An overview of the relationships between sleep and type 2 diabetes

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Type 2 diabetes is the most common form of diabetes, and it is a serious global health problem. Several studies have suggested that patients with type 2 diabetes had shorter sleep duration and poorer sleep quality than healthy people. Recent studies have also demonstrated that sleep quantity and quality are associated with metabolic changes such as insulin resistance, impaired glucose tolerance and type 2 diabetes. It is therefore important to raise awareness about the potential risks of sleep disorders and to provide support for patients and their families. In this review, we discuss the relationships between sleep and type 2 diabetes and the potential mechanisms underlying the relationship.

Keywords: Sleep; Sleep duration; Sleep quality; Type 2 diabetes

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Introduction

Diabetes remains one of the most important health problems in the world. According to the recent estimates of the International Diabetes Federation, approximately 415 million people (one in every 11 adults) have diabetes worldwide. Type 2 diabetes is the most common form of diabetes. It is estimated that about 91% of all adults with diabetes in high-income countries have type 2 diabetes [1].

In this context, many governments have prepared national programs that support healthy lifestyle practices such as healthy nutrition, physical activity and weight control for prevention and control of diabetes [2-5]. However, several studies have suggested that type 2 diabetes is also associated with sleep [6-9]. It is therefore important to raise awareness about the potential risks of sleep disorders and to provide support for patients and their families. In this review, we discuss the relationships between sleep and type 2 diabetes and the potential mechanisms underlying the relationship.

Sleep and Diabetes

In the past decades, there has been an increase in the number of studies with a focus on sleep in patients with diabetes. The results of studies have shown that patients with type 2 diabetes reported short sleep duration and poor sleep quality [7, 10-12]. The prevalence of poor sleep quality in patients with type 2 diabetes ranges between 52% and 85.7% [7, 9-11, 14]. Song et al. [15] also found that female patients with type 2 diabetes were more likely to report poor sleep quality compared with males (63% vs. 39%).
Recent studies have also demonstrated that sleep quantity and quality are associated with metabolic changes that may lead to cardiovascular diseases, hypertension [16, 17], metabolic syndrome, insulin resistance, impaired glucose tolerance and type 2 diabetes [8, 12, 16, 18]. In a cohort study, Ayas et al. [16] reported that both short (≤5 hours of sleep/night) and long sleep durations (≥9 hours of sleep/night) were associated with an increased risk of developing diabetes in women. Knutson et al. [7] found that short and poor sleep were independent predictors of poor glycemic control (assessed with glycated haemoglobin [HbA1c] level) among patients with type 2 diabetes, after controlling for covariates (i.e., age, gender, body mass index, insulin use, and the presence of long-term complications of diabetes). The researchers [7] also stressed that sleep restriction may mediate its effects on disease through weight gain. Similarly, Tsai et al. [12] demonstrated that sleep quality was a predictor of glycemic control in patients with type 2 diabetes.

**Mechanisms Underlying the Relationships Between Sleep and Type 2 Diabetes**

The scientific evidences have been provided allowing a better understanding of the links between sleep and metabolism. The links between these two variables are complicated [6, 16, 19]. It has been known that short sleep duration or poor sleep quality can cause harmful hormonal and metabolic changes [6, 19], through various mechanisms, including alterations in energy intake and expenditure, neuroendocrine hormones and an increase in the non-homeostatic drive to eat (motivation to eat in the absence of hunger). The possible mechanisms of link between sleep restriction and type 2 diabetes are presented in Table 1. As a result, the hormonal and metabolic changes due to sleep restrictions can cause weight gain and increase the risk of type 2 diabetes [6].

**Table 1. Possible mechanisms of link between sleep restriction and type 2 diabetes [6]**

<table>
<thead>
<tr>
<th>Mechanisms</th>
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<tr>
<td>1. Irregular eating habits, which include eating between meals and snacking in the middle of the night, may lead to greater total energy and fat intake.</td>
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<tr>
<td>2. Short sleep duration may decrease physical activity energy expenditure.</td>
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<tr>
<td>3. Changes in neuroendocrine hormones may lead to an increase in blood glucose level.</td>
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<tr>
<td>4. An increase in the non-homeostatic drive to eat may lead to greater total energy and fat intake.</td>
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In a recent study, Byberg et al. [19] demonstrated that sleep duration was negatively associated with glycemic control (assessed by HbA1c level) in adults. Basically, sleep quality was positively associated with both peripheral and hepatic insulin sensitivity, while it was negatively associated with insulin secretion. In the same study, the researchers stated that “shorter sleep duration was mainly associated with later alterations in glucose homeostasis, whereas poorer sleep quality was mainly associated with earlier alterations in glucose homeostasis” [19, p. e354].

**Conclusion and Suggestions**

In conclusion, inadequate sleep in terms of duration and quality has been recognized as a contributor factor to development of type 2 diabetes and poor glycemic control [6, 16, 19]. In addition, poor sleep quality is one of the factors that adversely affects diabetes self-management in patients with type 2 diabetes [13]. Therefore, health care providers should take into account the assessment and management of sleep. Nurses should identify patients at risk and provide support for them. Assessment of sleep pattern using an instrument is very important and provides nurses with useful information, especially in adults with type 2 diabetes. Nurses should also give information patients with type 2 diabetes on sleep-promoting practices (i.e., eating regular meals, avoiding daytime naps, limiting caffeine intake, and relaxation techniques) [20].

**Conflicting interests**

The author has declared that no conflict of interests exist.

**Abbreviations**

HbA1c: glycated haemoglobin.

**Author contributions**
B.K. read and approved the final manuscript.

References


