International Journal of Research and Review
www.ijrrjournal.com E-ISSN: 2349-9788; P-ISSN: 2454-2237

Review Article

Rukn Mā (Water): A Great Sustainer of Life- A Review

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ABSTRACT

The Unani System of Medicine has its origin in Greece and was developed by Arabs into an elaborate medical science based on the frame work of the teaching of *Buqrat* (Hippocrates) and *Jalinoos* (Galen). The fundamental framework of this system is based on deep philosophical insights and scientific principles. This system is based on *Empedoclean* theory of four *Arkān* (elements) i.e. *Arḍ* (Earth), *Mā* (Water), *Hawā* (Air), *Nār* (Fire), *Hippocratic* theory of four *Akhlāt* (Humours) i.e. *Dam* (Blood), *Balgham* (Phlegm), *Ṣafrā* (Yellow Bile) and *Sawdā* (Black Bile) and four approximate qualities or states of living human body described by *Pythagoras* i.e. *Ḥārr* (Hot), *Bārid* (Cold), *Raṭb* (Wet) and *Yābis* (Dry). *Mā* (Water) is a basic need of all living creatures and it is an important constituent of the body. About 60% of total body weight is water. Water provides replenishment of *Rutūbat Gharīziyya* (innate moisture) which dissolute continuously. Water by its fluidity transports the food in narrow vessels and delivers them to the tissues where food substances are utilized and wastes are eliminated, thus the body is cleared from toxic waste which can help the living machinery.

Key words: Unani System of Medicine, *Arkān, Rutūbat Gharīziyya,* Water.

INTRODUCTION

A saying goes, 'there is no life without water'. Life and water are inextricably connected. Life probably originated in water. Wherever life is found, there is water; and wherever liquid water is found, there is life. Water is more important to life than food, since man may live without food for several weeks but for only a few days without water. [1] Water makes up more than 60% of the material of living organisms themselves. It is the medium in which most cells are constantly bathed and is the major component of cells. The principle fluid medium of the cell is water, which is present in most cells (except fat cells) in a concentration of 70-85 %. [2] Many biomolecules are amphipathic; proteins, pigments, certain vitamins and the sterols and phospholipids of membranes all have both polar and nonpolar surfaces regions. Hydrophobic interactions among the nonpolar regions stabilize the structures composed of these molecules. Hydrophobic interactions are the most important determinants of structure in biological membranes among lipids, and between lipids and proteins, hydrophobic interactions between nonpolar amino acids also stabilize the three-dimensional structures of proteins. [3] The attractive forces between water molecules and the slight tendency of water to ionize are of crucial importance to the structure and function of biomolecules.

Aqueous solutions of weak acids or bases and their salts act as buffers against pH changes in biological systems.. Water has numerous roles in the human body. It functions as a building material; as a solvent, reaction medium and reactants; as a carrier for nutrients and waste products; and as a lubricant and shock absorber. [4] Water itself is not a nutrient but it helps in digestion, transportation and in metabolism of food constituents. Water provides replenishment of *Rutūbat Gharīziyya* which dissolute continuously. Water by its fluidity transports the food in narrow vessels and deliver them to the tissues where food substances are utilized and eliminates their wastes, thus it helps the body to get rid of the toxic waste, which can help the living machinery. [5]

Inferring from above *Rūkn Mā* (water) plays considerable role in carrying out living functions and its sustenance. It provides basic platform for sustenance of life.

Human body and water:

In the average 70 kilogram adult human, the total body water is about 60 percent of the body weight, or about 42 litres. [1,2,4] This percentage can change depending on age, sex and degree of obesity. As a person grows older, the percentage of total body water that is fluid gradually decreases. Women contain slightly less water than men in proportion to their body weight because women have more body fat than men. Lean individuals have more water than the obese. Infants and children have a great proportion of water than adults. Out of 42 litres, 28 litres is intracellular fluid (ICF). Thus, ICF constitutes about 40 percent of the total body weight in an average person. Extracellular fluid is 14 liters in a normal 70 kg adult. ECF accounts for about 20 percent of the body weight. The volume of interstitial fluid is 11 liters and, of plasma is 3 liters. [3,6]

Requirements of water in the body:

A person's water requirements vary considerably according to the climate, dietetic habits, activities and body build. A person should take enough fluid to excrete 1200-1500 ml of urine a day. In the tropics, where much water is lost through perspiration, about 2400-3000 ml of fluids is needed to maintain this urine volume. [7]

Water as vehicle:

Mā acts as a *badarqa* (carrier or vehicle) only not as a nutriment. It carries nutrients and waste materials in the body. [8] Because of this water eliminated from the body as such in quantity and quality as it enters into the body. [5] It means water enters into the body is equal to the water, which eliminated from the body (water input is equal to water output).

