



Xenobiotic-contaminated water and its impact on animal metabolism

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Abstract. The relevance of this research arises from the fact that, despite the significant scientific and technological advancements humanity has achieved, it has not yet learned to use it carefully and rationally. Rapid industrialisation and urbanisation of the planet, a sharp increase in its

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population, intensive chemicalisation of agriculture, and the intensification of many other types of anthropogenic pressure on nature have disrupted the circulation of substances and natural energy exchange processes in the biosphere, damaged its regenerative mechanisms, and as a result, its progressive destruction has begun. This research review aimed to present some of the main impacts of water quality on metabolism in animal organisms within the concept of “One Health”. The leading method for studying this problem is a review of recent literature. Typically, xenobiotics are chemical compounds that enter the body and are not formed as a result of metabolic pathway reactions. In this regard, water contaminated with xenobiotics enters the body with drinking water or food, and this does not apply to metabolic water, which is formed as a result of chemical reactions. Thus, along with the consumption of water due to hydration, other various chemical substances may enter the body, which are usually not present in drinking water. However, the type of chemical substances, as well as their quantity, are criteria that can transform water from a basic nutrient into a harmful product. Soil and water play an important role in the chemical composition of food or feed that grows in the soil, and the metabolism of plants or plant consumers can be balanced or unbalanced depending on the quality and quantity of water. The materials of the article have practical significance for elucidating the biological mechanisms of xenobiotic elimination and preserving the health of animals and humans

Keywords: pollutants; animal organisms; contaminants; fluid balance; elimination

Introduction

The impact of xenobiotics on the reproductive and developmental biology of all living organisms has become of paramount importance in the present day. As the effect of these xenobiotics on aquatic animals is an emerging area of research and development, several groups worldwide are working on these aspects, targeting various groups of fish in both marine and freshwater ecosystems (Akhila *et al.*, 2023).

Generally, xenobiotics refer to a wide range of compounds, including synthetic and industrial chemicals, drugs, pesticides, environmental pollutants, and other substances that are introduced into an organism’s system through various routes, such as ingestion, inhalation, or dermal exposure, according to E.A. Norman *et al.* (2019). The presence of xenobiotics in freshwater – particularly in water used as a source of drinking water for animals and humans – can largely be attributed to sewage systems for wastewater, but also to potential leaks,

especially during rainy weather and in humid atmospheric conditions.

P.F. Zabrodskii (2020) notes that when xenobiotics enter an organism, they can undergo biotransformation, which is the process of chemical modification that occurs within the body. This transformation is primarily carried out by enzymes in the liver, although other organs and tissues can also contribute. The purpose of biotransformation is to convert xenobiotics into more easily excretable forms and to neutralise or detoxify potentially harmful substances.

However, some xenobiotics may be difficult to eliminate or may be transformed into metabolites that are more toxic or reactive than the original compound. This can lead to adverse effects on the organism’s health, such as organ damage, disruption of physiological processes, or the development of diseases. The study of xenobiotics and their effects on living organisms

is a significant field within toxicology and environmental science. Understanding how xenobiotics interact with biological systems and the mechanisms of their metabolism and toxicity is crucial for assessing their potential risks to human and ecological health (Oesch *et al.*, 2018; Ortiz *et al.*, 2022; Rathore *et al.*, 2022).

B. Lussenburg *et al.* (2022) indicate that understanding how exogenous chemicals (xenobiotics) are metabolised, distributed, and eliminated is critical for determining the impact of these chemicals and their metabolites on the organism. Y. Hua *et al.* (2022) point out that it is of great importance for food safety and human health to study the migration and biotransformation of chemical pollutants among agricultural elements, such as soil, water, and crops. C.H. Chen (2024) notes that household products containing chemical compounds are used daily, while industrial chemicals and environmental pollutants are prevalent in the air and water bodies. As a result, humans are constantly exposed to these foreign substances, known as xenobiotics. Many of these foreign compounds that enter the body are lipophilic, or fat-soluble. Unlike hydrophilic substances, which dissolve in water, lipophilic compounds are nonpolar and either insoluble or only slightly soluble in water. Therefore, they must be converted into water-soluble forms before being eliminated from the body. The process of removing these foreign substances involves activation and detoxification mechanisms, which serve as crucial defences for the human body.

