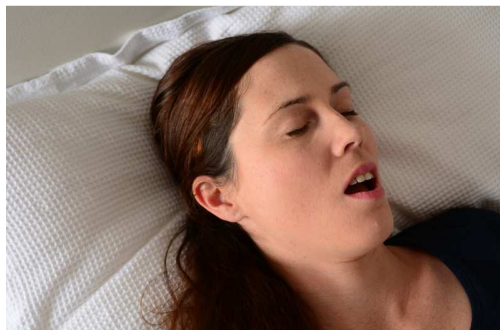


SNORING IN PREGNANCY: RISKS, REASONS, AND REMEDIES

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One of the best things a woman can do to increase her chances of a healthy pregnancy and healthy baby is to breathe well to optimally oxygenate herself and her baby. Unfortunately, many women, pregnant or not, do not breathe optimally. One indicator of this is snoring. Snoring used to be a *male thing*, but these days many women snore, and an increasing number of pregnant women do. About one in four report frequent snoring during pregnancy. By the third trimester, up to one-third of women may be habitual snorers.¹⁻⁴

Snorers are more likely to have problem pregnancies

The mother's breathing during pregnancy can affect not only her own health and wellbeing but also that of her child. Research has linked habitual snoring in pregnancy with increased risk of hypertension, pre-eclampsia, C-sections, low birth weight babies,¹ and low Apgar scores.⁵ The Apgar score is used to assess a baby's health immediately after birth. Overall, habitual snoring during pregnancy was associated with double the risk for high blood pressure and more than three times the risk for slowed foetal growth, compared with non-snorers.⁵ Chronic snorers are twice as likely to need a C-section.¹ For some of these women, the snoring may be a symptom of obstructive sleep apnea (OSA), a serious condition where blood oxygen levels drop and sleep is disrupted many times at night through intermittent stoppages in breathing.

Why do people snore?

Snoring can be related to weight gain – which is part of a normal pregnancy – but that does not make snoring in pregnancy normal. Along with weight gain, other *risk factors* such as nasal congestion, narrow nasal passages, small lower jaw, and alcohol consumption are often mistakenly thought of as primary causes of snoring, but you can have some or all of these risk factors and not snore, as well as have none and yet snore.

The factor that is invariably present with snoring and OSA (also referred to as *sleep disordered breathing* – SDB) is a dysfunctional baseline (awake and asleep) breathing pattern. Disordered or dysfunctional breathing is a general term to describe a physiologically abnormal respiratory pattern – that is, where the parameters of breathing are outside the accepted range or medical norms for breathing.

Snoring is fundamentally a dysfunctional breathing pattern.

Physiologic normal breathing

Physiologically normal breathing in adults is nasal, silent, slow, rhythmic and even, as well as light and diaphragmatic - *awake and asleep*. It is inaudible and virtually invisible. The adult norm for resting *tidal volume* is 400-600 mls/breath,^{6,7} with a respiration rate of 8-12 breaths/min,⁶ a *minute volume* of 4-6 L/min,⁶⁻⁸ and an alveolar carbon dioxide tension (PaCO₂) at 40-46 mmHg.⁸⁻¹¹ (See *Breathing physiology during pregnancy* section for some differences during pregnancy.)

When asleep, our metabolic rate is reduced and oxygen requirements are less during most sleep stages. During normal physiological sleep, tidal and minute volumes reduce significantly in both REM (rapid eye movement) and non-REM sleep.¹²⁻¹⁴ CO₂ normally increases in sleep by 3-7 mmHg.^{14,15} That is, healthy breathers breathe less air when asleep than when awake. This is not the daytime or night time breathing pattern in people who snore or have sleep apnea.

Dysfunctional breathing

Dysfunctional breathing patterns are characteristic in the daytime as well as during sleep in people with SDB.¹⁶ That is, it is not just a night-time problem. Breathing, awake and asleep, is controlled by the same chemoreceptors in the *respiratory centre* in the medulla.

The typical baseline dysfunctional breathing pattern is a combination of nose and mouth breathing, thoracic breathing, as well as heavy, audible, fast, and dysrhythmic breathing – with sighing, yawning and breath-holding in the day, and snoring, snorting, and apnea during sleep. The commonly overarching condition is hyperventilation or *overbreathing*.

Hyperventilation is classically defined as a condition in which the minute ventilation exceeds metabolic demands, and excessive quantities of CO₂ are exhaled, resulting in chronic or transient hypocapnia (low CO₂) and hemodynamic and chemical changes.¹⁷ Radwan¹⁸ found a daytime minute volume of 15L/min (i.e., near triple normal) and an inspiratory air flow rate more than double normal in men with OSA. See Table 1. A habitual mouth breather will hyperventilate – mouth breathing is generally faster than nose breathing and of greater tidal volume.

