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# Impact Of CPAP Therapy On Sleep Apnoea, Glucose Regulation, Metabolism, And Weight Loss In Patients With Respiratory Disorders

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**Abstract:**

Background: Obstructive Sleep Apnoea (OSA) is a prevalent sleep-related breathing disorder characterized by recurrent upper airway obstruction during sleep, leading to intermittent hypoxia, sleep fragmentation, and systemic health impacts. Continuous Positive Airway Pressure (CPAP) therapy is the gold standard treatment for OSA, but its effects on metabolic, cardiovascular, and lifestyle outcomes require further exploration.

**Aims**: This study investigates the impact of CPAP therapy on OSA severity, glycemic control, and systemic health outcomes. The evaluation also considers the impact of weight management, impact of smoking, and comprehensive lifestyle approaches on improving treatment outcomes.

**Methods**:

A literature review adhering to PRISMA guidelines was conducted, focusing on studies from 2000 onward. Metrics such as Apnoea-Hypopnea Index (AHI), glycemic parameters, body mass index (BMI), and adherence to CPAP therapy were analyzed. The influence of smoking and e-cigarette use on OSA was also examined. Results: CPAP therapy significantly improves glycemic control, lipid profiles, and cardiovascular health. Weight loss and lifestyle modifications further reduce OSA severity and enhance CPAP efficacy. Behavioral strategies improve patient adherence, while smoking and nicotine use exacerbate OSA symptoms. Emerging technologies and interdisciplinary approaches offer promising avenues for treatment optimization.

**Conclusion**:

CPAP therapy is a critical tool for managing OSA and its associated metabolic and cardiovascular impacts. Combining CPAP with lifestyle modifications and technological advancements enhances its effectiveness. Future research should focus on long-term outcomes and integrated intervention strategies to optimize patient compliance and health outcomes.

## Introduction:

Obstructive sleep apnoea (OSA) is a common disorder that is described as episodes of breathing cessation during sleep due to upper airway obstruction or collapse. With nocturnal attacks of events, it often led to excessive daytime somnolence and is often associated with cardiovascular diseases (1).

Obstructive Sleep Apnoea (OSA) and its prevalence have been rising world-wide. OSA is a chronic sleep-related breathing condition characterized by periodic narrowing and obstruction of the upper airway during sleep. Some of the known contributors to the development and progression of the disorder include impaired pharyngeal dilator muscle function, premature awakening to mild airway narrowing, and unstable control of breathing. Untreated OSA is often associated with the increased risk for developing cardiovascular disease, metabolic disorders, cognitive impairment, and psychological conditions like depression. It is also related to loss of productivity in the workplace and injuries due to motor-vehicular accidents. This association is because long untreated OSA could result in excessive daytime sleepiness, fatigue, non-refreshing sleep, nocturia, morning headache, irritability, and memory loss, as lesser time is spent in the evening to complete sleep (2).

Incidence and prevalence of metabolic diseases are on the rise every year due to rapid changes in the modern society's lifestyle, increased nutritional intake, and diminished physical activity and physical fitness. OSA has actively associated with metabolic diseases, including obesity, insulin resistance, T2DM, and Non-alcoholic fatty liver disease. A study by Li et.al concluded that deposition of visceral fat is a risk factor in developing OSA. The patients with OSA have significantly more pronounced visceral fat deposition and an increased ration of visceral to total fat, compared to obese patients without OSA. In addition to that, they found out that hyper-glycemia, insulin resistance, and T2DM are significantly higher in patients with OSA than healthy individuals (3).

## Oxygen desaturation with OSA

The decrease of oxygen saturation level during sleep is also strongly correlated with the glucose level in a 2-hour Oral Glucose Tolerance Test (OGTT), further strengthening the positive correlation between OSA severity and insulin resistance. This result is also supported by several studies that the intermittent hypoxemia and oxidative stress experienced by patients with OSA could be contributing to the development of insulin resistance (3) Therefor, hypoxemia-induced insulin resistance is due to the effect of hypoxemia on the phosphorylation of tyrosine kinase insulin receptors. Hypoxemia decreased the phosphorylation of tyrosine kinase insulin receptors, leading to reduced activity of insulin, and ultimately, insulin resistance.

