



INE | INSTITUTE OF
NUTRITIONAL
ENDOCRINOLOGY

Sleep: The Endocrinology of Sleep

Dr. Ritamarie Loscalzo



Medical Disclaimer: The information in this presentation is not intended to replace a one-on-one relationship with a qualified health care professional and is not intended as medical advice. It is intended as a sharing of knowledge and information from the research and experience of Dr. Ritamarie Loscalzo, drritamarie.com, and the experts who have contributed. We encourage you to make your own health care decisions based upon your research and in partnership with a qualified health care professional. This presentation is provided for informational purposes only and no guarantees, promises, representations or warranties of any kind regarding specific or general benefits, have been or will be made by Dr. Ritamarie Loscalzo, her affiliates or their officers, principals, representatives, agents or employees. Dr. Ritamarie Loscalzo is not responsible for, and shall have no liability for any success or failure, acts and/or omissions, the appropriateness of the participant's decisions, or the use of or reliance on this information.



Sleep and Hormone Interactions

Beneficial Effects During Slumber

- ✓ Growth Hormone
- ✓ Melatonin
- ✓ Leptin
- ✓ Estrogen
- ✓ Progesterone
- ✓ Testosterone



Undesirable Effects During Slumber

- ✓ Cortisol
- ✓ Insulin



Sleep and Insulin Resistance

- ✓ The effect of sleep deprivation on hormones, mental function, blood sugar metabolism, energy, and weight
- ✓ How to adopt a bedtime ritual that encourages sound sleep, including activities, herbs, and supplements that improve sleep
- ✓ Understanding sleep cycles and how to choose a bedtime that optimizes deep sleep duration
- ✓ Understanding the hormone interactions during sleep that contribute to energy, focus, fitness, and a flat belly
- ✓ Optimizing hormones during sleep to assure balanced blood sugar, mental clarity, a fit body, and high energy



Sleep Deprivation, Insulin Resistance, and Growth Hormone

✓ Sleep debt causes impairment in endocrine, cardiovascular, and immune systems

✓ **Glucose clearance rate depressed by 40% after 4 days**

of restriction of sleep to four hours a night, comparable to gestational diabetes

Spiegel K, Leproult R, Van Cauter, E Impact of sleep debt on metabolic and endocrine function. Lancet 1999 354: 1435-1439

✓ **Glucose tolerance is decreased during sleep debt**

Scheen AJ, Van Cauter E. The roles of time of day and sleep quality in modulating glucose regulation: clinical implications. Horm Res 1998;49(3-4):191-201

Scheen AJ, Byrne MM, Plat L, Leproult R, Van Cauter E. Relationships between sleep quality and glucose regulation in normal humans.

Am J Physiol 1996 Aug;271(2 Pt 1):E261-70

✓ **3 days of 10 - 12 hours of sleep can normalize fasting glucose**

✓ Sleep deprivation disrupts normal pattern of growth hormone surge during first three hours of sleep

Spiegel K, Leproult R, Colecchia EF, L'Hermite-Baleriaux M, Nie Z, Copinschi G, Van Cauter E. Adaptation of the 24-h growth hormone profile to a state of sleep debt. Am J Physiol Regul Integr Comp Physiol 2000 Sep;279(3):R874-83



Sleep and Growth Hormone

- ✓ Increases protein synthesis in every cell
- ✓ Promotes the release of fat from cells
- ✓ Shifts cell fuel from glycogen and glucose to fat
- ✓ Promotes insulin sensitivity

Secreted in response to:

- ✓ Empty or emptying stomach, via **ghrelin**
- ✓ Amino acids
- ✓ Exercise: increases with exercise intensity
- ✓ Deep sleep



Cortisol/Growth Hormone

- ✓ Cortisol surge before bed inhibits growth hormone surge
- ✓ Cortisol reduces the rate of fat burning
- ✓ Growth hormone added to the mix increases the rate of fat burning