The study aimed to analyse the influence of xenobiotics in water on metabolic processes in animals. The research methodology involved a comprehensive study and analysis of recent scientific literature. This approach aimed to review and synthesise the most up-to-date findings and theories relevant to the topic. The selection of sources was based on their scholarly significance, relevance, and contribution to the

existing body of knowledge. The analysis focused on identifying key themes, patterns, and gaps in the literature, providing a robust foundation for the research. By critically evaluating recent studies, the methodology ensured that the research was grounded in current scientific understanding, allowing for a well-rounded perspective on the subject matter.

Xenobiotic water contamination and its environmental impact

In this article, it is proposed to discuss “xenobiotic water”, which refers to water that is not produced within biological systems through metabolic reactions, but rather to the water ingested by humans and animals, namely drinking water or water that enters the organism along with food or feed. In this context, “xenobiotic water” does not refer to “polluted water” but to water that is not produced within the organism as an intermediate or final product of reactions.

Metabolic water is produced inside the organism in a multitude of reactions, playing a crucial role in maintaining proper hydration levels. The human body, as well as many other organisms, has evolved mechanisms to generate water as a byproduct of various metabolic processes (Nelson & Cox, 2014).

One of the primary sources of metabolic water is derived from cellular respiration (Ulrich & Zickermann, 2021; McClelland, 2022). During this process, glucose and oxygen are used to produce energy in various forms, but most commonly as adenosine triphosphate (ATP). Interestingly, as a byproduct of cellular respiration, water is generated through the combination of hydrogen ions and electrons in the electron transport chain (Bindoli & Rigobello, 2013). This metabolic water production occurs in the mitochondria, the powerhouse of the cell (Cox, 2005). Additionally, the breakdown of stored glycogen in the liver and muscles also yields metabolic water. As glycogen is

metabolised to release glucose for energy, the process produces water molecules as a byproduct. Furthermore, the oxidation of fat stores contributes to the production of metabolic water (Matkov, 2018). Fat molecules contain more hydrogen atoms compared to carbohydrates, making them a potent source for water synthesis when metabolised (Bindoli & Rigobello, 2020).

Overall, these metabolic reactions collectively contribute to the production of water within the organism. While the amount of water generated through these processes is relatively small compared to the water obtained from external sources such as drinking, it is nevertheless an important internal source of hydration, particularly in situations where access to external water is limited, such as during periods of water scarcity or in arid environments.

Water contaminated with xenobiotics refers to water that contains foreign substances, such as synthetic chemicals, pharmaceuticals, and pesticides (Gerrity *et al.*, 2011). These substances can enter water sources through direct discharge from industries, agricultural runoff, improper waste disposal, or accidental spills. They can be harmful to biological systems, including humans, animals, and plants, as they may interfere with normal cellular functions and essential physiological processes.

Water containing xenobiotics can have harmful effects on aquatic ecosystems and pose risks to human health. Many xenobiotics are persistent and do not easily degrade, leading to long-term contamination of water bodies, such as heavy metals (Ahmadi *et al.*, 2018). These substances can accumulate in the environment, potentially affecting aquatic organisms and the food chain.

Water treatment processes such as filtration, disinfection, and advanced oxidation are commonly employed to remove or reduce xenobiotics from water supplies. Additionally, regulations and monitoring programmes aim

to control the release of xenobiotics into water sources and mitigate their potential impacts on both the environment and human populations.

The significance of xenobiotics present in the water composition of biological systems is that they can have detrimental effects on human health, the environment, and aquatic life. Exposure to these contaminants can lead to the development of diseases, birth defects, and other health problems (Pankaj *et al.*, 2017). Additionally, xenobiotic water can disrupt ecosystems and harm wildlife by altering their behaviour, growth, and reproduction. This is why it is essential to monitor and regulate the presence of xenobiotic substances in water sources to ensure the safety of our natural resources and public health.

