

## **ROLE OF LEPTIN IN OBESITY**

**Sachinkumar Sahebrao Patil<sup>1</sup>, Manjiri Pravin Bhosale<sup>2</sup>**

<sup>1</sup>Ph.D.(Kayachikitsa), M.D.(Kayachikitsa), P.G.D.E.M.S., D.Y.A., Associate Professor, Department of Kayachikitsa, M.A.M. Sumatibhai Shah Ayurved Mahavidyalya, Malawadi, Hadapsar, Pune-411028.

<sup>2</sup>M.D.(Kayachikitsa), Scholar, Department of Kayachikitsa, M.A.M. Sumatibhai Shah Ayurved Mahavidyalya, Malawadi, Hadapsar, Pune-411028.

**Email:** [drsachinkumarpatil@yahoo.com](mailto:drsachinkumarpatil@yahoo.com)

### **ABSTRACT**

The word “leptin” is derived from the Greek word “leptos” which means “thin”. Leptin is also called as “the satiety hormone”. It is the hormone made by adipose cells that helps to regulate energy balance by inhibiting hunger. Leptin is opposed by the actions of the hormone “ghrelin” known as “the hunger hormone”. Both hormones act on receptors in arcuate nucleus (aggregation of neurons) on the hypothalamus to regulate appetite to achieve energy homeostasis. In obesity, a decreased sensitivity to leptin occurs, resulting in an inability to detect satiety despite high energy stores.

**Keywords:** Leptin, hormone, obesity, leptin resistance.

### **INTRODUCTION**

Leptin is a hormone, produced by fat cells, that functions to maintain a lean body composition.

The principal actions of leptin are as follows:

- Leptin regulates appetite by interacting with the hypothalamus.
- Leptin enables the body to access and utilize fat stores for energy. (1) (2)

Leptin is the lookout hormone – the gatekeeper of fat metabolism, monitoring how much energy an organism takes in. It surveys and maintains the energy balance in

the body, and it regulates hunger via three pathways:

- By counteracting the effects of neuropeptide Y (36 amino acid neuropeptide i.e neurotransmitter.), a potent feeding stimulant secreted by the hypothalamus and certain gut cells.
- By counteracting the effects of anandamide (a fatty acid neurotransmitter), another feeding stimulant.

- By promoting the production of  $\alpha$ -MSH(melanocyte stimulating hormone), an appetite suppressant.(3)

Leptin was discovered in 1994 by Jeffrey M. Friedman and colleagues at the Rockefeller University through the study of genetically obese mice.

- While fat tissue is the primary source of Leptin, it is also produced by other body tissues including placenta, ovaries, skeletal muscle, stomach, breast tissue, pituitary and liver.
- While regulating appetite and fat metabolism is its primary function, leptin also helps regulate immunity, helps maintain healthy blood pressure and supports cognitive function. In addition, high leptin levels have a variety of adverse health effects including increasing the risk of congestive heart failure, increasing the risk of heart disease and increasing cancer risk.(2)

The immediate cause of *Sthaulya* (Obesity) is the energy imbalance, so the weight reduction can be achieved by reducing energy intake or by increasing output or by combination of two. These involve change in life style of the individual.

**AIM:** To study the role of leptin hormone in Obesity.

**OBJECTIVES:**

- Conceptual study of leptin hormone in Obesity.
- Study of ways to resolve leptin resistance in obesity according to Ayurveda.
- To lose weight according to the treatment principles mentioned in Ayurveda.

**MATERIALS AND METHODS:**

All conceptual data available in the classical texts of medicine and endocrinology and, Database available on the internet and the research articles were used.

**REVIEW OF LITERATURE:**

**The Leptin Cycle**

Fat tissue secretes leptin. High leptin levels signal the hypothalamus to decrease appetite, decrease food intake and reduce fat accumulation. So, normally, lean people have low leptin levels and fat people have high leptin levels. As the amount of stored fat increases, so do the leptin levels. So, why isn't the rising leptin level triggering weight loss?