Water Inputs: Water inputs are composed of three major sources: the water we drink, the water we eat and the water we produce. The water we drink is essentially composed of water and other liquids with high water content (85 to >90%). Various foods which we eat have a wide range of water content (40 to > 80%). The water we produce results from the oxidation of macronutrients (endogenous or metabolic water). [4,7]

Water outputs/ excretion: The main routes of water loss from the body are kidneys, skin and the respiratory tract and, at very low level, the digestive system. [4]

Details of water inputs from different sources and water excretion from different routes are mentioned below in table: - [1,7]

Daily intake/ Water input	Amount(ml)	Daily excretion	Amount(ml)
Fluids like water, tea, coffee, milk etc	1500-1750	Urine	1200-1500
Water in solid food	600-900	Perspiration	700-900
Water from oxidation of carbohydrates, protein and fat	300-350	Respiration	400
		Faeces	100-200
Total	**2400-3000**	**Total**	**2400-3000**

Functions of Water [9]

1. Water as a building material: "Water, present in each cell of our body and various tissues and compartments, acts first as a building material." *Burhanuddin Nafees* states that moisture is the material for growth, which is in part provided by water, [10] that's why water needs are higher during the growth period. Maximum growth occurs in the children. To fulfill the necessity of growth the quantity of *Ruṭūbat* is more in children i.e. the water quantity of children is about 75% of total weight in comparison to adult which is 60% of total body weight. [4,9]

Replenishment of *Rutūbat Gharīziyya* (innate moisture): Growth and development continuously taking place in children, which is due to presence of fluid or moisture in their body parts. [10] As moisture is the material for growth and it of course can't change or grow without an efficient cause which is the *Tabiyat* (Nature) here. *Tabiyat* (Nature) operates through the *Ḥarārat Gharīziyya* (innate heat), means *Rutūbat Gharīziyya* is the material for *Ḥarārat Gharīziyya*. [10-12] All life sustaining functions of the body are manifested with the help of *Ḥarārat Gharīziyya* eg., absorption, assimilation, digestion, eliminate on of waste material etc. The property of heat is its ability to dissolute substances, therefore along with heat, such a matter/ substance is required which is least affected by the heat. Because water is coldest liquid at the room temperature, thus it is least affected by the heat and thus prevents the body from being lost. Essence of fluidity is water and fluid things dissolute rapidly as compared to solids. That is the reason why water drunk more than solid food. [5]

2. Gives shape and form to cells: By far the most abundant substance to diffuse through the cell membrane is water. It should be recalled that enough water ordinarily diffuses in each direction through the red cell membrane per second to equal about 100 times the volume of the cell itself. Yet, normally, the amount that diffuses in the two directions is balanced so precisely that virtually zero net movement of water occurs. Therefore, the volume of the cell remains constant, giving shape and form to cells. However, under certain conditions, a concentration difference for water can develop across a membrane, just like as concentration differences for other substances can occur. When this happens, net movement of water does occur across the cell membrane, causing the cell either to swell or to shrink, depending on the direction of net movement. [2] No living thing can resist drying. [13]

3. Helps form the structure of large molecules: Irrespective of the origin of nature's molecular and macromolecular building materials, a given biological function and activity is generally associated with a highly specific three-dimensional structure, maintained largely by weak, noncovalent forces, the formation and stability of which require the involvement of water. In the case of proteins, folding takes place on the ribosome in an aqueous medium of complex composition. Liquid water structure is labile and extremely sensitive to dissolved molecular species of all types but that, in turn, water also affects the intra- or intermolecular behavior of such dissolved molecules. So, those molecules, which form the building blocks of all living matter, should also be sensitive to the nature of their aqueous environment. Hydration phenomenon does play a dominant role in the promotion of native structure, structures that are associated with life processes. [14]

4. Alleviate movement of water molecules through biological membranes: Particles such as some ions and molecules are required to be able to move around biological organisms. One way in which this happens is in solutions e.g. transport of oxygen in blood around the vascular system. Movement of solutions within fixed channels such as blood vessels and lymphatic vessels is easily explained by comparison with e.g. the movement of the fluids along pipes. Some ions and molecules in biological system also need to be able to move through tissues and membranes e.g.

cell membranes. They move by the processes of diffusion and active transport.

