



International Diabetes Federation

THE IDF CONSENSUS STATEMENT ON SLEEP APNEA AND TYPE 2 DIABETES:

Background to the statement

Recent research demonstrates the likelihood of a relationship between type 2 diabetes and sleep-disordered breathing (SDB), in particular obstructive sleep apnea (OSA), the most common form of SDB.

Links between diabetes and micro and macrovascular complications such as cardiovascular disease (CVD), nephropathy (kidney disease), retinopathy (eye disease) and neuropathy (nerve disease) are now well established and represent a huge burden to the individual and society.

In recent years studies have demonstrated that diabetes is likely to be associated with other problems and conditions which all add to the burden. They include disability, impaired cognitive function, reduced quality of life and sleeping disorders.

The IDF consensus statement on sleep apnea and type 2 diabetes wants to raise awareness of the association between sleep apnea and type 2 diabetes. IDF calls on health decision makers to encourage further research into the links between the two conditions and urges healthcare professionals to adopt new clinical practices to ensure that a person with one condition is considered for the other.

FACTS:

- Type 2 diabetes and OSA are likely to be linked
- Overweight and obesity may play a role, but some recent studies show an association between the two conditions that is independent of overweight/ obesity.
- OSA may have effects on glycemic control in people with type 2 diabetes.
- OSA is associated with a range of cardiovascular complications such as hypertension, stroke and heart failure.

IDF recommendations to healthcare professionals

- Healthcare professionals working in both type 2 diabetes and OSA need to be aware, educated and trained about the link between both conditions. They should aim to develop routine interventions that are appropriate for both conditions.
- People with OSA should be routinely screened for possible metabolic disorders and cardiovascular risk. Screening tests are inexpensive and easy to conduct, and include measurement of
 - Waist circumference
 - Blood pressure



unite for diabetes



- Fasting lipids
- Fasting glucose
- Screening people with type 2 diabetes for OSA is more complex, however they should be screened particularly when they present with classical symptoms such as witnessed apneas, heavy snoring or daytime sleepiness. One screening strategy uses a two-stage approach in which a structured questionnaire (e.g., the Berlin questionnaire) is used in the first stage to assess the pre-test probability of sleep apnea. Those identified to be at high risk for OSA undergo a second stage, with an overnight evaluation at home with pulse oximetry or portable monitoring.
- Management of OSA includes:
 - Weight reduction for the overweight and obese. Losing weight should be the primary treatment strategy as it may improve energy, social interaction and work performance and reduce accidents. Additionally, reduction of daytime sleepiness may encourage physical activity, which will have positive effects on glucose metabolism and on keeping a healthy body weight.
 - Continuous Positive Airway Pressure (CPAP) treatment. This therapy is currently the best treatment for moderate to severe OSA and should be considered where appropriate. CPAP treatment has been shown to have a positive impact particularly in people who have CVD.

IDF Recommendations for further research include:

- Conduct epidemiological studies of the prevalence of OSA (also in people with type 2 diabetes and metabolic syndrome, in children with obesity and/or type 2 diabetes, different ethnic groups and gestational diabetes and pre-eclampsia)
- Evaluate the effects of OSA on insulin secretion, insulin resistance and complications of type 2 diabetes
- Implement intervention studies that analyse the effects of various therapies for OSA in people with diabetes, particularly focusing on cardiovascular outcomes, and the mechanism linking sleep apnea with diabetes
- Further develop resources for effective diagnosis and treatment of OSA in all settings.

Research Studies:

Recent research in the fields of diabetes and sleep apnea demonstrate the likelihood that a relationship exists between type 2 diabetes and sleep-disordered breathing. Excerpts from key studies referenced in the consensus statement are listed below:

- According to findings from the Sleep Heart Health Study¹:
 - More than half of people with type 2 diabetes have some form of sleep



disorder, with up to a third of those affected by obstructive sleep apnea (OSA).