Glucagon-like Peptide-1 (GLP-1) is an intestinal-derived peptide secreted from L-cells located in the distal ileum and colon in response to food intake. It also plays a role in glucose-dependent insulin secretion and inhibition of glucagon secretion that leads to delayed gastric emptying and normalization of glucose levels after meals (4) The relationship between OSA and GLP-1 levels is investigated in a study found increased OSA severity is related to higher fasting GLP-1 levels and lower GLP-1 response to OGTT. These early data suggested possible associations between sleep disturbances and GLP-1 dysregulation (4).

The Gold Standard method used in diagnosing OSA and other respiratory distress associated with sleeping is the use of a Polysomnograph (PSG). PSG is a comprehensive examination used to diagnose OSA, but it is labour-extensive and time-consuming. The primary outcome measure for the severity of OSA is the Apnoea-Hypopnea Index (AHI). This index represents the frequency of apnoea and periods of reduced airflow > 10 seconds that would result in brief attacks of arousal or decreased oxygenation Mild OSA is defined as 5-15 episodes of apnoea, Moderate OSA as 15 to 30 episodes, and Severe OSA if events are greater than 30 episodes per hour of sleep (2).

Currently OSA has led to the classification of sleep to Rapid Eye Movement (REM) sleep and Non-Rapid Eye Movement (NREM) sleep. NREM sleep is further subdivided into three stages and is primarily based on their Electroencephalography (EEG) and Electromyelography (EMG) activity. Of most importance is the Stage 3 of NREM sleep, or the deep Sleep, as it correlates with the increase in the release of Growth Hormones. Studies also found that deprivation of Stage 3 NREM sleep to test subjects is associated with increased insulin resistance, as Growth Hormone activity has been associated with Insulin activity and utilization (5).

## CPAP therapy with OSA

Obesity and elevated body mass index (BMI) are associated with short sleep duration as one of the important factors contributing to poor sleep could be severe obesity (6-7). Continuous Positive Airway Pressure (CPAP) is still considered as the Gold Standard treatment for OSA. CPAP therapy uses positive pressure that is applied to obstructed or narrowed airways using a face or nose mask to keep the airway open and patent (8). CPAP can help improve oxygenation by increasing functional residual capacity and reducing airway resistance, reducing the work of breathing, improving diaphragmatic function, decreasing upper airway resistance and potentially reducing the occurrence of obstructive sleep apnoea (9,10.11.12.13.14).

**Effect of cigarette smoking on OSA:**

Cigarette smoking is the leading cause of chronic obstructive pulmonary disease (COPD). Chronic exposure to cigarette smoke can cause inflammation and damage to the airways and lungs, leading to the development and progression of COPD (17). Cigarette smoke contains harmful chemicals that can irritate the airways, increase mucus production, and cause the air sacs in the lungs to lose their elasticity (18). This results in airflow obstruction, difficulty breathing, and symptoms such as coughing, wheezing, and shortness of breath. Cigarette smoking can worsen COPD symptoms, decrease lung function, increase the frequency and severity of exacerbations, and reduce overall quality of life. Smoking cessation is a necessary in managing COPD and slowing its progression (19). Inhaling cigarette smoke can cause irritation and inflammation in the upper airway, which has been associated with the onset of obstructive sleep apnoea (OSA) due to airway inflammation (20). In addition to that, the level of nicotine dependence was notably greater in patients with more severe obstructive sleep apnoea.

**Methodology**

A literature review was conducted to assess the prevalence of specified inclusion criteria for patient selection in the study. The literature search was structured according to the preferred reporting Items for Systematic Review (PRISMA) guidelines, focusing on studies published from the year 2000 to the present. Since the year 2000, the implementation of PRISMA guidelines has become increasingly important, especially given the rising volume of published research. A systematic review relies on clearly defined search criteria to guarantee the relevance and quality of the studies included. These criteria typically cover particular timeframes, populations, interventions, outcomes, and study designs that are relevant to the specific research question as presenting in figure 1.

Figure (1).