Leptin

- ✓ Secreted by the fat cells – the white adipose tissue
- ✓ Signals the hypothalamus and pancreas “we are full”
- ✓ Hypothalamus response is to turn off appetite
- ✓ Pancreas response is to stop producing insulin
- ✓ Has a 24-hour circadian rhythm and is controlled by eating
- ✓ Pancreas and hypothalamus become leptin resistant



Normal Leptin Function

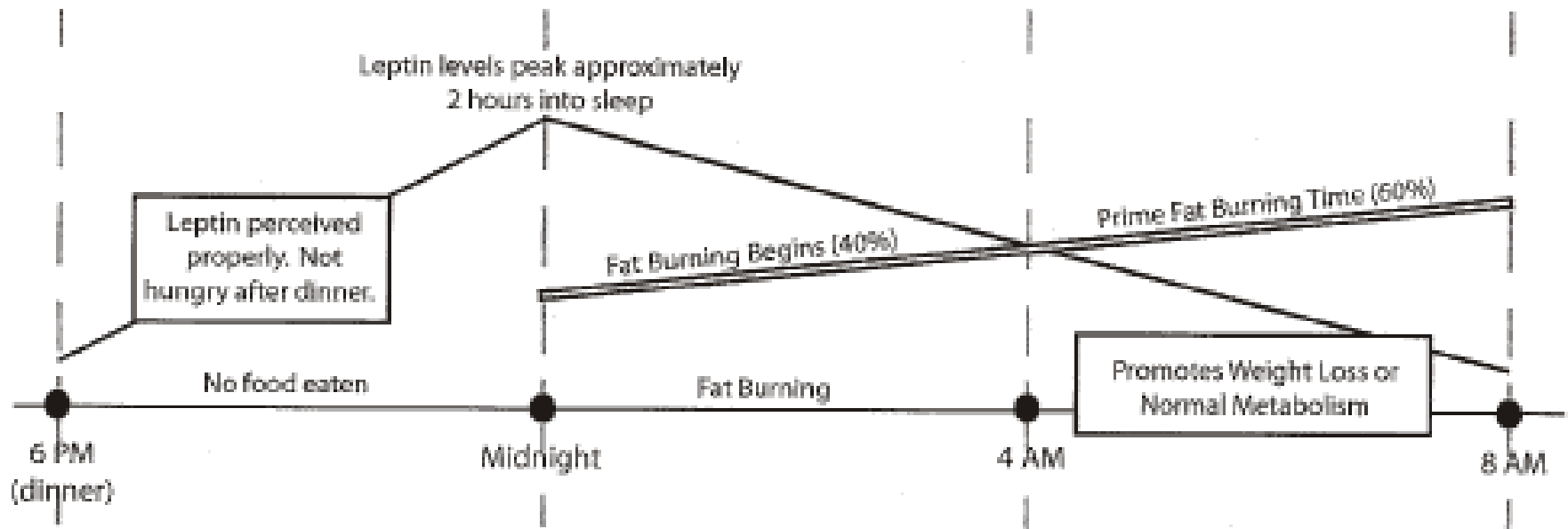


Chart from: Richards BJ. *Mastering Leptin*. Minneapolis: Wellness Resources Books, 2004