5. Serve as a solvent: Water is a polar solvent. It readily dissolves most of charged or polar biomolecules. Nonpolar molecules such as lipids and waxes are insoluble in water. The salt such as NaCl is dissolved by water. Sodium chloride (NaCl) is dissolved in water by the mechanism of hydration and stabilization of the Na^+ and Cl^- ions, weakening the electrostatic interactions between them and thus counteracting their tendency to associate in a crystalline lattice. The same phenomenon of hydration is applied to charged biomolecules, compounds having functional groups like ionized carboxylic acids ($-COO^-$), phosphate esters or anhydrides and protonated amines ($-NH3^+$). Water readily dissolves such compounds by replacing solute-solute hydrogen bonds with solute-water hydrogen bonds, thus decreasing the electrostatic interactions between solute molecules. [3,14,15] By its solvent action it forms a great number of colloidal solutions and thus serves as a universal medium in which intracellular and extracellular chemical reactions take place. Perhaps no chemical reaction inside the body can take place without water. [13] Uncharged but polar biomolecules such as sugars dissolve readily in water because of the stabilizing effect of hydrogen bonds between the hydroxyl groups or carbonyl oxygen of the sugar and the polar water molecules. [3,4,16]

6. Helps to regulate body temperature: Water by its burudat (coldness) reduces the intensity of hararat. [10] Body temperature is regulated by water in the following ways: (a) Heat absorption- Due to high specific heat of water more heat is required to raise the temperature of 1 gm of water through $1^{\circ}C$ than most of known solids and liquids. By virtue of this property water can mop up large quantity of heat. (b) Heat conduction and distribution- Heat conducting power of water being very high it acts as a very good agent in carrying away heat from the site of production and distributing it throughout the body. By the two above properties, water acts as an important heat buffer. (c) Heat loss- Water helps heat loss through urine and stool and by evaporation from skin, lungs, etc. Evaporation of water by sweating, respiration, and insensible perspiration is an efficient mechanism for regulating body heat. Sweating is the chief mode of heat loss. [19] Water has got the highest latent heat of evaporation. By the help of these properties water takes an important part in regulating body heat. [4,13]

7. Helps in digestion of ingested food: *Burhanuddin Nafees* states that, ingested food has dominance of *Rūkn Arḍ*. If water not added to this food, there will be no solvent present for digestive enzyme to act upon, [10] and the digestive juices are mainly watery, which helps in digestion. [7] Water also acts as a buffer between ingested food and *ḥarārat* of stomach by mixing with food, because heat of stomach is so high that it can burn down the food. [10,17]

8. Transports of nutrients to cells: Without nutrition, there are two possibilities for survival of anything for some period. There is no disbursement in that body or the loss is replenished continuously. [8] Water itself is not a nutrient but it helps in digestion, transportation and in metabolism of food constituents. [5] In *Arkān Arbaʿa* only Water has some special properties like it mixes with all type of food as a part and facilitates the food transportation through narrow channels. Water helps the nutritious material like blood to maintain their consistency and facilitate them to assimilate as a replenishment of the body. [4,11]

9. Carries waste products away from cells: Water by its fluidity transports the food in narrow vessels and deliver them to the tissues where food substances are utilized and eliminates their wastes, thus it helps the body to get rid of the toxic waste which can help the living machinery. The part of water absorbed into its organs is excreted out from the body by sweating during the process of nutrition in organ i.e. absorption, adhesion and integration. [19] It means, water acts as *badarqa* (vehicle). [11]

10. It is a medium for chemical reactions: Chemical reactions only happen when the reactants make contact with each other. Solutions are generally good "mediums" for chemical reactions because the solvent, e.g. water, encloses solutes- which could be "reactants" if there is a possibility of them reacting with each other if and when they collide- in a common volume of space. When two or more potential reactants are present in the same solution they may collide and react with one other. Water molecules participate in decomposition reactions whereby certain macromolecules are broken down into smaller ones. Examples include breakdown of carbohydrates and proteins during digestive process. [4] Water is also produced by the oxidative metabolism of hydrogen containing substrates in the body. Approximately, 1 g of glucose, protein (albumin) and palmitic acid, 0.6, 0.37 and 1.12ml water, respectively, is endogenously produced, or for 100 kcal of energy, 15, 13 and 9 ml water is produced. [4,7]

11. Participate in chemical reactions: Water molecules participate in many chemical reactions, e.g. Hydrolysis- It is a chemical reaction taking place inside cell with the help of hydrolytic enzymes and Water. Splitting of an organic compound into two or more parts by a hydrolytic enzyme is taking place by combining hydrogen from a water molecule with one part of the compound and the hydroxyl portion of the water molecule with the other part of the compound. For instance, protein is hydrolyzed to form Amino acids, glycogen hydrolyzed to form glucose, and lipids are hydrolyzed to form fatty acids and glycerol. It means by enabling hydrolysis reactions, water participates in the biochemical breakdown of what we eat (proteins, lipids and carbohydrates). [4] And hydrolysis also facilitates the breakdown of ATP by losing its terminal phosphate and to form adenosine diphosphate (ADP), as the whole life activities depends on the coupling of exergonic and endergonic reactions, for the oxidation of foods and also drives other reactions forward. [20,21]