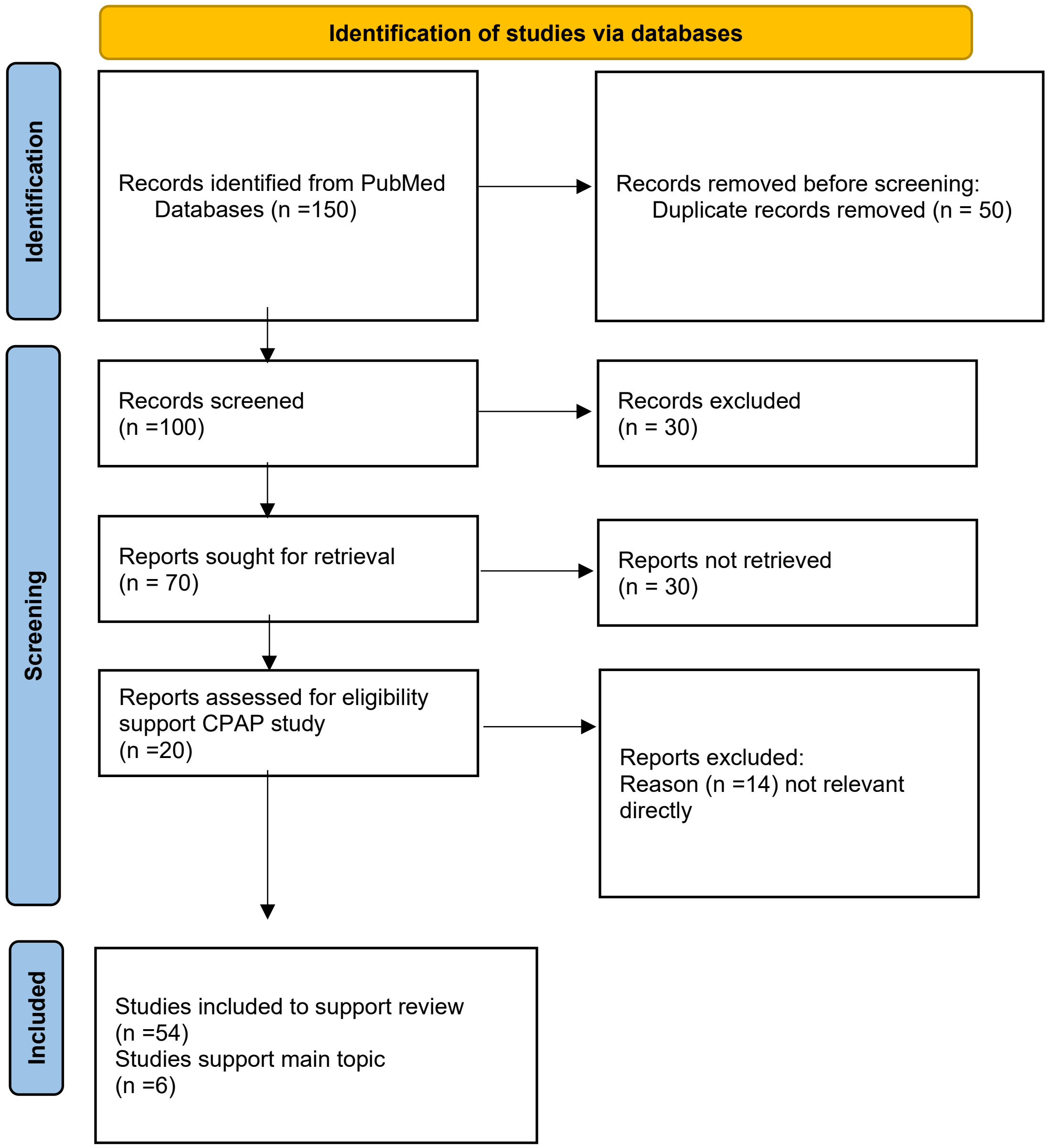


Figure (1): The process of selecting a study design entails identifying the most appropriate study types that can yield direct evidence in support of the primary research topic. The following study designs are frequently employed in research: This example showcases how to choose pertinent studies that directly align with the main research focus, highlighting how both the criteria for study design selection and the criteria for study selection can effectively guide this process.