Metabolic water refers to water produced as a byproduct of metabolic processes in specific organisms, particularly those adapted to survive in water-scarce environments. It serves as a supplementary source of water, but it is not the sole or primary means of meeting an organism's water requirements (Ferrier, 2014). Certain organisms, such as desert-dwelling animals, plants, and microorganisms, have metabolic adaptations that allow them to generate water as a byproduct of their metabolic processes. This metabolic water production helps these organisms survive in arid or water-scarce environments where access to external water sources is limited.

In these cases, metabolic water is derived from the breakdown or metabolism of internal energy stores, such as glycogen or fats. During the breakdown of these energy stores, metabolic reactions release water molecules as byproducts. This internally generated water can be utilised by the organism to meet its water needs, supplementing or compensating for the lack of external water sources.

The production of metabolic water varies depending on the specific organism and its

physiological adaptations. For example, some desert-dwelling animals, such as kangaroo rat (*Dipodomys phillipsii*) (Swaner, 2013) – Fig. 1a, certain reptiles (*Uma scoparia*) – Fig. 1b, and wild Bactrian camel (*Camelus ferus*) – Fig. 1c have highly efficient kidneys that concentrate their urine and minimise water loss. This conservation of water, along with metabolic water production, helps them survive in water-scarce environments and assists in

regulating body temperature, humidity, evaporation, and excretion.

It is important to note that metabolic water production is often relatively limited compared to the total water needs of an organism. While it can contribute to water balance and be beneficial in water-stressed environments, additional water intake through drinking or other external sources is typically necessary for proper hydration for all living organisms.



Figure 1. Animals fully adapted to xeric environments

Note: a – kangaroo rat (*Dipodomys phillipsii*); b – reptiles (*Uma scoparia*); c – wild Bactrian camel (*Camelus ferus*)

Source: developed by the authors

Importance of water for metabolic pathways in animals

Water quality plays a crucial role in the health and well-being of both animal and human organisms. Here are some key influences of water quality on organisms:

Hydration – Water is essential for maintaining proper hydration in organisms. Adequate water intake is necessary for the functioning of cells, tissues, and organs (Buck *et al.*, 2017). Poor water quality, such as water contaminated with pollutants or pathogens, can lead to dehydration or waterborne diseases, negatively impacting the health of animals and humans (Hulea & Ahmadi, 2021).

Nutrient absorption – Water serves as a medium for the absorption and transportation of nutrients within organisms. Inadequate water quality can hinder nutrient absorption, leading to nutrient deficiencies and related health issues.

Contaminant exposure – Water quality affects the degree of exposure to contaminants,

including pollutants, chemicals, heavy metals, pesticides, and pathogens. Consuming water with high levels of contaminants can have detrimental effects on the immune system, organ function, and overall health of organisms (Widmaier *et al.*, 2008).

Disease transmission – Poor water quality can facilitate the transmission of waterborne diseases and infections. Pathogens such as bacteria, viruses, and parasites can contaminate water sources, leading to illnesses in animals and humans when consumed or used for hygiene purposes.

Aquatic ecosystems – Water quality is vital for the health of aquatic ecosystems and the organisms that inhabit them. Contaminated water can disrupt the ecological balance, harm aquatic species, and degrade habitats, affecting the overall biodiversity and functioning of the ecosystem (Pedersen *et al.*, 2003).

Excretion – Water plays a vital role in the process of excretion, which is the removal of

waste materials from the body. The excretory system, consisting of organs such as the kidneys, helps maintain the body's internal environment by filtering waste products and excess substances from the bloodstream and eliminating them through urine.

Urine formation – The kidneys filter waste products, excess ions, and other substances from the blood to form urine. Water is a key component of urine and acts as a solvent that helps dissolve and transport these waste materials out of the body (Pollard *et al.*, 2018).