Leptin Resistance

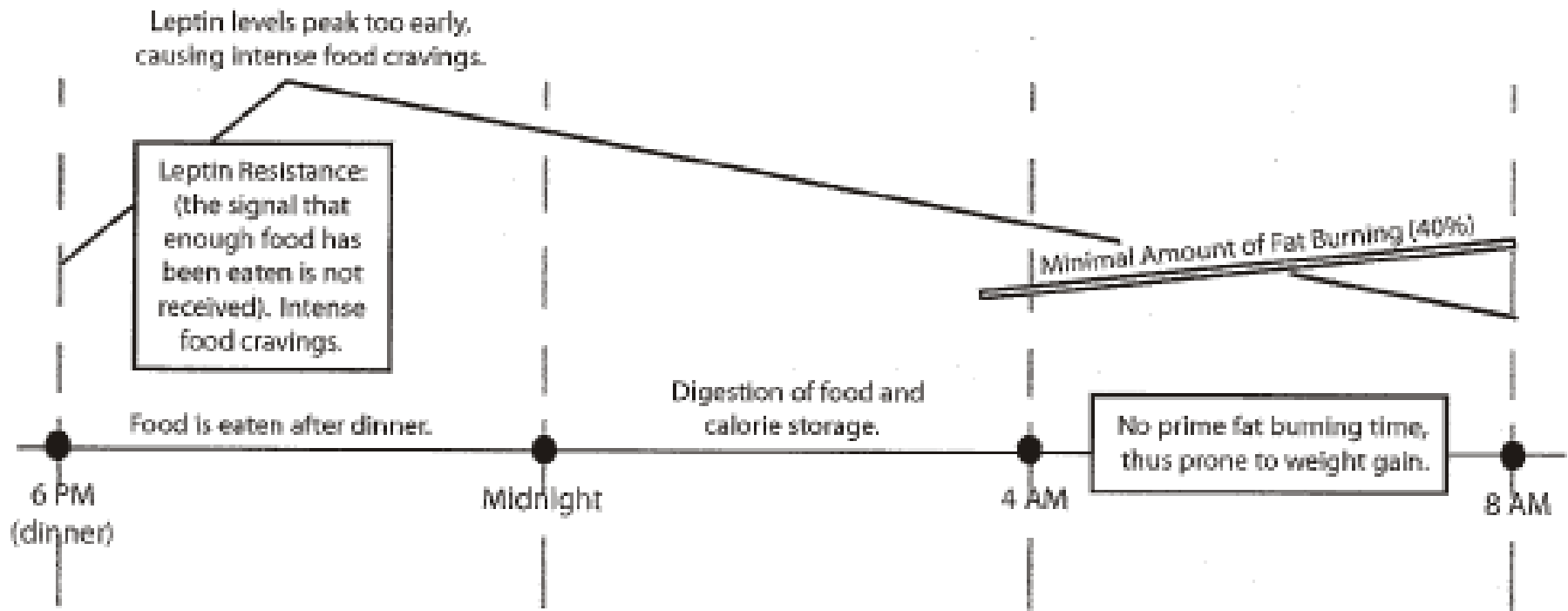
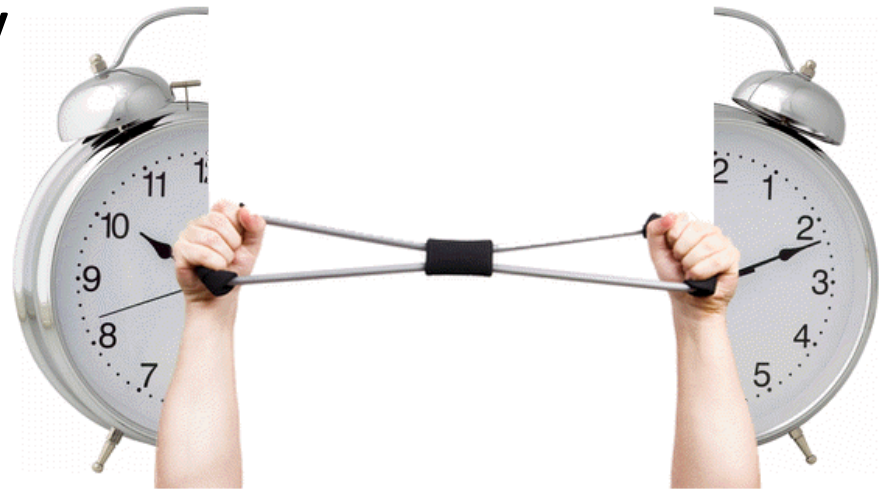


Chart from: Richards BJ. *Mastering Leptin*. Minneapolis: Wellness Resources Books, 2004



