MECHANISM OF URINE FORMATION

[1]Sultanova Sh.B., [2]Nurullaeva M.A., [3]Ziyamutdinova Z.K.
[1,2]The students of Tashkent Pediatric Medical Institute
[3]Research advisor, The teacher of candidate of biological sciences of Tashkent Pediatric Medical Institute, The Department: Medical and biological chemistry, medical biology, general genetics
https://doi.org/10.5281/zenodo.11138358

Abstract*. The main mechanism of homeostatic renal function is the formation and excretion of urine. When urine is formed, the kidneys perform significant work against osmotic forces, since the concentration of osmotically active substances in human urine usually exceeds the concentration of these substances in the blood plasma. Thus, the urea content in human blood plasma does not exceed 0.04%, while urine contains more than 2% urea; in the blood the amount of sodium chloride is about 0.6%, in the urine - over 1%.*

Keywords*: homeostatically, kidney, urine, glomerular filtration, tubular reabsorption, glycosaminoglycans, ammonigenesis, ultrafiltrate.*

INTRODUCTION.

The kidneys serve as the main organ of excretion and the main organ of osmoregulation. Their functions include removing waste products and foreign substances from the body, regulating the chemical composition of body fluids by removing substances that exceed current needs, regulating the water content of body fluids (and thereby their volume), and regulating the pH of body fluids.

The kidneys are abundantly supplied with blood and homeostatically regulate blood composition. Thanks to this, the optimal composition of the tissue fluid is maintained, and, consequently, the intracellular fluid of the cells washed by it, which ensures their efficient functioning. The kidneys adapt their activity to changes occurring in the body. Moreover, only in the last two sections of the nephron - in the distal convoluted tubule of the kidney and the collecting duct of the kidney - does functional activity change in order to regulate the composition of body fluids. The rest of the nephron up to the distal tubule functions the same under all physiological conditions.

The end product of kidney activity is urine, the volume and composition of which varies depending on the physiological state of the body.

MATERIALS AND METHODS.

Urine formation consists of 3 stages: glomerular filtration, tubular reabsorption, selective secretion. Glomerular filtration Glomerular filtration occurs in the glomeruli of the kidneys. The speed of this process depends on the difference in hydrostatic and oncotic pressure. Hydrostatic pressure is created work of the heart. Oncotic pressure is caused by proteins blood plasma. Both pressures prevent filtration. The amount of glomerular filtration depends on the condition permeability of the glomerular filter, through which it does not pass the squirrels are hiding. In addition, the basement membrane formed by glycosaminoglycans, has a negative charge, which makes it difficult protein filtration. Consequently, the filtrate will contain all constituent parts of blood plasma, except proteins. Tubular reabsorption During tubular reabsorption, selection occurs in the tubules body reabsorption, due to which the body substances and water necessary for the body are preserved. Tubular reabsorption occurs by simple diffusion and active+transport systems

of membranes. Reab+ Some substances undergo sorption, which is why it is called selective. Due to the fact that the proximal convoluted canals have a large surface area and contain a lot of mitochondria Dry, about 80% of substances are reabsorbed here.

RESULT AND DISCUSSIONS.

Blood entering the kidneys through the renal arteries not only supplies the hard-working glandular apparatus of the kidneys with the necessary nutrients and oxygen, but also frees the body from a number of substances - products of tissue metabolism.

The kidneys are abundantly supplied with blood: 1500 liters of blood pass through the kidneys per day, which corresponds to 900-1200 ml/min. From the flowing blood, an amount of urine is formed, which is approximately 1/1000 of the blood that passes, that is, 800-1500 ml per day. The process of urine formation includes the following stages:

1. ultrafiltration of blood plasma by renal glomeruli;
2. selective reabsorption of chemicals by the renal tubules;
3. secretion from the blood into the lumen of the renal tubules of substances intended for excretion in the urine;
4. secretion of protons and production of ammonium ions (ammonigenesis)

As a result of passive filtration of the liquid part of the blood in the renal glomeruli, an ultrafiltrate or primary urine is formed. About 200 liters of ultrafiltrate are produced daily. The ultrafiltrate contains all components of blood plasma, with the exception of proteins with a molecular weight of over 50,000 Da. Every day, about 30,000 mmol of sodium, 800 mmol of potassium, 300 mmol of ionized calcium, 1000 mmol (180 g) of glucose and 800 mmol (48 g) of urea are supplied to 200 liters of filtrate at their normal concentration in the blood plasma.

Healthy kidneys filter only small amounts of protein and protein-related compounds. In the proximal parts of the renal tubules, isosmotic transport occurs, ensuring the reabsorption of substances. All substances in primary urine are divided into threshold and non-threshold. Threshold substances are reabsorbed, non-threshold substances are not, and therefore are excreted in the urine in quantities proportional to their concentration in the blood plasma. Reabsorption occurs both by simple diffusion and active transport. Active transport requires a lot of energy, so the activity of K+, Na+- ATPases is high in the renal tubules. Na+, Cl-, H2O, glucose and other monosaccharides, amino acids, Ca2+, Mg2+, pH, bicarbonates, and proteins are actively reabsorbed. Moreover, glucose and proteins are reabsorbed by the kidneys almost completely, amino acids - by 99%, H2O - by 96%, Na+ and Cl- - by 70%; the remaining substances are more than half.

CONCLUSION.

Primary urine passes continuously through the convoluted renal tubules. The epithelial cells that make up their walls do a lot of work. They actively absorb large amounts of water and all the substances needed by the body from primary urine. From the epithelial cells they return to the blood flowing through the network of capillaries that encircles the kidney tubules. How much work the renal epithelium does can be judged, for example, by the fact that its cells absorb about 96% of the water contained in it from primary urine. Renal epithelial cells spend a huge amount of energy on their work. Therefore, metabolism occurs in them very intensively. This is confirmed by the fact that the kidneys, which make up only 1/160 of our body weight, consume approximately 1/11 of the oxygen supplied to it. The resulting urine flows through the tubes of the pyramids to

the papillae and seeps through the openings in them into the renal pelvis. From there it flows down the ureters into the bladder and is removed out.

REFERENCES

1. Uetani N, Bouchard M. Plumbing in the embryo: developmental defects of the urinary tracts. Clin Genet. 2009 Apr;75(4):307-17. [PubMed]
2. Costantini F, Kopan R. Patterning a complex organ: branching morphogenesis and nephron segmentation in kidney development. Dev Cell. 2010 May 18;18(5):698-712. [PMC free article] [PubMed]
3. Kreidberg JA. Podocyte differentiation and glomerulogenesis. J Am Soc Nephrol. 2003 Mar;14(3):806-14. [PubMed]
4. Bhaskar A, Oommen V. A simple model for demonstrating the factors affecting glomerular filtration rate. Adv Physiol Educ. 2018 Jun 01;42(2):380-382. [PubMed]
5. Komlosi P, Bell PD, Zhang ZR. Tubuloglomerular feedback mechanisms in nephron segments beyond the macula densa. Curr Opin Nephrol Hypertens. 2009 Jan;18(1):57-62. [PubMed]