The search criteria included a history of obstructive sleep apnoea (OSA), current diabetes status, and the presence of metabolic conditions. Key demographic information, including height, weight, body mass index (BMI), and measurements of neck and waist circumference, will be documented at each visit. The Epworth Sleepiness Scale (ESS), depicted in Figure 1, will also be utilized. Sleep assessments will be conducted using Polysomnography (PSG), which involves monitoring oxygen saturation via pulse oximetry, respiratory effort through Plethysmography, and Electrocardiography (ECG). All patients will receive Continuous Positive Airway Pressure (CPAP) treatment during the evaluation to assess its impact. The baseline Apnoea-Hypopnea Index (AHI) will be recorded and compared to the AHI values obtained post-CPAP intervention, along with total sleep hours. Additionally, dietary and exercise programs aimed at body weight improvement will be implemented both before and after the intervention. Collectively, our exclusion criteria for this research will focus on patients with connected data who fall into the following categories: individuals unable to undergo PSG monitoring, patients who cannot use CPAP therapy, subjects unable to participate in dietary and exercise programs, and those who cannot provide accurate measurements for height and weight, neck and waist circumference, and ESS scoring.

**Figure (2)**

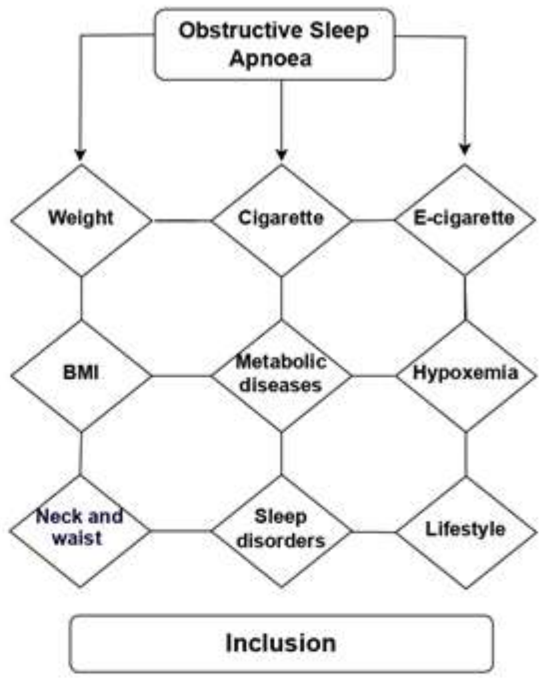


**Figure (2)**: Illustrate the factors that contribute to the progression of obstructive sleep apnoea.

**Result:**

The findings of the research have concentrated on the reasons behind the implementation of the impact effect of inclusion criteria that were established for the study. Weight can significantly affect sleep quality and duration in various ways. Obesity, particularly excess weight around the neck and abdomen, significantly increases the risk of obstructive sleep apnoea (OSA). Obesity is defined as having a BMI of 30 or higher, while a BMI of 25.0 or above indicates that a person is overweight. OSA is marked by frequent interruptions in breathing during sleep, leading to poor sleep quality and increased daytime fatigue (21). Individuals with obesity (BMI over 30) who report shorter sleep durations experience twice as many sleep-related issues compared to those who are not obese. Furthermore, both obesity and being overweight are associated with getting less sleep than non-obese individuals (22-23). Research by Kuna & Peppard et al. indicates that participants who experienced weight loss also showed a decrease in the severity of obstructive sleep apnoea (OSA), as measured by the apnoea -hypopnea index (AHI) (24). The study highlights the significant role of body mass index (BMI), where lower BMI levels are linked to milder forms of sleep apnoea. The study stress the importance of weight management strategies for individuals with OSA, noting that sustained weight loss can result in long-term health benefits, such as fewer apnoea episodes and improved sleep quality. Lifestyle interventions leading to weight loss are seen as effective ways to reduce the severity of OSA, especially in those with higher BMI. Longitudinal research from Peppard et al. points out that even modest weight changes can positively affect outcomes related to sleep-disordered breathing, suggesting potential improvements in respiratory health through weight management (25). Additionally, findings from Young & Foster et al. indicate that sleep-disordered breathing is linked to increased mortality risks over time, highlighting the critical need to address obesity in OSA treatment (26-27). These studies converge on the idea that weight loss is a successful strategy for mitigating OSA severity, which may have profound implications for long-term health. The findings specifically demonstrate that significant reductions in BMI are associated with improved sleep quality and lower AHI scores, reinforcing the need to tackle obesity when managing sleep-related disorders in obese individuals, particularly those with type 2 diabetes. Tom, Chloe et al. investigates the relationships between waist and neck