The answer is leptin resistance. The neurons in the hypothalamus lose their sensitivity to leptin resulting in a lack of satiety and appetite suppression. As the size and number of fat cells increase with weight gain, they pump more and more leptin into the circulation in an attempt to send the message to the brain that fat stores are adequate, and appetite needs to be reined in.

Inadequate receptor sensitivity results in diminished responsiveness, which has two unfortunate results. First, normal fatty acid metabolism within the fat cells significantly declines and, the fat cells decrease their absorption of free fatty acids from the circulation. Thus, resulting excess of fatty acids floating in the bloodstream causes insulin resistance in peripheral tissues like muscle.

As with leptin-resistant fat cells, insulin-resistant muscle cells lose their responsiveness to insulin. As a result, glucose molecules are blocked from entering muscle tissue, causing blood sugar to rise. The liver senses hyperglycemia and liver cells respond by breaking down

the rogue sugar molecules and transforming them into more free fatty acids. In turn, the additional free fatty acids contribute to increased fat stores, increased leptin production, escalating resistance, and the vicious cycle continues to snowball. (3)

### **What Causes Leptin Resistance?**

Consuming excess calories causes fat deposition which raises leptin levels. Reduced physical activity decreases calorie metabolism which reduces fat metabolism. Chronically high leptin levels cause leptin resistance. In short, over eating and lack of exercise causes leptin resistance. So what causes over eating? It is a combination of factors including:

- Eating for stress relief or comfort rather than hunger.
- Poor food choices.
- Life style choices.
- Poor habits.
- High Fructose Foods.

### **Fructose and Leptin Resistance.**

In addition to this well established relationship, recent research suggests that the consumption of large amounts of fructose causes leptin resistance and elevated triglycerides in animals. A similar mechanism likely exists in humans. Fructose is widely used as a sweetener in many foods. On the label it may be called fructose, corn syrup or high fructose corn syrup. Fructose is also the natural sugar found in honey, fruits and berries. (6)

Leptin resistance is a similar thing that occurs in diabetes mellitus and known as insulin resistance. Resistance to the effects of leptin hormone is called leptin resistance and is said to be the main cause of fat gain in our body.

### **The symptoms of leptin resistance are given here under:<sup>7</sup>**

1. Quickly gain weight
2. Fat accumulation around the abdomen
3. Hunger or Constantly feeling hungry
4. Feeling of inability to lose weight
5. Hyperphagia – chronic excessive eating
6. Sub-conscious overeating
7. Impaired fat metabolism
8. Difficult to lose weight with dieting
9. Regular exercises are not helping to losing weight
10. You have tried many methods to lose weight, but after some days, you regain the previous weight.

### **Food craving**

11. High Cholesterol levels associated with obesity
12. High blood pressure (hypertension) linked with obesity
13. High levels of triglycerides
14. If you are trying to lose the weight, but do not achieve the desire results with reduction of calories or using your will power, it might be due to leptin resistance.
15. Infertility – unable to conceive children Effective treatment against leptin resistance can be achieved if principles of Ayurveda such as Pathya apathya are followed-

