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1. **Discuss the role of kidney in Glucose homeostasis.**

The two main contributions of the kidneys in regulating glucose levels are (i) Gluconeogenesis (ii) Selective reabsorption of Glucose

1. Gluconeogenesis by the Kidneys

Gluconeogenesis is a metabolic pathway that resulrs in the generation of glucose from certain non carbohydrates substances, the contribution of gluconeogenesis by kidneys is increased in diabetes and prolonged fasting.

Gluconeogenesis is one of the several mechanisms used by humans to maintain blood glucose levels, avoiding hypoglycemia. The kidneys hsve necessary enzymes for the production of glucose via gluconeogenesis.

The turnover of glucose is approximately 250g per day, with the brain consuming nearly 125g, based on a number of studies in healthy individuals, the kidneys contribute 20% to 25% of glucose reeleased into circulation in the fasting state, whereas the remainder comes from the liver through a combination of gluconeogenesis and glycogenolysis. Like other organs and tissues the kidneys also require glucose for energy production. In fasting individuals the kidneys consume 5% to 10% of all glucose used by the body for energy requirements.

Thus the kidneys contribute to overall glucose homeostasis by producing glucose for circulation via gluconeogenesis and by uptake and utilization of glucose for energy needs

1. Selective reabsorption of Glucose by the Kidneys

The kkidneys are extremely effective in the resbsorption of glucose, in healthy individuals under normal physiological conditions, the kidneys reabsorbs virtually all of the glucose that is filtered and rreturns it to the circulation, most of the filtered glucose is reabsorbed by SGLT-2 which is located in the proximal tubule another sodium-glucose cotransporter SGLT-1 is responsible for reabsorbing the remaining glucose.

1. **Discuss the process of Micturition**

Micturition is the process of expelling urine from the bladder. This act is also known as voiding of the bladder.

Micturition is fundamentally a spinal reflex facilitated and inhibited by higher brain centers and, like defecation, subject to voluntary facilitation and inhibition, during micturition, the perineal muscles and external urethral sphincter are relaxed, the detrusor muscle contracts, and urine passes out through the urethra.

The perineal muscles and external sphincter can be contracted voluntarily, preventing urine from passing down the urethra or interrupting the flow once urination has begun. It is through the learned ability to maintain the external sphincter in a contracted state that adults are able to delay urination until the opportunity to void presents itself. After urination, the female urethra empties by gravity. Urine remaining in the urethra of the male is expelled by several contractions of the bulbocavernosus muscle.

1. **Explain Juxtaglomerular apparatus**

The juxtaglomerular apparatus(JGA) is a structure in the kidney that regulates the function of each nephron, the juxtaglomerular apparatus is so named because its proximity to the glomerulus, it is found between afferent arteriole and the distal convoluted tubule of the same nephron.

The juxtaglomerular apparatus consists of three types of cells

* The Macula densa, a part of the distal convoluted tubule
* Juxtaglomerular cells which secrete renin
* Extraglomerular mesangial cells

The macula densa is a specialized group of epithelial cells in the distal tubules that comes in close contact with the afferent and efferent arterioles.

Renin is produced by the juxtaglomerular cells. These cells are similar ro epithelium and are located in the tunica media of the afferent arterioles as they enter the glomeruli. The juxtaglomerular cells secrete renin in response to

* Stimulation of beta-1-adrenergic receptor
* Decrease in renal perfusion pressure
* Decrease in NaCl concentration at the macula densa, often due to a decrease in glomerular filtration rate

Extraglomerular mesangial cells are located in the junction between the afferent and efferent arterioles.

1. **Discuss the role of kidney in regulation to Blood pressure**

The kidneys play a central role in the regulation of arterial blood pressure, a large body of experimental and physiological evidence indicates that renal control of extracellular volume and renal perfusion pressure are closely involved in maintaining the arterial circulation and blood pressure.

The rise in blood pressure produced by injection of kidney extracts is due to renin, an acid protease secreted by the kidneys into the bloodstream. This enzyme acts in concert with angiotensin-converting enzyme to form angiotensin II Active renin has a halflife in the circulation of 80 min or less. Its only known function is to split the decapeptide angiotensin I from the amino terminal end of angiotensinogen (renin substrate).

1. **Discuss the role of Kidney in Calcium Homeostasis**

The role of the kidneys in calcium homeostasis has been reshaped from a classic view in which the kidney was regulated by systemic calcitropic hormones such as vitamin D3 or parathyroid hormone to an organ actively taking part in the regulation of calcium handling.