circumferences and the various characteristics of obstructive sleep apnoea (OSA) (28). The findings suggest that both waist and neck measurements are significantly correlated with the severity of OSA. These physical metrics can serve as useful clinical indicators for identifying patients at risk for OSA, highlighting the importance of anthropometric measurements in the diagnosis and assessment of sleep apnoea. Yeh et al, Knechtle et al and Sergi et al. highlight the significance of waist and neck circumferences in understanding and predicting obstructive sleep apnoea (29-30-31). Increased measurements in these areas are associated with a higher risk of OSA, indicating that healthcare providers should consider these anthropometric indicators in their assessments and management strategies. Additional evidence suggests a connection between active smoking and obstructive sleep apnoea (OSA). Research indicates a distinct association between cigarette smoking and negative sleep outcomes, particularly OSA (32-33-34-35). Smoking may worsen pre-existing sleep disorders or elevate the likelihood of developing new ones. Strategies for effective intervention could involve smoking cessation programs, which could improve overall health, enhance sleep quality, and lower the risks associated with sleep apnoea. Research has highlighted a significant relationship between metabolic syndrome and the severity of sleep disorders, particularly obstructive sleep apnoea (OSA) (36-37-38). This connection emphasizes the complex interactions among OSA, metabolic syndrome, lipid profiles, and insulin resistance. The findings advocate for effective management approaches aimed at enhancing overall health outcomes for individuals affected by these conditions. On the other hand, sleep disorder marked by frequent interruptions in breathing during sleep due to blockage of the upper airway. This condition can have various physiological and psychological effects. Sleep Disorders suggests that Upper Airway Resistance Syndrome (UARS) should be regarded as part of OSA rather than a distinct disorder (39-40). Apnoea and hypopneas are categorized as obstructive when there is respiratory effort involved and central when there is none. The apnoea -hypopnea index (AHI), which quantifies the number of apnoea and hypopneas per hour of sleep, is the most commonly used measure to assess the severity of OSA, although there are no established standards for classifying its severity (40). Merianos et al. interestingly study found an association between e-cigarette use, cigarette smoking, and inadequate sleep duration among U.S. young adults (41). It suggests that individuals using nicotine products may experience disrupted sleep patterns, leading to insufficient sleep. The research highlights the potential public health implications of nicotine consumption on sleep health, as inadequate sleep can have various negative effects on overall well-being. So et al. explores the primary and interactive impacts of various nicotine products, including combustible cigarettes and e-cigarettes, on sleep quality (42). It reveals that both product types are associated with sleep disruptions, and individuals who use both (dual users) may experience more significant sleep problems than those who use only one type. The results indicate that nicotine consumption negatively affects sleep health and underscore the necessity for additional research into the interplay of these products and their influence on sleep. Hypoxemia associated with obstructive sleep apnoea (OSA) and characterized by common sleep-related issues, including decreased oxygen saturation, increased carbon dioxide levels, interrupted sleep patterns, frequent night awakenings, heightened respiratory effort, and elevated activity of the sympathetic nervous system (43) Pasquale et al. emphasize the importance of addressing nocturnal hypoxemia and adherence to continuous positive airway pressure (CPAP) therapy (44). The researchers investigate the impact of different degrees of nighttime oxygen deprivation on mortality risks for individuals with sleep disorders. Their findings indicate that increased compliance with