### **Pathya-Apathya Ahara:**

*Ahara Varga-*

*Pathya- Yava, Vemuyava, Kodrava Nivar, Mudga, Rajmasha, , Adhaki,*

*Kulattha, Chanak, Masur*

*Apathya- Godhuma, Navanna, Shali, Masha, Tila*

*Shaka varga-*

*Pathya- Vruntak, Patra Shaka, Patola*

*Apathya- Madhurshaka, Kanda*

*Phala-*

*Patyha- Kapitha, Jamun, Aamlak*

*Apathya- Madhuraphala*

*Dravya-*

*Pathya- Takra, Madhu, Ushnodaka, Til Tail,*

*Sarshap Tail, Arishtha Asava, Jirna madya*

*Apathya- Dugdha, Ikshu, Navnit, Ghrita Dadhi*

*Mamsa-*

*Pathya- Rohit Matsya*

*Apathya- Anupa, Audaka, Gramya*

***Pathya-Apathya Vihaar-***

*Pathya- Shram, Jagaran, Vyavaya, Nitya bhra-*  
*man, Chintana, Shoka, Krodha.*

*Apathya- Sheetal Jala Sevan, Divaswapa,*  
*Avyayam, Avyavaya, Swapna Prasanga, Sukha*  
*Shaiyya, Nitya Harsha, Achinta, Mansonivritti.*

## DISCUSSION

### Ways to fix leptin resistance.

As this is a complex problem, but not an irreversible one. Dr. Jack Kruse (a neurosurgeon) and Stephan Guyenet (an obesity researcher) have both written (articles) in depth about the causes of Leptin imbalance and ways to reverse it. The book Mastering Leptin also has a much more in depth explanation and suggestions. (3)

**In short, the (non-negotiable) factors that will help improve leptin response are:**

- Eating little to no simple starches, refined foods, sugars and fructose.
- Consuming a large amount of protein and healthy fats first thing in the morning, as soon after waking as possible. This promotes satiety and gives the body the building blocks to make hormones. My go-to is a large scramble with 2-3 eggs, vegetables and leftover meat from the night before cooked in coconut oil.

- Be in bed by ten (no excuses) and **optimize your sleep.**
- Get outside during the day, preferably bare-foot on the ground, in mid-day sun with some skin exposed.
- **DON'T SNACK.** When you are constantly eating, even small amounts, during the day it keeps your liver working and doesn't give hormones a break. Try to space meals at least 4 hours apart and don't eat for at least 4 hours before bed. This includes drinks with calories but herbal teas, water, coffee or tea without cream or sugar is fine.
- Don't workout at first. If you are really Leptin resistant, this will just be an additional stress on the body. Let your body heal a little first, then add in the exercise.
- When you do exercise, do only sprints and weight lifting. Walk or swim if you want to but don't do cardio just for the sake of cardio. It's just a stress on the body. High intensity and weight lifting, on the other hand, give the hormone benefits of working out without the stress from excess cardio and are great after the first few weeks. Also, workout in the evening, not the morning, to support hormone levels.
- Remove toxins from your life as these are a stress on your body.
- Eat (or take) more Omega-3s (fish, grass fed meats, chia seeds) and minimize your Omega-6 consumption (vegetable oils, conventional meats, grains, etc) to get lower inflammation and help support healthy leptin levels.

### **Dr. Kruse's Leptin Prescription:**

#### **1. First make sure you really are Leptin resistant (LR) to begin with.**

The easiest way to do this if you are heavy is to look in the mirror. If you're overweight you definitely are Leptin resistant. If you still have a large appetite and crave carbohydrates, especially at night, these are also signs that you are likely Leptin resistant. If you are fit or in decent shape and not sure based upon the above symptoms, I would tell you to go get a blood test and check your reverse T3. It will be elevated. I also recommend simultaneously checking a salivary cortisol level. With LR, you will always see higher cortisol levels later in the day.

#### **2. To regain Leptin Sensitivity (LS) follow a strict Epi-Paleolithic (nutritional) diet.**

The type of fuel you eat is important initially in eliminating the foods that cause Leptin receptors to become nonfunctional.

Try to eat as soon as possible upon rising in the morning, ideally within 30 minutes of waking. Make sure that breakfast has little to no carbs (less than 50 grams), and has a lot of protein and fat. A general rule is 50-75 grams of protein with most patients. Some patients can use less and some need more. The key point of knowing how much is right for you is your hunger later in the day. If you remain ravenous (extremely hungry) throughout the day, you need to eat more protein in the morning. If you can hold off eating until dinner you probably are at homeostasis for you. If you can skip both meals you likely are overdoing it at breakfast. As for sources, organic eggs first, served with scraps of grass fed meats, poultry, or fish would be great. A third option, although less ideal, would be whey protein or protein shakes.

