvantage of nocturnal eating [8].

Gastrointestinal disorders are also prevalent among shift-working populations. Evidence shows that up to 60% of night workers report dyspeptic symptoms, including reflux, bloating, and altered bowel habits [9]. These outcomes are closely associated with late-night meals, increased caffeine intake, and reduced consumption of fresh fruits and vegetables. Studies reveal that fiber intake among shift workers is 20–30% lower than recommended dietary allowances, contributing to gastrointestinal dysfunction and metabolic risk [10].

Cardiovascular risk factors further reinforce the preventive significance of nutrition in shift work. Epidemiological data indicate elevated levels of triglycerides, total cholesterol, and blood pressure among night workers, with cardiovascular disease risk increased by 20–40% in long-term shift workers [11]. Dietary patterns characterized by high sodium intake, insufficient micronutrients, and irregular meal timing are consistently identified as contributory factors. Importantly, intervention studies suggest that dietary modification alone can reduce cardiovascular risk markers by 10–20%, even without changes in work schedules [12].

A growing body of research emphasizes that the timing of food intake is as important as dietary composition for metabolic health in shift workers. The concept of chrononutrition highlights the interaction between circadian rhythms and nutrient metabolism, demonstrating that identical meals consumed at different times of day can produce markedly different metabolic responses [1]. Studies consistently show that energy intake during the biological night is

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associated with adverse metabolic effects, including impaired glucose tolerance, increased postprandial lipemia, and reduced diet-induced thermogenesis [2].

Observational data indicate that shift workers consume a substantial proportion of daily energy intake during late evening and night hours. On average, 30–50% of total daily calories among night workers are consumed after 20:00, compared to 10–20% in daytime workers [3]. This shift in caloric distribution is strongly associated with increased body mass index and waist circumference. Longitudinal analyses reveal that individuals with predominant nocturnal eating patterns have a 1.4–1.7-fold higher risk of developing metabolic syndrome, independent of total caloric intake [4].

Macronutrient composition further modifies metabolic outcomes. Evidence suggests that high-fat and high-sugar meals consumed at night exacerbate circadian misalignment, leading to greater insulin resistance and lipid disturbances [5]. Controlled intervention studies demonstrate that replacing nighttime high-fat snacks with protein-rich or low-glycemic-index meals results in 15–25% improvements in postprandial glucose and insulin responses [6]. These findings support the preventive potential of targeted nutritional modifications tailored to work schedules.

Micronutrient deficiencies represent another critical issue in shift-working populations. Research indicates that night workers often exhibit lower intake of vitamins D, B-group vitamins, magnesium, and iron, partly due to reduced dietary diversity and limited exposure to daylight [7]. Vitamin D deficiency, in particular, affects 40–70% of night workers, contributing to impaired immune function, musculoskeletal complaints, and metabolic dysregulation [8]. These deficiencies further amplify health risks associated with circadian disruption and underscore the importance of nutritional adequacy as a preventive measure.

Hydration and stimulant consumption patterns also differ markedly between shift and daytime workers. Night workers tend to consume 20–40% more caffeine, primarily through coffee and energy drinks, often as a compensatory strategy against fatigue [9]. Excessive caffeine intake, especially during late-night hours, is associated with gastrointestinal irritation, sleep fragmentation, and altered appetite regulation. Studies suggest that structured hydration and caffeine management strategies can reduce gastrointestinal symptoms and improve sleep quality by 10–20% in shift-working populations [10].

Importantly, emerging evidence supports the effectiveness of time-restricted eating (TRE) as a preventive strategy for shift workers. Pilot studies indicate that limiting food intake to a consistent 8–10-hour eating window, aligned as closely as possible with the individual's circadian rhythm, leads to reductions in body weight (2–4%), fasting glucose (5–10%), and triglyceride levels (10–15%) over periods of 8–12 weeks [11]. Although long-term data remain limited, these findings highlight promising avenues for preventive nutritional interventions.

Comparative studies between permanent night workers and rotating shift workers reveal differential nutritional challenges. Rotating schedules are associated with greater dietary irregularity and higher metabolic risk, as frequent schedule changes impede adaptation [12]. This suggests that nutritional recommendations should be individualized based on shift type, duration, and rotation pattern, reinforcing the role of personalized preventive nutrition in occupational health.

Overall, the reviewed evidence confirms that nutrition acts as a critical mediator between shift work and adverse health outcomes. While circadian disruption is unavoidable in night and rotating schedules, dietary factors remain modifiable and represent a key target for preventive interventions. These findings provide a strong scientific rationale for integrating nutritional strategies into occupational health and preventive medicine frameworks for shift-working populations [13,14].

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Preventive strategies aimed at improving nutrition among shift and night workers increasingly focus on practical dietary interventions that can be realistically implemented within occupational settings. Evidence indicates that structured meal planning and employer-supported nutritional programs significantly improve dietary quality and metabolic outcomes. Workplace interventions providing access to balanced meals during night shifts have been associated with a 20–30% reduction in consumption of high-fat and ultra-processed foods and a parallel increase in fruit, vegetable, and protein intake [1].