CPAP treatment may reduce some of the dangers related to nocturnal hypoxemia in patients with obstructive sleep apnoea syndrome (OSAS) and obesity hypoventilation syndrome (OS). These results highlight the necessity for effective management strategies to improve patient adherence and tackle the health risks associated with these conditions. Lifestyle factors impact obstructive sleep apnoea (OSA) and offers recommendations for managing the condition. Key suggested lifestyle changes include weight management, regular exercise, dietary adjustments, and the avoidance of alcohol and sedatives. The discussion focuses on how these changes can enhance sleep quality and may lessen the severity of OSA, underscoring the importance of healthcare professionals incorporating lifestyle counselling into patient care to improve outcomes (45-46-47). Martínez-Cerón et al. (2016) conducted a randomized clinical trial assessing the impact of CPAP on glycemic control in OSA patients with type 2 diabetes. The study found that CPAP therapy significantly improved glycemic metrics, indicating its potential role in managing diabetes among OSA patients (48). This is supported by Giampá et al. (2022), who evaluated CPAP's effects on metabolic syndrome, concluding that CPAP can facilitate improvements in metabolic parameters, further underscoring its role in the context of metabolic dysfunction associated with sleep apnoea (49). The relationship between CPAP therapy and cardiovascular outcomes has been rigorously investigated. Picard et al. (2022) studied nocturnal blood pressure and fluctuations, revealing that short-term CPAP therapy could improve blood pressure dynamics in patients with OSA (50). Similarly, van de Perck et al. (2023) focused on CPAP's influence on upper airway dynamics and ventilatory flow, further elucidating the mechanism through which CPAP could confer cardiovascular benefits to patients suffering from OSA (51). Aside from CPAP, lifestyle interventions have been shown to affect OSA severity. Carneiro-Barrera et al. (2022) reported that an interdisciplinary weight loss and lifestyle intervention significantly reduced OSA severity, suggesting that holistic approaches in conjunction with CPAP may enhance treatment outcomes (52). Moreover, the effectiveness of behavioral strategies in improving CPAP adherence was addressed by Tolson et al. (2023), indicating that multi-dimensional interventions can increase CPAP uptake and self-efficacy among patients (53). Martelli et al. (2022) performed a meta-analysis examining the prevalence of elevated hemoglobin and hematocrit levels in OSA patients, finding that CPAP treatment can mitigate these hematologic abnormalities, further linking OSA management to improvements in systemic health outcomes (54). The collective findings from these studies underscore the multifaceted benefits of CPAP therapy in patients with OSA, particularly in terms of glycemic control, cardiovascular health, and treatment adherence. Moreover, the incorporation of lifestyle modifications and technological innovations represents a promising avenue for enhancing CPAP efficacy and patient compliance. Continued research is paramount to optimize treatment strategies for OSA and its associated health impacts. Future studies should evaluate long-term outcomes and the effectiveness of integrated intervention paradigms that combine CPAP with lifestyle and technological support.

The collective findings from these studies underscore the multifaceted benefits of CPAP therapy in patients with OSA, particularly in terms of glycemic control, cardiovascular health, and treatment adherence.

**Table 1: Summary of Key Studies on CPAP and OSA Outcomes**

| **Study (Author, Year)** | **Population (n)** | **Intervention** | **Outcome(s) Measured** | **Key Findings** | **Trend** |
|---|---|---|---|---|---|
| **Martínez-Cerón et al., 2016** | OSA + T2DM (n=60) | CPAP | HbA1c, Fasting glucose | Significant ↓ HbA1c, improved glucose control | HbA1c ↓ |
| **Giampá et al., 2022** | OSA + Metabolic Syndrome (n=100) | CPAP | Lipid profile, Insulin resistance | Improved lipids, ↓ insulin resistance | Lipids ↑, IR ↓ |

| | | | | | |
|---|---|---|---|---|---|
| **Picard et al., 2022** | OSA adults (n=80) | CPAP (short-term) | Nocturnal BP | ↓ nocturnal BP fluctuations | BP ↓ |
| **Carneiro-Barrera et al., 2022** | OSA (n=120) | Lifestyle + CPAP | AHI, BMI | ↓ AHI severity, ↓ BMI | AHI ↓, BMI ↓ |
| **Tolson et al., 2023** | OSA patients (n=150) | CPAP + Behavioral Support | Adherence, ESS | ↑ adherence, improved sleepiness scores | Adherence ↑ |
| **Martelli et al., 2022** | Meta-analysis | CPAP | Hb/Hct | CPAP normalized elevated Hb/Hct | Hb/Hct ↓ |

**Summary**: Table 1 illustrates consistent evidence supporting CPAP therapy as a cornerstone in the management of obstructive sleep apnoea (OSA). Arrows indicate the direction of change Across multiple studies, CPAP was shown to improve glycaemic control (HbA1c ↓), stabilize cardiovascular outcomes such as blood pressure (BP ↓), and reduce apnea severity (AHI ↓). When combined with lifestyle interventions, CPAP produced even greater reductions in body mass index (BMI) and apnoea severity. In addition, behavioural strategies enhanced adherence (Adherence ↑), which is critical for long-term effectiveness. Meta-analytic evidence further supports CPAP's role in mitigating systemic health complications (e.g., Hb/Hct ↓). Collectively, these findings underscore that CPAP not only improves sleep-related outcomes but also provides systemic health benefits, particularly when integrated with lifestyle and behavioural support.