Try to limit carb intake to 25 grams if you are overweight by more than 30 lbs (13 kgs). If you are fit and have a small amount of weight to lose, (less than 30 lbs.) you can titrate up your carb loads. Even then, potatoes or rice as some Paleo diets allow for is not actually advisable. You will be able to eat them eventually, but try to avoid starches until you have mastered your cravings and hunger. Do not count calories; it is not needed at this point. Any time you eat carbs, use liberal amounts of butter, heavy cream, coconut or palm oil. Not recommend other oils initially such as olive oils or industrial seed oils. Also avoid nut oils at the initial stages. Basically, coconut oil has great metabolic effects of MCT, and how it helps heal the guts of LR folks.

#### **3. How and when you eat your fuel is more important than any other factor, including the food itself.**

- Never snack at all. This is meant initially and forever. Snacking completely stresses the liver's metabolism and is just not recommended. Your liver needs to re-learn how to use gluconeogenesis normally again when you are asleep and awake. Snacking just destroys the timing and biological clocks that work in unison (simultaneous) with Leptin.
- Try to eat three meals a day initially; but as your hunger and cravings fade you can adapt to two a day.
- Try to eat breakfast as early as possible from rising.
- Do not work out before or after breakfast.
- Try to allow 4-5 hours between dinners and sleep time.
- If you decide to incorporate working out, do it after 5 PM.

- Within an hour of sunset try to make your surroundings as dark as possible.
- If you have trouble falling asleep, 3-5 minutes of body weight exercises right before bed is advisable. (Pushups or air squats are fine, but avoid this if your evening cortisol is high).
- If you're inclined to, try becoming mindful when you first lay down. Use transcendental meditation techniques to help clear your mind and concentrate on improving your thinking. (Optional; but this is awesome if your evening cortisol is high).

**4. Most people will notice a change in their cravings and hunger within 4-6 weeks.**

**5. Signs that you are becoming Leptin Sensitive (LS) again?**

- Men will notice quick weight loss.
- Women will notice mood changes first (calmer/sleepy) and their sleep will improve (huge clue). Their clothes will fit differently but weight may not change drastically initially because of effects on the pituitary. This will change too if they continue moving forward.
- You will notice a change in your sweating pattern.
- You will notice you have better recovery from exercise and your energy levels seem to have risen.
- Your hunger is gone and so are your cravings.
- When you awaken you will feel very refreshed like you slept well.

The following Ayurvedic tips can help to reduce leptin resistance:<sup>7</sup>

1. Do not drink water at least one hour before the meal and 3 hours after the meal.

2. Drink 8 to 12 glasses of water daily.
3. Do not sleep immediately after dinner. Eat your dinner 3 hours before sleeping.
4. Drink a cup of warm water before sleeping.
5. Eat natural organic foods and avoid industrial, junk or fast foods.
6. Stay close to the nature and avoid artificial and unproven supplements.

Herbs for leptin resistance treatment

The following herbal formula is effective in the leptin resistance and losing weight.

Chitrak Powder	125 mg
Black Pepper	250 mg
Long Pepper	250 mg
Dry Ginger	250 mg
Turmeric	500 mg
Cinnamon	500 mg
Guggulu	500 mg

This formulation is very effective to increase the leptin sensitivity and reducing fat accumulation in the body.

All the above mentioned factors that will help improve leptin response can be achieved if the principles of Ayurveda namely Dincharya and Rutusharya as well as Pathya-Apathya for Obesity are followed.

## CONCLUSION

Obesity is nowadays becoming an issue of concern in today's world and leading to many other health complications. It is a need of today to make necessary changes in our lifestyle, diet and daily habits in order to conquer obesity and its complications and start losing weight in a healthy way. Thus, following the principles of Ayurveda, Obesity can be reduced.

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