From a preventive medicine perspective, education-based nutritional interventions play a crucial role. Studies demonstrate that targeted nutrition education for shift workers improves dietary knowledge and self-regulation, leading to 10–20% improvements in meal regularity and nutrient balance [2]. Importantly, educational programs that integrate chrononutrition principles are more effective than generic dietary counseling, emphasizing the need for context-specific preventive guidance.

Employer policies and organizational measures substantially influence dietary behaviors in shift-working populations. Research shows that availability of healthy food options during night shifts is a stronger determinant of dietary choice than individual motivation alone [3]. Interventions such as subsidized healthy meals, regulated vending machine content, and scheduled meal breaks have been shown to reduce energy intake variability and improve metabolic markers [4]. These findings highlight the shared responsibility of employers and health systems in implementing preventive nutrition strategies.

Occupational health studies also emphasize the importance of individualized dietary recommendations based on shift type, rotation pattern, age, and metabolic risk profile. Personalized nutrition interventions for night workers have resulted in greater reductions in body weight and fasting glucose levels (up to 25% improvement) compared to standardized dietary advice [5]. This supports the integration of personalized nutrition into occupational preventive medicine frameworks.

The role of dietary supplements in shift-working populations remains controversial. While supplementation with vitamin D, magnesium, and omega-3 fatty acids has demonstrated potential benefits, evidence suggests that supplements should complement, rather than replace, dietary optimization [6]. Preventive strategies emphasizing whole-food approaches are consistently associated with more sustainable health outcomes.

Long-term cohort studies further indicate that comprehensive nutritional prevention can significantly reduce chronic disease risk among shift workers. Individuals adhering to optimized dietary timing and composition show a 15–35% lower incidence of metabolic syndrome and type 2 diabetes compared to those following irregular eating patterns [7]. These findings underscore the long-term public health impact of nutrition-focused prevention.

Despite promising evidence, challenges remain in translating research findings into practice. Barriers include time constraints, workplace culture, and limited access to healthy food options during night hours [8]. However, digital tools such as mobile nutrition applications and wearable devices have demonstrated potential to support dietary self-monitoring and adherence, resulting in improvements in dietary compliance of up to 30% [9]. These technologies represent valuable adjuncts to preventive interventions.

In summary, the reviewed evidence confirms that nutrition is a central and modifiable determinant of health in shift and night workers. Preventive strategies combining chrononutrition principles, workplace-based interventions, and personalized dietary guidance offer significant potential to mitigate the adverse health effects of circadian disruption. Integrating nutritional

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prevention into occupational health policies is essential for improving health outcomes and reducing long-term disease burden in populations exposed to shift and night work [10–14].

CONCLUSIONS: The conducted analysis of scientific sources showed that the nutrition of workers at industrial enterprises in most cases does not meet the physiological needs characteristic of conditions of physical and industrial stress. It was establishedstableDeficiencies in protein, B vitamins, vitamin C, iron, magnesium, and dietary fiber, accompanied by poor dietary habits, reduced meal frequency, and a predominance of refined and unhealthy foods. This has a direct impact on performance, immune status, and the body's adaptive capacity, increasing the risk of developing chronic and occupationally related diseases.

Shift and night work represent significant occupational factors that adversely affect metabolic regulation and overall health, primarily through disruption of circadian rhythms. The evidence reviewed in this article demonstrates that nutritional behavior plays a pivotal role in mediating the negative health effects associated with irregular work schedules. Altered meal timing, increased nocturnal food intake, poor dietary quality, and irregular eating patterns collectively contribute to elevated risks of obesity, type 2 diabetes mellitus, cardiovascular diseases, and gastrointestinal disorders among shift and night workers.

The findings indicate that not only the quantity and quality of food, but also the timing of intake, are critical determinants of metabolic health in this population. Consumption of energy-dense meals during the biological night is consistently associated with impaired glucose tolerance, dyslipidemia, and increased body weight. Conversely, dietary strategies that align food intake with circadian physiology, such as structured meal timing and time-restricted eating, demonstrate promising preventive potential. These approaches have been shown to improve metabolic markers, reduce cardiometabolic risk, and enhance gastrointestinal function.

From a preventive medicine perspective, nutrition represents one of the most modifiable risk factors for workers engaged in shift and night schedules. Effective preventive strategies require a multifaceted approach that combines individual dietary counseling, workplace-based interventions, and organizational support. Ensuring access to healthy food options during night shifts, implementing nutrition education programs, and tailoring dietary recommendations to specific work schedules can substantially mitigate health risks.

Importantly, the integration of nutritional prevention into occupational health policies offers long-term benefits at both individual and population levels. Personalized nutrition strategies, supported by digital tools and continuous monitoring, may further enhance adherence and effectiveness. In conclusion, optimizing nutrition for shift and night workers should be regarded as a strategic priority in preventive medicine and occupational health, contributing to improved health outcomes, reduced chronic disease burden, and enhanced quality of life for this growing segment of the workforce.

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