Kidney function – Adequate water intake is crucial for the proper functioning of the kidneys. Water helps maintain optimal blood volume and pressure within the kidneys, ensuring efficient filtration and removal of waste products. Insufficient water intake can lead to concentrated urine, which may contribute to the formation of kidney stones or urinary tract infections.

Waste elimination – Water helps dilute waste substances in the urine, making them easier to excrete. It assists in flushing out toxins, metabolic byproducts, and excess substances like urea, uric acid, and electrolytes from the body. Without sufficient water, these waste products may accumulate and cause various health problems.

Fluid balance – Water plays a critical role in maintaining fluid balance throughout the body. It helps regulate osmotic pressure and electrolyte concentrations, which are essential for cellular function (Buck *et al.*, 2017). Adequate hydration ensures that the body can effectively eliminate waste materials and maintain overall physiological stability.

To ensure the well-being of both animals and humans, it is essential to maintain and monitor water quality through measures such as regular testing, water treatment and purification, proper waste disposal, and safeguarding water sources from pollution. Regulatory bodies, environmental agencies, and public health organisations often establish guidelines and

standards to protect water quality and promote the health of organisms that depend on it (Patterson *et al.*, 2010).

Water is an essential component for the proper functioning of metabolic pathways in organisms. Metabolic pathways are a series of chemical reactions that occur within cells to break down molecules, generate energy, and synthesise new molecules necessary for life processes. Here are some ways in which water is involved in metabolic pathways:

Solvent and reaction medium – Water serves as a universal solvent and provides the medium for metabolic reactions to occur. Many metabolic reactions take place in the aqueous environment inside cells, where water acts as a solvent, facilitating the transport of molecules, ions, and substrates involved in these pathways.

Hydrolysis reactions – Hydrolysis is a common metabolic reaction in which water molecules are used to break down complex molecules into simpler components. For example, during digestion, water is involved in hydrolysing food molecules such as carbohydrates, proteins, and lipids into their respective monomers (sugars, amino acids, and fatty acids).

Protein folding – Proper protein folding is essential for the functioning of enzymes, receptors, and other proteins. Water molecules interact with amino acids as proteins fold, stabilising their structures and ensuring they achieve their functional conformations.

Transport and diffusion – Water plays a crucial role in the transport and diffusion of metabolites within cells and tissues (Alberti, 2010). Metabolites produced in one part of the cell need to be transported to other cellular compartments or even different cells (Lea *et al.*, 2003). Water, along with specialised transport proteins, facilitates the movement of metabolites across cell membranes (Groot & Grubmüller, 2001). Water's role as a transport medium is vital for the movement of nutrients,

waste products, hormones, and other molecules throughout the body, being directly involved in cell size (Lloyd, 2013), volume (Sachs & Sivaselvan, 2015), and shape (Koivusalo *et al.*, 2009). Blood, for example, is primarily composed of water and acts as a medium for transporting oxygen, nutrients, and waste products between cells and organs.

Aquaporins are a family of membrane proteins that facilitate the rapid transport of water molecules across cell membranes (Abir-Awan *et al.*, 2019). They are essential for maintaining water balance in various tissues and organs of mammals. These water channels play a crucial role in regulating water movement, osmotic balance, and fluid homeostasis within cells and tissues (Lodish *et al.*, 2005). Among mammals, there are several types of aquaporins, each with specific distributions and functions, as follows:

Aquaporin-1 (AQP1) – is one of the first aquaporins discovered and is widely expressed in various tissues, including the kidneys, lungs, red blood cells, and the endothelium of blood vessels.

Aquaporin-2 (AQP2) – is primarily found in the kidney's collecting ducts and is regulated by the hormone vasopressin.

Aquaporin-3 (AQP3) – is present in the plasma membranes of various tissues, including the kidneys, skin, and gastrointestinal tract.

Aquaporin-4 (AQP4) – is highly expressed in the brain and spinal cord, where it plays a role in regulating brain water balance and cerebrospinal fluid dynamics.

