

# What is Refeeding Syndrome?

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**R**efeeding syndrome describes a series of metabolic events that occur by reintroducing nutrition to patients who are underweight, starved or severely malnourished. When these types of patients begin to be fed again, primarily with carbohydrates, the result is electrolyte disturbances such as a rapid fall in phosphate, magnesium and potassium levels. Another big concern is fluid retention and micronutrient deficiencies such as thiamine and folic acid. Thiamine is important for carbohydrate metabolism. It is a water soluble vitamin, and total body stores can quickly become depleted with weight loss and malnutrition. If refeeding syndrome is severe, it may result in pulmonary failure, cardiac failure, hypotension, arrhythmias, seizures, neuromuscular dysfunction and neurologic complications.

Refeeding syndrome was first discovered in Far East prisoners of war after World War II. After a period of prolonged starvation and weight loss, low blood pressure developed and cardiac size diminished in the prisoners. When the prisoners began to eat again, they became acutely ill. During starvation, the secretion of insulin is decreased in response to a reduced intake of carbohydrates. Instead, fat and protein stores are catabolized to produce energy, which results in an intracellular loss of electrolytes, in particular phosphate. Malnourished patients' intracellular phosphate stores can be depleted despite normal serum phosphate concentrations.

A main sign of refeeding syndrome is that patients develop hypophosphatemia. Phosphate is necessary for the accrual of lean tissue mass and a vital component of the metabolic pathway. When one starts to eat again, the reintroduction of carbohydrates causes a sudden shift from fat and protein back to carbohydrate metabolism, and secretion of insulin increases, causing circulating insulin levels to increase.

This stimulates uptake of phosphate into the cells that results in hypophosphatemia. The serum phosphorous level falls with refeeding due to a shift of phosphate from the extracellular to the intracellular compartment due to the huge demand for this ion for synthesis of phosphorylated compounds. The result of

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this sudden reduction in phosphorous levels can cause a multitude of life-threatening complications that involve multiple organs resulting in respiratory failure, cardiac failure, cardiac arrhythmias, seizures, coma and red blood cell dysfunction. In addition, the increased insulin levels cause a rapid uptake of glucose, potassium and magnesium into cells, and the serum concentration of these agents fall dramatically. The body also begins to retain fluid and the extracellular space expands causing rapid weight gain.

The reduction in serum electrolytes and fluid retention can lead to a number of systemic pathologies. There is an increase in cardiac workload, increased stroke work, heart rate and oxygen consumption. As a result, this increase in demand for nutrients and oxygen may out strip the supply. In patients with cardiovascular disease or in patients with severe organ damage from starvation, the increase in cardiac work and circulating fluid can cause acute heart failure. The mechanism of heart failure that occurs with refeeding is multifactorial. It is due to the reduced heart mass that accompanies weight loss, which makes it difficult for the heart to handle the increase in total circulatory blood volume seen with refeeding. Even though the heart mass does revert toward normal with weight gain, the first few weeks of refeeding require close attention to an anorexic patient's cardiovascular status until this process has occurred.

The reintroduction of carbohydrates exerts a considerable strain on the respiratory system, whose musculature may be atrophied due to starvation. This causes an increase in carbon dioxide production and oxygen consumption, and an increase in respiratory quotient (RQ), which can cause difficulty in breathing.

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With malnutrition and starvation, the gut atrophies, and the production of digestive enzymes diminishes. When nutrition is reintroduced, the gut may be initially intolerant, requiring time to adapt. Many patients complain of gastrointestinal discomfort, bloating, nausea and diarrhea. A bowel regimen with the use of products such as Miralax or Benefiber may help alleviate these symptoms during the early stages of the refeeding process.

The most effective way to treat refeeding syndrome is to be aware of the symptoms and identify the patients who are at risk. The introduction of nutrition should be done slowly by starting the caloric intake low and advancing slowly to avoid overfeeding. The dietary treatment is to individualize a patient's meal plan based on his/her rate of weight gain. In general, starved anorexics are metabolically inefficient. At EDC-Denver, at-risk patients are generally started around 1,100 calories per day and advanced by 200 to 300 calories every 2-3 days on average and often require 3,500-5,000 calories per day to restore weight. However, weight gain does not always correlate exactly with the total excess calories consumed over basal requirement.

It is important to check labs often such as potassium, phosphorous, magnesium, sodium and glucose. It is also important to supplement the patient with electrolytes and vitamins as necessary to help alleviate potential problems. Serum protein levels often remain within normal limits, while low albumin levels likely indicate the degree of stress or illness rather than nutritional depletion. Patients should be monitored closely for signs and symptoms of refeeding syndrome, which include vital signs such as heart rate, blood pressure, respiratory rate, mental status, and neurological function. They should also be assessed for fluid balance, signs of edema, fluid overload and weighed on a regular basis. At EDC-Denver, the clinical staff monitors at-risk patients very closely for the signs and symptoms of refeeding syndrome and often supplement them early to ward off potentially serious consequences of refeeding syndrome.

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## What is Normal Eating?

| By Ellyn Satter

Normal eating is going to the table hungry and eating until you are satisfied. It is being able to choose food you like and eat it and truly get enough of it – not just stop eating because you think you should. Normal eating is being able to give some thought to your food selection so you get nutritious food, not being so wary and restrictive that you miss out on enjoyable food. Normal eating is giving yourself permission to eat sometimes because you are happy, sad, bored or just because it feels good. Normal eating is three meals a day, or four or five, or it can be choosing to munch along the way. It is leaving some cookies on the plate because you know you can have some again tomorrow, or it is eating more now because they taste so wonderful. Normal eating is overeating at times, feeling stuffed and uncomfortable. And it can be undereating at times and wishing you had more. Normal eating is trusting your body to make up for your mistakes in eating. Normal eating takes up some of your time and attention, but keeps its place as only one important area of your life.

In short, normal eating is flexible. It varies in response to your hunger, your schedule, your proximity to food and your feelings.

Article from *Secrets of Feeding a Healthy Family*. For more information visit [www.ellynsatter.com](http://www.ellynsatter.com)