

Chapter 14

Water and Its Importance

14.1 Introduction

Water is the elixir of life. It is one of the fundamental needs of man. Water is the important part of all our body functions and processes, including digestion and elimination when you are on a diet, water also acts as a weightless aid because it can help you eatless. “Drinking water” is important during weightloss because it provides hydration without unwanted calories. Water is an essential nutrient for all known forms of life and the mechanisms by which fluid and electrolyte homeostasis is maintained in humans are well understood until, recently our exploration of water requirements has been guided by the need to avoid adverse events such as dehydration.

14.2 Distribution in Body

Water is the largest constituent of the body, about 60—70(per cent of the total body weight consisting of water. The water content of soft tissues ranges from 70—80 per cent while that of bone about 20 per cent. Body water is distributed as follows

1. Inside the cells of tissue — intracellular water (50 per cent).
2. Outside the tissue cells — extracellular water (20 per cent).
 - (a) Water in blood plasma (about 4 per cent),
 - (b) Interstitial water — water in tissue space (9 per cent)
 - (c) Lymph in the lymphatic vessels (7 per cent)

Additional minor divisions of extracellular water are cerebrospinal fluid and aqueous humour (in the anterior chamber of the eye).

Approximate quantitative data for a man weighing 70 kg are given in Table

Total Body Weight	70kg	As % of Body Weight
Total Water	50 kg	70
i. Intracellular	35 kg	50
ii. Extracellular (Thiosulphate space)	12 kg	17
(a). Plasma	3 L	4
(b). Lymph	5 L	7
(c). Interstitial water(Tissue Fluid)	4 L	6

14.2.1 Composition of Body Fluids

An approximate composition of body fluids are as follows:

Plasma

Plasma contains proteins (about 7-8%) and small quantities of organic substances like glucose, amino acids, glucose etc. and inorganic salt like sodium bicarbonate and sodium chloride.

Lymph

Lymph is a fluid found in lymphatic vessel. The composition of Lymph varies widely. The protein content varies from 2-7%. The electrolyte content of lymph is similar to that of plasma.

Interstitial Fluid

There is no direct information regarding the composition of interstitial fluid bathing the tissue cells. Since the blood capillaries do not permit proteins to pass out it is presumed that interstitial fluids has very little proteins and it has a crystalloid composition similar to that of plasma.

Intracellular fluid

The intracellular fluid (ICF) cannot be determined directly. The difference between the total body water and total extra cellular fluid (ECF) is taken as ICF. The cell contents have large amounts of proteins(17-18%). The concentration of sodium in the ICF has been estimated to be 20 mEq to that of potassium 110 mEq per litre

Permeability of the cell membranes

The cell membrane freely permeable to water, glucose, lactate, amino acids and acetoacetate. The intracellular fluid is hypertonic to extra cellular fluid. The cell has active transport mechanism which prevents water from entering the cell freely from the extracellular fluid.

14.3 Functions of Water

Water is needed for most body functions :

- (i). Water is a universal solvent and is able to dissolve all the products of digestion.
- (ii). Maintain health and integrity of every cells in the body.
- (iii). Keep the blood stream liquid enough to flow through blood vessels.
- (iv). Help to eliminate the bye products of body's metabolism, excess electrolytes (for e.g. sodium and potassium.) and urea, which is a waste product formed through processing of dietary proteins.
- (v). Regulate body temperature through sweating :- When you get too warm, your body produce sweat and the evaporation of which cools the body.
- (vi). Moisture mucous membranes such as those of the lungs, nose and mouth.
- (vii). Lubricate and cushion joints :- Soft tissues like cartilage hold water to cushion the movement of fingers lips, spine and all the major joints of your body.
- (viii). Reduce the risk of cystitis by keeping the bladder clean out of bacteria.
- (ix). Aid digestion and prevent constipation :- An adequate amount of water keeps, stools soft and easier to move out of the body.
- (x). Moisture the skin to maintain its texture and appearance.
- (xi). Carry nutrients and oxygen to cells :- Water dissolves cellular food and oxygen and carries it all over the body through blood stream.
- (xii). Serve as a shock absorber inside the eyes, spinal chord and in the amniotic sac surrounding the foetus in pregnancy.
- (xiii). Protects vital organs like brain, heart, lungs, digestive system and every major system in our body.
- (xiv). Nutrient absorption :- In addition to helping with food breaks down, water also helps dissolve vitamins, minerals and other nutrient from your food. It then delivers these vitamin components to the rest of your body for use.
- (xv). Water is a main component of saliva. Saliva also includes small amount of electrolytes, mucus and enzymes. It is essential for breaking down solid food and keeping your mouth healthy.

14.4 Types of Water Available

14.4.1 Tap Water

A piped water supply, tap water is found everywhere from the water that flushes a public toilet to the water that comes out of your kitchen sink or cleans your glassware in your dishwasher.

Pros Though many people turn their noses up at the idea of drinking tap water over taste or safety concerns, the truth is that tap water is safe to drink across much of the United States.

What's more, tap water isn't only good for you, it's cheaper than buying various types of bottled water.

Cons While there are industry regulations in place. Trusted Source that are meant to keep lead and other harmful substances from contaminating the water supply, sometimes this doesn't work. A prime example of this is the ongoing water crisis in Flint, Michigan.

Public water supplies can also contain pesticide residue, aluminum, and other undesirable substances. If, however, you're worried that the treatments performed on your water supply aren't up to par, you can always purchase a home filtration system for further cleansing.

14.4.2 Mineral Water

Pulled from a mineral spring, mineral water is, as the name states, full of minerals including sulphur, magnesium, and calcium — all things that are good for you.