Aquaporin-5 (AQP5) – is found in tissues with secretory and absorptive functions, such as salivary glands, the respiratory tract, and lacrimal glands.

Aquaporin-7 (AQP7) and Aquaporin-9 (AQP9) – are found in adipose tissue and liver cells, respectively.

Aquaporin-6 (AQP6) – is primarily found in intracellular vesicles of the kidney's collecting duct cells (Delgado *et al.*, 2013).

The function of aquaporins goes beyond maintaining water balance. For instance, they are involved in cell migration, cell signalling, and interactions with other molecules (Hoffmann & Pedersen, 2011).

Mammalian aquaporin water channels are fundamental for maintaining water homeostasis and osmotic balance in various tissues and organs. Their selective permeability to water allows the rapid movement of water molecules across cell membranes, ensuring the proper functioning of cells and tissues throughout the body (Roccaro *et al.*, 2013).

Enzymatic reactions – Enzymes, which are proteins that catalyse metabolic reactions, often require water as a necessary component for their activity. Water molecules can be directly involved in enzymatic reactions, either as a reactant or as a participant in the catalytic process.

Temperature regulation – Water possesses a high heat capacity, allowing it to absorb and release heat with minimal temperature changes. Since metabolic reactions produce heat as a by-product, water's ability to maintain a stable temperature is essential for regulating body heat. This characteristic ensures that metabolic processes occur within an optimal temperature range, promoting efficient enzyme activity and proper cellular function.

Metabolite synthesis – Water is involved in the synthesis of many essential metabolites, including carbohydrates, proteins, lipids, and nucleic acids. Water molecules are incorporated into these compounds during their biosynthesis, contributing to their structure and functionality.

In summary, water is integral to metabolic pathways as a solvent, participant in reactions, transport medium, and temperature regulator. It enables the efficient functioning of cellular processes and the synthesis and breakdown of molecules necessary for life (Saragovi *et al.*, 2022). Maintaining adequate hydration and

consuming high-quality water is vital for supporting optimal metabolic function in organisms. Additionally, water is involved in both catabolic (breakdown) and anabolic (synthesis) metabolic pathways. In catabolic reactions, water is often used to break chemical bonds, releasing energy. In anabolic reactions, water is often a product as molecules are built up (Khesbak *et al.*, 2011). For instance, in photosynthesis, water molecules are split to provide electrons and protons needed to convert carbon dioxide into glucose.

ATP formation – The synthesis of adenosine triphosphate (ATP), the primary energy currency of cells, occurs in metabolic pathways such as cellular respiration and photosynthesis. These processes involve the movement of protons across cell membranes, creating proton gradients that drive ATP synthesis through ATP synthase. Water molecules are released as a by-product of these reactions and help regulate the proton gradients and energy flow.

Detoxification – Water aids in the removal of waste products and toxins from the body through processes such as urination and sweating. The kidneys use water to filter waste products and excess substances from the blood, forming urine that is excreted from the body. Sweating helps regulate body temperature and eliminates waste products through the skin.

The water needs of animals can vary depending on the species, size, diet, activity level, and environmental conditions. Here are some general guidelines regarding water requirements for different types of animals:

Domestic animals – Dogs typically require about 0.3 litres of water per pound of body weight per day. However, this can vary based on factors such as size, activity level, and diet. Cats generally need about 0.1 to 0.15 litres of water per 5 pounds of body weight per day. Cats consuming wet food derive some of their water intake from their diet. Horses can between 20 and

60 litres of water per day, depending on factors such as size, climate, diet, and activity level.

Livestock animals – Cows typically require around 30 to 45 litres of water per day. However, lactating cows or those in hot climates may need more. Sheep and goats generally need about 2 to 4 litres of water per day. This requirement can increase during hot weather or lactation. Pigs typically require about 2 to 4 litres of water per day, depending on their size and environmental conditions.

Wild animals – Have varying water requirements based on their size, diet, and habitat. Desert-dwelling animals, such as camels, kangaroo rats (Longland & Dimitri, 2021), and certain reptiles, have unique adaptations to conserve water and can survive in very limited amounts.