**Table 2. Studies on Risk Factors and Modifiers of OSA Outcomes**

| **Study** | **Population** | **Risk Factor / Modifier** | **Outcomes** | **Key Findings** | **Trend/Impact** |
|---|---|---|---|---|---|
| **Kuna et al., 2021** | OSA + Obesity (n≈1000, Sleep AHEAD) | Weight loss | AHI, Sleep quality | Weight reduction significantly ↓ AHI and improved sleep | Weight ↓ → AHI ↓ |
| **Peppard et al., 2000** | General population cohort | Moderate weight change | Sleep-disordered breathing | Even modest weight loss improved outcomes; weight gain worsened OSA | Weight change ↔ OSA severity |
| **Young et al., 2008** | Wisconsin cohort | OSA severity | Mortality risk | Higher OSA severity associated with increased long-term mortality | Severe OSA ↑ mortality |

| | | | | | |
|---|---|---|---|---|---|
| **Foster et al., 2009** | OSA + T2DM (RCT) | Weight loss intervention | OSA severity | Lifestyle weight loss ↓ AHI and improved metabolic health | Weight ↓ → AHI ↓ |
| **Tom et al., 2018** | OSA adults | Neck & waist circumference | OSA characteristics | Neck/waist size strongly correlated with OSA severity | ↑ Neck/Waist → ↑ OSA risk |
| **Yeh et al., 2010** | Asian bariatric pts | Neck circumference | OSA risk | Neck size predictive of OSA in bariatric patients | ↑ Neck → ↑ OSA |
| **Sergi et al., 1999** | Moderate-severe obesity | Anthropometry | OSA severity | Waist & neck circumference linked to OSA progression | ↑ Waist/Neck → ↑ Severity |
| **Merianos et al., 2023** | US young adults | E-cigarette use | Sleep duration, quality | Nicotine use disrupted sleep and ↓ duration | E-cigarette → Poor sleep |
| **So et al., 2021** | Dual users (cigarettes + e-cigarettes) | Nicotine products | Sleep health | Dual users had worse sleep disruption than single users | Dual use → Severe disruption |
| **Pasquale et al., 2023** | OSA + Obesity hypoventilation | Nocturnal hypoxemia | Mortality, CPAP compliance | Nocturnal hypoxemia ↑ mortality; CPAP compliance ↓ risk | Hypoxemia ↑ mortality, CPAP ↓ risk |

**Summary**: Table 2 presents evidence on risk factors and modifiers that influence OSA outcomes beyond CPAP therapy. Arrows indicate the direction of impact: ↓ = beneficial reduction (e.g., lower AHI, improved sleep quality), ↑ = harmful increase (e.g., higher OSA risk, elevated mortality), and ↔ = mixed or variable effects. Weight and anthropometric indicators such as neck and waist circumference are consistently associated with OSA severity, with larger measurements linked to worse outcomes. Weight reduction interventions produce significant improvements in AHI and overall sleep quality, underscoring obesity as a primary modifiable risk factor. Smoking and e-cigarette use are linked to sleep disruption and poorer outcomes, particularly among dual users. Nocturnal hypoxemia was identified as a critical predictor of mortality, although CPAP adherence can mitigate these risks. Collectively, these studies highlight the importance of addressing lifestyle, anthropometry, and smoking behaviors alongside CPAP therapy to achieve optimal patient outcomes.