- Sleep disturbances in people with diabetes can be as prevalent as 58 percent.
- As reported in studies published in *European Respiratory Journal* in 2003ⁱⁱ and *Journal of Internal Medicine* in 2001ⁱⁱⁱ, up to 40 percent of people with OSA will have diabetes.
 - The *European Respiratory Journal* study also suggests that those with mild OSA were significantly more likely to have impaired glucose tolerance and diabetes than those without OSA.
 - Additional glucose-insulin studies indicate that intermittent shortage of oxygen in the body^{iv,v,vi} and/or the sleep fragmentation^{vii,viii} that result from OSA cause a physiologic stress which can have an impact on glucose metabolism and can play an important role in the development of insulin resistance.
- Evidence from three separate studies suggests:
 - The association between type 2 diabetes, insulin resistance, metabolic syndrome and OSA is not totally dependent on obesity.^{ix,x,x}
 - The prevalence of OSA in people with diabetes can be up to 23 percent.^x
 - The prevalence of some form of SDB in people with diabetes can be up to 58 percent.ⁱ
- Two studies of metabolic syndrome suggest that individuals with OSA demonstrated signs of metabolic syndrome^{xii} and conversely those with metabolic syndrome showed an increased risk of OSA.^{xiii}
- In people with diabetes, the impact of CPAP treatment on the improvements in insulin sensitivity has been mixed, however some studies have shown a significant reduction in A1C levels in people who had less optimal control.^{xiv,xv}

ⁱ Resnick HE, Redline S, Shahar E, Gilpin A, Newman A, Walter R, Ewy GA, Howard BV, Punjabi NM: Diabetes and sleep disturbances: findings from the Sleep Heart Health Study. *Diabetes Care* 26(3): 702-709, 2003

ⁱⁱ Meslier N, Gagnadoux F, Giraud P, Person C, Oukel H, Urban T, Racineux JL: Impaired glucose-insulin metabolism in males with obstructive sleep apnoea syndrome. *Eur Respir J* 22(1): 156-160, 2003

ⁱⁱⁱ Elmasry A, Lindberg E, Berne C, Janson C, Gislason T, Awad Tageldin M, Boman G: Sleep-disordered breathing and glucose metabolism in hypertensive men: a population-based study. *J Intern Med* 249(2): 153-161, 2001

^{iv} Larsen JJ, Hansen JM, Olsen NV, Galbo H, Dela F: The effect of altitude hypoxia on glucose homeostasis in men. *J Physiol* 504 (Pt 1): 241-249, 1997

^v Braun B, Rock PB, Zamudio S, Wolfel GE, Mazzeo RS, Muza SR, Fulco CS, Moore LG, Butterfield GE: Women at altitude: short-term exposure to hypoxia and/or alpha(1)-adrenergic blockade reduces insulin sensitivity. *J Appl Physiol* 91(2): 623-631, 2001

^{vi} Oltmanns KM, Gehring H, Rudolf S, Schultes B, Rook S, Schweiger U, Born J, Fehm HL, Peters A: Hypoxia causes glucose intolerance in humans. *Am J Respir Crit Care Med* 169(11): 1231-1237, 2004



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- vii Spiegel K, Leproult R, Van Cauter E: Impact of sleep debt on metabolic and endocrine function. *Lancet* 354(9188): 1435-1439, 1999
- viii Gottlieb DJ, Punjabi NM, Newman AB, Resnick HE, Redline S, Baldwin CM, Nieto FJ: Association of sleep time with diabetes mellitus and impaired glucose tolerance. *Arch Intern Med* 165(8): 863-867, 2005
- ix Coughlin SR, Mawdsley L, Mugarza JA, Calverley PM, Wilding JP: Obstructive sleep apnoea is independently associated with an increased prevalence of metabolic syndrome. *Eur Heart J* 25(9): 735-741, 2004
- x West SD, Nicoll DJ, Stradling JR: Prevalence of obstructive sleep apnoea in men with type 2 diabetes. *Thorax* 61(11): 945-950, 2006
- xi Elmasry A, Janson C, Lindberg E, Gislason T, Tageldin MA, Boman G: The role of habitual snoring and obesity in the development of diabetes: a 10-year follow-up study in a male population. *J Intern Med* 248(1): 13-20, 2000
- xii Gruber A, Horwood F, Sithole J, Ali NJ, Idris I. Obstructive sleep apnoea is independently associated with the metabolic syndrome but not insulin resistance state. *Cardiovasc Diabetol* 5: 22, 2006
- xiii Lam JC, Lam B, Lam CL, Fong D, Wang JK, Tse HF, Lam KS, Ip MS: Obstructive sleep apnea and the metabolic syndrome in community-based Chinese adults in Hong Kong. *Respir Med* 100(6): 980-987, 2006
- xiv Babu AR, Herdegen J, Fogelfeld L, Shott S, Mazzone T: Type 2 diabetes, glycemic control, and continuous positive airway pressure in obstructive sleep apnea *Arch Intern Med* 165(4): 447-452, 2005
- xv Hassaballa HA, Tulaimat A, Herdegen JJ, Mokhlesi B. The effect of continuous positive airway pressure on glucose control in diabetic patients with severe obstructive sleep apnea. *Sleep Breath* 9(4): 176-180, 2005