Aquatic animals – Animals such as fish, amphibians, and marine mammals, obtain their water needs from their surrounding environment.

Common xenobiotic water pollutants that pose a risk to animals

Xenobiotics are substances that are foreign to the biological systems they enter, often originating from human activities such as pharmaceutical production, agriculture, industry, and personal care. These contaminants can enter water systems through various pathways, leading to potential environmental and human health risks.

Pharmaceuticals as xenobiotic contaminants: Pharmaceuticals are widely used for medical purposes and are commonly found in water systems due to incomplete metabolism and excretion by humans. These compounds can enter the environment through sewage discharges, landfill leachate, and runoff from areas with pharmaceutical manufacturing facilities. Once in water systems, pharmaceuticals can have diverse ecological and human health impacts. Thus, pharmaceuticals can disrupt aquatic ecosystems by affecting the behaviour, growth, and reproduction of aquatic organisms.

Hormone-disrupting pharmaceuticals, such as birth control pills, can alter the reproductive behaviours of fish, leading to changes in population dynamics (Dhaval *et al.*, 2013).

Long-term exposure to low levels of pharmaceuticals in drinking water might have cumulative effects on human health. The presence of antibiotics in water systems can contribute to the development of antibiotic-resistant bacteria, posing challenges for disease treatment.

Pesticides as xenobiotic contaminants: Pesticides are chemicals used to control pests in agriculture, and they can contaminate water systems through runoff from treated fields and improper disposal. These compounds can persist in the environment and have significant implications for both ecosystems and human health. Pesticides can harm non-target organisms, leading to declines in pollinator populations (e.g., bees) and disruptions in food chains. The bioaccumulation of pesticides in aquatic organisms can lead to increased concentrations as they move up the food chain. Pesticide-contaminated water can find its way into drinking water sources, posing potential risks to human health. Chronic exposure to pesticide residues in water has been associated with a range of health issues, including neurodevelopmental disorders and certain cancers (Johnson *et al.*, 2012).

Industrial chemicals as xenobiotic contaminants: Industrial chemicals, including heavy metals and organic pollutants, are released into water systems through industrial processes, waste disposal, and accidental spills. These contaminants can have far-reaching effects on aquatic ecosystems and human well-being. Heavy metals, such as mercury, cadmium, and lead can accumulate in aquatic organisms, causing deformities and reproductive issues (Ahmadi *et al.*, 2016).

Organic industrial pollutants, such as polychlorinated biphenyls (PCBs), can disrupt endocrine systems in aquatic animals. Consumption

of fish and shellfish from contaminated water bodies can lead to human exposure to heavy metals and persistent organic pollutants.

Industrial chemicals in water systems can also contaminate agricultural produce, indirectly affecting human health.

Personal care products as xenobiotic contaminants: Personal care products, including cosmetics, fragrances, and cleaning agents, often contain chemicals that can enter water systems through domestic wastewater discharge. These compounds can contribute to emerging environmental challenges. Some compounds in personal care products can interfere with the growth and development of aquatic organisms. Synthetic fragrances and antimicrobial agents can be persistent in water systems, affecting aquatic life. Certain ingredients in personal care products, such as endocrine-disrupting phthalates, can pose risks to human health when present in water sources. The potential for exposure to a mixture of chemicals from various personal care products is a concern that requires further research (Mathew *et al.*, 2017).

Mitigating the impacts of xenobiotic contaminants on water systems requires a multi-faceted approach, such as wastewater treatment, regulation and monitoring, pharmaceutical disposal programmes, integrated pest management, green chemistry, and product design.

Upgrading wastewater treatment facilities to include advanced treatment processes, such as ozonation and activated carbon filtration, can help remove a wider range of contaminants, including pharmaceuticals and personal care products. Strengthening regulations on the discharge of pharmaceuticals, pesticides, and industrial chemicals into water systems can help minimise their entry. Regular monitoring of water bodies for contaminant levels is crucial. Implementing proper disposal programmes for unused or expired pharmaceuticals can reduce

their presence in the environment (Tahar *et al.*, 2013; Embrandiri *et al.*, 2016).