TABLE 1: PHYSIOLOGICALLY NORMAL BREATHING VS BREATHING IN PEOPLE WITH SDB

Parameter	Normal	People with SDB
Respiration Rate <i>breaths per minute</i>	8-12 ⁶	16 (av) (Awake) ¹⁹ 16-28 (Asleep) ¹⁹
Tidal Volume <i>mls per breath</i>	500 mls ^{6,7}	950 mls (Awake) - OSA ¹⁸
Minute Volume <i>litres per minute</i>	4-6 L ⁶⁻⁸	9L (Awake) – Snorers ²⁰ 15L (Awake) - OSA ¹⁸ 20 - 22L (Asleep) - OSA ¹⁹ CSA ^{21,22}
Inspiratory Flow Rate <i>mls per sec</i>	280 mls/sec ¹⁴	620 mls/sec (Awake) - OSA ¹⁹

Consequences of hyperventilation and hypocapnia

The noise of snoring is created by turbulence and the vibration of soft tissues in the throat – the more mls of air you breathe per second through your airway, the greater the turbulence and vibration. High velocity airflow also narrows the aperture of the glottis and increases resistance to airflow,²³ increases negative pressure (suction) on the upper airway (Bernoulli Effect, Venturi Effect), and contributes to narrowing and collapse of the upper airway and OSA.²⁴⁻²⁸

In addition, when you overbreathe the tissues lining your nasal passages and upper airway can get dehydrated, swollen,²⁹ and inflamed via histamine release from mast cell degranulation,^{30, 31} further narrowing your airway. The consequences of hypocapnia include narrowing of blood vessels, elevation of blood pressure, reduced tissue oxygenation (Bohr Effect), and anxiety states.^{29, 32}

Breathing physiology during pregnancy

Significant changes in respiratory physiology are normal during pregnancy. Minute ventilation increases to 50% above non-pregnant level at term.³³ Both oxygen consumption and CO₂ production increase 20-30% by the third trimester necessitating increased minute ventilation to maintain normal acid base status. In addition, progesterone directly stimulates the central respiratory centre causing a further increase in minute ventilation. The net effect is a mild chronic respiratory alkalosis (slightly elevated pH) and a decrease in the arterial PaCO₂ of up to 10mmHg.²⁹ So a degree of hyperventilation is normal in pregnancy.

However, a woman may already have a degree of hyperventilation/hypocapnia pre-pregnancy as a consequence of, for example, habitual mouth breathing or snoring, chronic anxiety,³⁴ or asthma.³⁵ Then, a further increase in minute ventilation during pregnancy, as naturally occurs and which may be exaggerated by increased stress levels or anxiety, may have adverse effects on the foetus such as decreased foetal oxygen tension, increased base deficit, lower Apgar scores, and delayed onset of rhythmic neonatal breathing.^{29, 36}

Because hypocapnia affects tissue oxygenation, blood chemistry, metabolism, and function of the smooth-muscle of the gastrointestinal tract, it can also impact nutrient absorption and utilisation. This may have implications for mineralisation, bone formation, and skeletal development amongst other things. Hypocapnia is also a consistent feature of systemic inflammatory response.^{29, 37}

Remedies

It is very important when there is evidence or concern regarding snoring and sleep apnea that a woman see her doctor to determine whether (further) medical evaluation is necessary and to discuss treatment options. The most common treatment is CPAP (continuous positive airway pressure) - a machine that uses air pressure to keep the airways open during sleep. CPAP can be highly effective in improving sleep quality and co-morbidities, but this treatment may not always be acceptable or tolerable for the person. Dental devices (e.g., mandibular advancement splints) may be another option. There are various medications (e.g., nasal sprays) and surgical procedures for snorers, but these do not always work and may not be appropriate in pregnancy.

Fortunately one can also improve the way one breathes. *Breathing retraining* can help reduce nasal congestion, restore nasal breathing, and establish optimal posture and optimal use of the breathing muscles. It aims to establish breath control and efficiency, as well as an *appropriate* rate and volume of breathing during rest, sleep, speech and exercise, and when under stress. An improvement in symptoms, sleep quality, and general wellbeing is usually observed within the first 24 hours.

An experienced and knowledgeable breathing educator understands the special breathing physiology of pregnancy and adapts the training appropriately. Improving one's breathing should be comfortable, gradual, and easily applied into everyday life. Improved baseline breathing and breath control are also valuable during labour and birthing.

Breathing retraining is substantially different from *deep, diaphragm/abdominal breathing techniques* commonly taught in various health disciplines. It is far more comprehensive than just restoring a nasal breathing pattern.

Breathing retraining is a natural and science-based approach to the management of breathing disorders, but is often overlooked. Unfortunately, assessment of baseline breathing pattern is not part of a standard medical evaluation for SDB, and dysfunctional breathing remains under-diagnosed and under-treated.

Breathing retraining is complementary to pharmaceutical and appliance-based treatments. Achieving and maintaining physiological normal breathing is a preventative health initiative beyond measure.

Suggestions to reduce the likelihood or intensity of snoring

- Breathe through your nose during the day whenever it is comfortable to do so, or breathe more gently through your mouth when you cannot manage nose-breathing
- Avoid any activity that makes you breathe heavily, puffing and panting through your mouth.
- Sleep on your side
- Elevate your upper body slightly (not just your head) in bed, by putting a rise between mattress and base, or use a special wedge-shaped pillow.
- Try not to gain more than the recommended amount of weight.

Breathing Retraining - You can change the way you breathe.

For more information

For information about breathing workshops (online courses and live) for health professionals, please contact: Tess@TessGraham.com.au. Tess Graham offers: - ***Breathing for Pregnancy, Birth and Beyond*** in an online webinar series as well as a live training for midwives, childbirth educators and other health professionals. For information about breathing retraining consultations and sessions (skype, online and live) please contact: admin@BreatheAbility.com.au

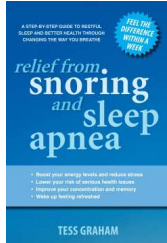
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Tess Graham is the author of *Relief from Snoring and Sleep Apnea: A Step-by-Step Guide to Restful Sleep and Better Health through Changing the Way You Breathe* (Penguin Aus 2012; Amazon 2014) and a companion product - *Breathing Exercise Instruction Audio* which can be found in the online store - TessGraham.com.

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