## Discussion:

Obstructive Sleep Apnoea (OSA) is a multifaceted condition that impacts not only respiratory health but also metabolic functions. The relationship between OSA and metabolic syndrome—characterized by insulin resistance, hypertension, and abnormal lipid level has been extensively studied in recent research. Numerous studies have consistently identified that individuals with OSA face an elevated risk of developing metabolic syndrome, which in turn heightens the risk of cardiovascular diseases, type 2 diabetes, and various other comorbid conditions. A significant metabolic effect of OSA is its adverse impact on glucose metabolism. Research indicates that patients with OSA are more prone to impaired glucose regulation, leading to insulin resistance and an increased likelihood of developing type 2 diabetes (Martínez-Cerón et al., 2016) (48). Additionally, a study by Giampá et al. (2022) found that Continuous Positive Airway Pressure (CPAP) therapy can enhance glycemic control in OSA patients with type 2 diabetes, suggesting CPAP’s potential role in diabetes management (49). OSA's influence on lipid profiles is another critical metabolic effect. Studies indicate that individuals with OSA often experience dyslipidemia, a condition that raises the risk of cardiovascular disease (Martínez-Cerón et al., 2016) (48). Furthermore, research indicates that CPAP therapy can lead to improvements in lipid levels among OSA patients, suggesting a potential role for CPAP in mitigating cardiovascular risk. The benefits of CPAP therapy for OSA patients extend beyond glycemic control they also include enhancements in lipid profiles and blood pressure regulation. A study by Picard et al. (2022) (50) demonstrated that short-term CPAP therapy could improve nocturnal blood pressure and its fluctuations in OSA patients, while research by van de Perck et al . (2023) (51) highlighted how CPAP influences upper airway dynamics and ventilatory flow, potentially contributing to cardiovascular improvements. In addition to CPAP, lifestyle changes have also been shown to affect the severity of OSA. Research by Carneiro-Barrera et al. (2022) (52) indicated that a comprehensive weight loss and lifestyle intervention notably reduced OSA severity, suggesting that an integrative approach combining CPAP with lifestyle modifications may yield better treatment outcomes. Benefits of CPAP in Managing Metabolic Effects of OSA These findings underscore CPAP therapy’s critical role in managing the metabolic consequences of OSA, including enhancements in glycemic control, lipid profiles, and blood pressure regulation, which collectively can lower the risk of cardiovascular diseases and other associated health issues. Additionally, CPAP has been found to improve patient adherence and treatment efficacy, which is essential for the long-term management of OSA. Future Directions Despite the established benefits of CPAP in addressing the metabolic effects of OSA, further research is necessary to refine treatment approaches for OSA and its related health implications. Future studies should investigate long-term outcomes and the effectiveness of integrated approaches that combine CPAP with lifestyle and technological assistance. In summary, the metabolic implications of OSA are intricate and varied, necessitating a holistic treatment strategy that incorporates CPAP therapy, lifestyle changes, and technological advancements. By recognizing the advantages of CPAP in managing the metabolic challenges associated with OSA, healthcare professionals can formulate more effective treatment strategies that enhance patient outcomes and mitigate the risks of cardiovascular diseases and other comorbidities.

## Conclusion:

CPAP therapy offers multifaceted benefits for patients with OSA, particularly in improving glycemic control, cardiovascular health, and systemic outcomes. It has demonstrated effectiveness in reducing metabolic dysfunction, stabilizing nocturnal blood pressure, and mitigating hematologic abnormalities. Furthermore, lifestyle interventions, such as weight loss and interdisciplinary strategies, enhance CPAP efficacy and contribute to better patient outcomes. Behavioral approaches have also proven valuable in increasing CPAP adherence and self-efficacy. The integration of lifestyle modifications and technological innovations represents a promising avenue for advancing OSA management. Interestingly, the impacts of various nicotine products, including cigarettes and e-cigarettes, on sleep quality reveals that both product types are associated with sleep disruptions. This evidence can demonstrate that e-cigarettes are harmful and may cause adverse side effects. Future research should focus on evaluating long-term outcomes and the potential of combined intervention strategies to optimize treatment efficacy and patient compliance. In the future recommendation is to Assess the cost-effectiveness of CPAP therapy compared to other OSA management strategies. Explore ways to make CPAP devices more affordable and accessible, particularly in low-income settings.

**Declarations:**

1- Funding: Self support fund for this research review.
2- Conflicts of Interest: Conflicts of interest present an ongoing challenge in the research surrounding Continuous Positive Airway Pressure (CPAP) therapy for Obstructive Sleep Apnoea (OSA) and its effects on glucose profiles, metabolism, and weight loss. Acknowledging and addressing potential COIs is essential for promoting unbiased research that accurately reflects the true efficacy of CPAP in managing respiratory disorders during sleep. By fostering transparency and encouraging independent studies, the medical community can better serve patients, ensuring that treatment recommendations are based on sound, impartial evidence.
3- Data Availability: The findings that inform our study were primarily based on research gathered from PubMed.
4- Author Contributions: A.A(Abdulrhaman Alqamidy) content assessment for review Discussion writing. W.A(Wael Alshehri) Contant writing whole and assessment of the study stractsure. M.A ( Mohammed Alasmary), K.A( Khalid M Alfawzan, A.A.A (abdulaziz Ayedh alharbi), B.M.M( Basmah Mousa Mubaraky), A.M. A( Wasaif Mubarak Albarquawi) References formatting editing and content check.
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