Guidelines for Managing Leptin and Insulin

- ✓ Never eat after dinner
- ✓ Eat only three meals a day
- ✓ Allow five to six hours between meals
- ✓ Do not eat large meals
- ✓ Eat slowly
- ✓ Eat a breakfast containing protein
- ✓ Reduce the intake of starchy carbohydrates



Ghrelin and Sleep

- ✓ Ghrelin is secreted by cells in the stomach wall
- ✓ Eating suppresses ghrelin
- ✓ Ghrelin stimulates appetite
- ✓ **Sleep deprivation increases ghrelin and hunger**
<http://www.drritamarie.com/go/PMID18564298>
- ✓ Ghrelin is a potent stimulator of growth hormone
- ✓ Waiting to eat until you are very hungry and your stomach is empty **stimulates fat burning and muscle sparing**



Sleep Deprivation and Hunger

- ✓ Sleep deprivation decreases leptin, increases ghrelin, and stimulates hunger
- ✓ A reduction of sleep duration to 4 hours for two consecutive nights has recently been shown to decrease circulating leptin levels and to increase ghrelin levels as well as self-reported hunger



<http://www.drritamarie.com/go/PMID18564298>



Melatonin

- ✓ Produced by pineal gland
- ✓ Turned on by low light conditions
- ✓ Turned off by bright light
- ✓ Promotes deep sleep
- ✓ **Protects from tumor growth**
- ✓ Reduced by computer and TV at night
- ✓ Inhibited by eating too close to bedtime
- ✓ Produced from the amino acid tryptophan and requires vitamin B6 for synthesis



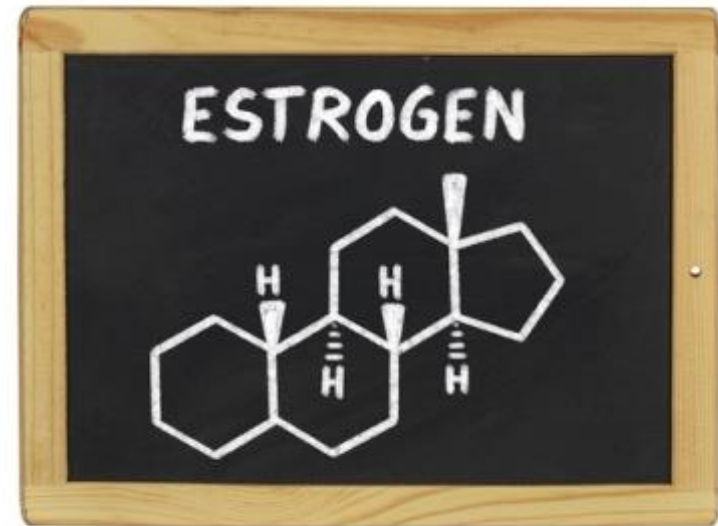
Progesterone

- ✓ Promotes deep sleep
- ✓ **Prevents lipid peroxidation**
- ✓ Blocks the atherogenic effects of cortisol
- ✓ **Anti-inflammatory and antioxidant effects**
 - Reduces NK cells, TNF-alpha, and Th1 cytokines
 - Stimulates the production of IL-4 and IL-10 and increases levels of reduced glutathione and superoxide dismutase
- ✓ Suppresses excess estrogen
- ✓ Activates the GABA receptor sites - calming
- ✓ Involved in regulation of hypoglycemia



Estrogen

- ✓ Significantly increases the amount of time patients had REM sleep
- ✓ Reduces the time spent awake from 20 to 12 minutes during the first two sleep cycles of the night
- ✓ Deep sleep promoting effect is beyond hot flash control



Testosterone

- ✓ Diminished testosterone linked with snoring and sleep apnea
- ✓ Sleep can increase testosterone
- ✓ Sleep deprivation decreases testosterone
- ✓ An extra few hours of sleep can double testosterone



<http://www.drritamarie.com/go/PMID17520786>
<http://www.drritamarie.com/go/PMID19684340>