12. Serves as lubricant: Water provides *ruṭūbat* into the organs and keeps it moist. [5,10,17] Water also acts as a lubricant to prevent friction and drying. In joints, pleura, peritoneum, conjunctiva, etc., the aqueous solution is practically free from fats and acts as a lubricant against rubbing and drying. [4,13]

13. Respiratory mechanism: ECF also helps in respiratory mechanism through the blood. O2 and CO2 are nonpolar, biologically active gases. The blood picks up the oxygen in lungs with the help of water soluble carrier proteins (such as haemoglobin and myoglobin) and delivers it to the cell at the same time it picks up carbon dioxide from the cell in the form of carbonic acid (H_2CO_3) in aqueous solution and releases it into lungs. [2,15,22]

14. Formation of an enzyme-substrate complex: In separate state, both enzyme and substrate force neighboring water molecules into an ordered shell. By binding of substrate to enzyme, some water molecules are released and also there is increase in entropy. The increase in entropy provides a thermodynamic push toward formation of the enzyme-substrate complex. The binding of an enzyme to its substrate may involve noncovalent bonds including several hydrogen bonds and one or more ionic interactions as well as hydrophobic and Vander Waals interactions. The formation of all these weak bonds contributes to a net decrease in the free energy of the system. Energy released when an enzyme binds non-covalently to its substrate is the main source of enzyme's catalytic power. [3]

RESULT

In the present study "*Rukn Mā* (Water): A great sustainer of life- A review" main focus was compilation, description and exploration of literatures on importance of *Rūkn Mā* from ancient Unani and recent modern literatures. Among *Arkān Arbaʿa* only water has some special properties like

it mixes with all type of food as a part and facilitates the food transportation through narrow channels. Water helps the nutritious material like blood to maintain their consistency and facilitate them to assimilate as a replenishment of the body. The part of water absorbed into its organs is excreted out from the body by sweating during the process of nutrition in organ i.e. absorption, adhesion and integration. In the body it produces the *Khilt-e-balgham*, which nourishes certain organs of the body. Total body water is about 60 percent of the total body weight. Three dimensional structures of biomolecules, necessary for biological functions and activity are maintained largely by hydrogen bonding and hydrophobic forces. Water acts as a universal biological solvent, in which many cellular chemicals are dissolved and others are suspended as solid particulates. Water has numerous roles in body. It functions as a building material; as a solvent, reaction medium and reactants; as a carrier for nutrients and waste products; and as a lubricant and shock absorber. It provides replenishment of *Rutūbat Gharīziyya* which dissolute continuously.

DISCUSSION

Water may be understood here in the sense of radical moisture (Paracelsus), which is absolutely essential to life. The plant cannot shoot out leaves, flowers and fruit without it; so man cannot thrive without this radical moisture, or innate moisture. About 60% of body weight is water. Major component of cell is water. Proteins, electrolytes and glucose are mainly dissolved in cytosol while neutral fat globules, Glycogen granules, ribosomes, secretory vesicles and five important organelles are dispersed. Many chemical reactions of the cell involve water. Water maintains the vascular volume and allows blood circulation, which is essential for the function of all organs and tissues of the body. [4] Thus, the cardiovascular and respiratory systems, the digestive tract, the reproductive system, the kidney and liver, the brain and peripheral nervous system, all depend on adequate hydration to function effectively. Thus, water is not important only for origin of life but also for existence of purposeful life. [20]

CONCLUSION

Various functions like; acts as a building material; as a solvent, reaction medium; as a carrier for nutrients and waste products; and as a lubricant and shock absorber, show that water is important for sustenance of life.Continuous dissolution taking place during living process, so there must be replenishment of loss for continuation and sustenance of life. Replenishing material should be identical to the lost one, provided from diet made up of four *Arkān*. But without water , food can't be transported and assimilated in the body. Water mixes with all type of food as a part and facilitates the food transportation through narrow channels by maintaining their consistency. And water helps the nutritious materials like blood to maintain their consistency and facilitate them to assimilate as a replenishment of the body. Here I have tried at my level best to highlight and to explore the role of *Rukn Ma'a* in sustenance and continuation of life. Future research for the better understanding and scientific validation of functions of *Rukn Ma'a* are needed.

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How to cite this article: Bano S, Zulkifle M, Ali MK. *Rukn Mā* (water): a great sustainer of life- a review. International Journal of Research and Review. 2019; 6(9):364-370.

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