PHYSIOLOGICAL RESPONSES TO NUTRITIONAL IMPAIRMENT

PHYSIOLOGICAL RESPONSES TO NUTRITIONAL IMPAIRMENT Metabolic response to fasting or starvation

The constant need for glucose by metabolically active tissues in the body , such as the brain, red and white blood cells and the renal medulla, necessitates homeostasis of blood glucose levels even during periods of fasting. During short-term fasting periods, when insulin levels fall and glucagon levels rise, glycogenolysis is the main source of glucose, whereby glycogen stores from the liver and skeletal muscle are converted to glucose via lactate (the Cori cycle). After approximately 24–40 hours of fasting, glycogen reserves are depleted and gluconeogenesis (the de novo synthesis of glucose from non-carbohydrate precursors such as the amino acids glutamine and alanine, as well as fructose, glucose production. The generation of amino acids occurs from catabolism of skeletal muscle, in amounts of up to 75 /uni00A0 g per day for the average-sized individual. Under conditions of even more prolonged fasting (>48 hours), glucose production is met by the breakdown of fat stores (lipolysis); this provides glycerol, which is then converted to fa tty acids and glucose. Fatty acids can be converted to ketones, which can be used as a metabolic substrate by the majority of tissues in circumstances of extended fasting, reducing the need for muscle breakdown. Resting energy expenditure levels significantly decrease in starvation, related in part to reduced conversion of inactive thyroxine (T) to active tri-iodothyronine (T). Nevertheless, 4 3 this reduction is insu ffi cient to obviate the need for metabolic substrates, leaving a glucose requirement of approximately 200 /uni00A0 g per day even during conditions of prolonged fasting. Summary box 25.1 Metabolic response to starvation /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF /uni00A0 /uni00A0

Low plasma insulin High plasma glucagon Hepatic glycogenolysis Protein catabolism Hepatic gluconeogenesis Lipolysis: mobilisation of fat stores (increased fat oxidation) – overall decrease in protein and carbohydrate oxidation Adaptive ketogenesis Reduction in resting energy expenditure (from approximately 25–30 kcal/kg per day to 15–20 kcal/kg per day

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