HOMEOSTATIC FUNCTIONS OF THE LIVER IN MAMMALS

The liver among other human organs is accredited with several homeostasis functions in mammals.

The liver is a multiorganelle vital to homeostasis, the steady state internal milieu required for function and survival in mammals. Being the largest internal organ, it plays various functions which include metabolic, detoxification, nutrient storage and immune, biliary functions. That way, correct functioning of different biochemical pathways allows the body to maintain balance despite changes in external and internal conditions. This paper explores the liver's basic homeostatic functions focusing on its metabolic, detoxifying, storage, digestive and immune roles.

1. Metabolic Regulation

The liver is significant in maintaining carbohydrate, lipid and protein balance and also it is involved in carbohydrate and lipid metabolism.

a. Carbohydrate Metabolism

The liver has an important role for regulating blood glucose homeostasis by glycogenesis, glycogen lysis and gluconeogenesis. Following a meal, high blood glucose concentration stimulates insulin release that causes the liver to effect glycogenesis to convert glucose to glycogen for storage. When fasting or for any other reason there is need to mobilise energy, glycogen lysis takes place, which consists of the breakdown of glycogen which is converted into glucose to maintain a normal and steady blood glucose level. Also, the liver with the rank of a gluconeogenic organ is capable of synthesizing glucose starting from non-carbohydrate precursors: lactates, glycerols and amino acids. This regulatory system helps to avoid

hyperglycaemia during duplications of food intake and hypoglycaemia during period of fasting (Sherwood et al., 2020).

b. Lipid Metabolism

Liver is an important component of lipid metabolism because it synthesizes, stores and transports fats. It synthesizes, cholesterol, phospholipids several types of lipids involved in structure of cell membranes and energy storage molecules such as triglycerides. Lipoproteins include the very low-density lipoproteins also abbreviated as VLDL, and high-density lipoproteins or abbreviated as HDL; these are organic compounds produced in the liver to transport lipids in the blood stream. Also, the liver assist in the digestion of fats broken down in the small intestines, and stores carbohydrate as triglycerides. Metabolic disorders of lipid lead to fatty liver diseases or hyperlipidaemias and cause imbalance in this systemic homeostasis (Guyton & Hall, 2021).

c. Protein Metabolism

This organ is actively involved in protein metabolism since it delaminates amino acids with its aim of producing energy or glucose it also creates ammonia. Cells are toxic to ammonia and are immediately changed into urea through the urea cycle and are eliminated by the kidney. Another important function of the liver involves in the synthesis of most of the plasma protein, including the albumin that helps to support the osmotic pressure in blood vessels, clotting factors that play a great role in homeostasis. These processes maintain nitrogen balance, regulate fluids and control ability to clot, the all-important aspects of homeostasis (Sherwood et al., 2020).

2. Detoxification and Excretion

As for bodily regulations, the liver counteracts toxins and helps to eliminate them, that is, it regulates chemical balance.

a. Detoxification of Xenobiotic

They liver has the role in metabolizing most drugs, alcohol and any chemical that is in the environment. This process in fact incorporates two stages. In Phase I the toxins undergo oxidation, reduction or hydrolysis by enzymes like the cytochrome P450 enzyme. Ambient oxygen free radicals are generated in phase II where the liver combines these reactive molecules with easily eliminated polar molecules such as glucuronic acid. This mechanism brought about safeguard the body against the build-up of poisonous chemicals in the body (Guyton, & Hall, 12th edition 2021).

b. Ammonia Detoxification

Ammonia being a product of protein metabolism, is trans-sulfated into urea in the liver through the urea Cycle. Urea is water soluble and it gets to the kidneys and eliminated from the body in urine. This process helps overcome the actions of toxic ammonia that includes Hepatic encephalopathy and also helps in achieving nitrogen balance.

c. Bilirubin Processing

Bilirubin is a waste product of the recycling of haemoglobin in the liver and it is process by the liver. It acts with glucuronic acid to convert bilirubin into water soluble and appearing in the bile. It helps to avoid the process of bilirubin in the blood that causes jaundice. Consequently, bilirubin is particularly important in the aspects of waste removal and red blood cell turnover regulation (Sherwood et al., 2020).

3. Storage Functions

The liver stores glycogen, vitamins and minerals as well to release them to the body when needed.

a. Glycogen Storage

This excess glucose is then converted to glycogen, and stored in / within hepatocytes. During rising energy demand, the glycogen stored in the liver is metabolised into glucose and docketed into the bloodstream. This mechanism assists in balancing the energy supply especially during periods of fasting or when activities to do with body energy consumption are rife (Guyton & Hall, 2021).

b. Vitamin and Mineral Storage

Liver also contains fats solutions and vitamins, including vitamin A, vitamin D, vitamin E, vitamin K and vitamin B12. The body's store of vitamin A helps the eyes and a healthy immune system, while vitamin K is necessary for clotting blood. The liver also stores Iron as Ferritin and releases it to haemoglobin synthesis synthesis and copper which is important for enzyme reactions. These reserves prevent the condition of nutritional deficiency and help provide physiological equilibrium (Sherwood et al., 2020).

4. What do the liver do for bile production and fat digestion

Another overall regulatory process of the liver is bile production. Bile soluble fats and other lipids in the intestine besides facilitating digested and absorption of lipids and fat soluble

vitamins (A, D, E, and K). The concern of liver is in maintaining the bile production because gallbladder and gallbladder bile duct stores this bile and releases during the digestion phase in small intestine. It also helps eliminate waste product like bilirubin and cholesterol, eradicate cholesterol from the body and other wastes in the body (Henry et al., 2017).

5. Immune Functions

The liver is involved in the immune system first by the synthesis of acute-phase proteins and second through its residing cellular components.

a. Kupffer Cells

Kupffer cells or parenchymal cells are liver macrophages which scavenge bacteria, virus, damaged blood corpuscles especially red blood cells. They also eliminate pathogens and dead cells which prevent organism infection and enhance bit innate immunity (Sherwood et al., 2020).

b. Acute-Phase Response

In infection or injury, the animal's liver produces acute-phase proteins like the C-reactive protein and the fibrinogen. They work to boost the immune response – inflammation and formation of tissues. This highlights the liver's responsibility of connecting metabolic and immune balance as we discussed earlier (Guyton & Hall, 2021).

REFERENCES

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Sherwood, L., Klandorf, H., & Yancey, P. H. (2020). Animal physiology: From genes to organisms (3rd ed.). Cengage Learning.