Promoting integrated pest management practices in agriculture can reduce reliance on synthetic pesticides, mitigating their entry into water systems. Encouraging the development of personal care products and industrial chemicals with reduced environmental persistence and toxicity can limit their impact on water systems. Xenobiotic contaminants, including pharmaceuticals, pesticides, industrial chemicals, and personal care products, pose significant challenges to water systems and the environment as a whole. Their entry into aquatic ecosystems can have far-reaching ecological and human health consequences. Effective mitigation strategies involve a combination of regulatory measures, technological advancements in wastewater treatment, and shifts in consumption patterns towards more sustainable products. Safeguarding water quality from these contaminants is crucial for the well-being of both ecosystems and human populations.

Conclusions

Water's role in metabolic pathways is multifaceted and essential for sustaining life. It acts as a solvent for reactions, participates in hydrolysis, aids in ATP production, regulates temperature, facilitates nutrient transport, supports detoxification, contributes to proper protein folding, and is intricately involved in both catabolic and anabolic processes. Water's ability to act

as a medium, solvent, and participant in metabolic reactions underscores its fundamental importance to the functioning of the human body. Xenobiotic metabolism is a complex process influenced by a wide range of factors. Genetic variability, age, sex, co-exposure to other chemicals, disease states, nutritional status, and environmental factors can all impact how efficiently the body processes and eliminates foreign compounds. Understanding these factors is essential for personalised medicine approaches, risk assessment, and designing effective interventions to minimise the adverse effects of xenobiotics on human health. Enzymes such as cytochrome P450s and glucuronosyltransferases play a critical role in xenobiotic metabolism by facilitating the detoxification and elimination of foreign compounds from the body. These enzymatic processes are essential for maintaining health and preventing the accumulation of toxic substances in the body.

The perspective of the research is to obtain high-quality products from animal husbandry and, accordingly, to reduce the threat to human health.

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Conflict of Interest

None.

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Анотація. Актуальність дослідження зумовлена тим, що на сьогоднішній день у своєму розвитку людство досягло того рівня, коли, оволодівши величезним науково-технічним потенціалом, воно ще не навчилася дбайливо і раціонально його використовувати. Швидка індустріалізація та урбанізація планети, різке зростання її народонаселення, інтенсивна хімізація сільського господарства, посилення багатьох інших видів антропогенного тиску на природу порушили кругообіг речовин та природні обмінні енергетичні процеси в біосфері, пошкодили її регенераційні механізми, внаслідок чого почалося її прогресуюче руйнування. Цей огляд дослідження мав на меті представити деякі з основних впливів якості води на метаболізм в організмі тварин у концепції «Єдиного здоров'я». Провідним методом дослідження цієї проблеми є огляд літературних даних останніх років. Зазвичай ксенобіотики – це хімічні сполуки, що надходять в організм, які не утворюються в результаті реакцій метаболічних шляхів. З цього приводу вода, забруднена ксенобіотиками, потрапляє в організм з питвом або їжею, і це не стосується метаболічної води, яка утворюється в результаті хімічних реакцій. Таким чином, разом із споживанням води внаслідок гідратації в організм

можуть надходити інші різноманітні хімічні речовини, які зазвичай не присутні в питній воді. Але тип хімічних речовин, а також їх кількість є критеріями, які можуть перетворити воду з основної поживної речовини на шкідливий продукт. Ґрунт і вода відіграють важливу роль у хімічному складі їжі чи корму, що росте в ґрунті, а метаболізм рослин або споживачів рослин може бути збалансованим або незбалансованим залежно від якості та кількості води. Матеріали статті мають практичне значення для з'ясування біологічних механізмів елімінації ксенобіотиків та збереження здоров'я тварин і людини

Ключові слова: полютанти; тваринні організми; контамінанти; флюїдний баланс; елімінація