Pros Mineral water does indeed have some health benefits. Trusted Source, since it provides minerals your body can't create on its own. It can also help aid in digestion, and many people even like the taste of it over tap water, though that's down to personal preference.

Cons One of the main downsides to mineral water is cost, especially when compared to tap water. Many of the minerals from this type of water can also be obtained from a healthy, varied diet.

14.4.3 Spring or Glacier Water

Spring or glacier waters are types of bottled waters that are claimed to be bottled at the source from where the water flows — either from the spring or glacier.

Pros In theory, spring or glacier waters should be relatively clean and free of toxins. They also contain many of the same helpful minerals found in mineral water.

It also tends to be pretty readily available in stores, think well-known brands like Evian and Arrowhead, in both large and small bottles, which makes it easily accessible.

Cons Depending on how much you drink, spring water could get pricey, especially in comparison to tap water. Also, some spring water is raw, unfiltered, and untested water, which could pose potential health risks depending on what it contains.

14.4.4 Sparkling Water

Sometimes referred to as carbonated water or soda water, sparkling water is infused with carbon dioxide gas while under pressure.

Pros Sparkling water offers a different mouth feel to flat water, which could be a welcome change if you want something fizzy without sugar or artificial sweeteners.

That said, there are flavoured sparkling waters available that do contain one or both types of sweeteners. Plus, because sparkling water tends to be mineralized — think Perrier and San Pellegrino — you're getting the added bonus of health-promoting minerals with your carbonation.

Cons While there are some minerals present in sparkling water, there aren't enough to be truly beneficial to your health in a meaningful way. In addition, it can be expensive compared to both tap and certain types of bottled water.

14.4.5 Distilled Water

This type of water is boiled and the steam is collected and condensed back into a liquid.

Pros Distilled water is a great option if you live somewhere — or are visiting somewhere — where the tap water supply is contaminated or possibly could be.

Cons Because all potentially harmful substances are removed from purified water, you also miss out on some of the potentially beneficial ones that are added to tap water supplies like fluoride, which helps to reduce tooth decay.

In addition, purchasing purified water or even installing a filtration system at home can be pretty costly.

14.4.6 Flavoured or Infused Water

Flavoured water is water that's sweetened with either sugar or artificial sweeteners, and contains natural or artificial flavourings

Pros Flavoured water, like Hint and Propel, can offer a tasty alternative to plain water, which makes it easier to drink in larger amounts.

It can also add variation to your water intake since there are so many flavours available. Flavour can be added naturally by infusing fruit and vegetables into tap or bottled water, or you could purchase artificially flavoured waters in most stores.

Cons Often, flavoured waters contain added sugar or artificial sweeteners. Varieties with sugar can lead to weight gain and have a negative effect on those with diabetes. What's more, some people may react negatively to artificial sweeteners.

14.4.7 Alkaline Water

Alkaline water has a higher pH level than normal tap water and contains alkaline minerals and negative oxidation reduction potential (ORP).

Pros The fact that this type of water has a higher pH level has led some people to believe that it may help neutralize acid in the body, help slow the ageing process, or even prevent cancer.

There's very little scientific proof, however, of this being true.

Cons It's generally safe to drink alkaline water, but it could reduce stomach acidity, thereby lowering its ability to kill off harmful bacteria.

In excess, it could also lead to metabolic alkalosis, which could produce symptoms like nausea and vomiting.

14.4.8 Well Water

Well water comes straight from the ground, though it's untreated and carries with it a number of risks.

Pros If you happen to live in an area where wells are plentiful, or you even have one in your own backyard, the convenient access to what seems like fresh water could be attractive.

While there are many proponents of raw, untreated water, the benefits may not outweigh the potential risks.

That said, there are steps you can take to ensure your well water is suitable for drinking. For example, testing your well water annually for bacteria, nitrates, and pH levels. It's also possible to install a filtration system.

Cons Because the water hasn't been treated, there's a big chance of contamination — particularly from bacterial and parasitic infections like giardia.

While well water used to be the norm, there's a reason that city water supplies and the regulations surrounding them were put into place — you simply don't know what you're getting unless you test or treat the well water yourself.

14.5 Sources of Water

Water is taken in food and also as drinking water. You get some of the water in your body through the foods you eat.

- Fresh water :- It is the best drink because it does not contain energy imparting components and is best for hydrating the body. Water from the tap is mostly free and generally available wherever you go.
- Milk :- Milk is an important fluid especially for children which contain 90% water. Fat milk is suitable for children below two years of age.
- Tea :- Tea can also be an important source of fluid. It can help you meet your daily fluid recommendations and is a source of antioxidant and poly phenols which appear to protect heart disease and cancer.
- Cell reactions :- water is formed in the tissues by the oxidation of hydrogen present in fats, carbohydrates and proteins.

Some of the water is made during the process of metabolism. You also get water through liquid foods and beverages, such as soup, milk, tea, coffee, soda, drinking water, and juices. Alcohol is not a source of water because it is a diuretic.

14.6 Water Requirements

The following table shows water or fluid required by different category of subjects, each day.

Category	Requirement
Infant(0-6 months)	0.7 litres
Infants(7-12 months)	0.8 litres
Girls and Boys (1-3 years)	1.0 litres (\approx 4 cups)
Girls and Boys (4-8 years)	1.2 litres (\approx 5 cups)
Boys (9-13 years)	1.6 litres (\approx 6 cups)
Boys (14-18 years)	1.9 litres (\approx 7-8 cups)
Girls (9-13 years)	1.4 litres (\approx 5 cups)
Girls (14-18 years)	1.6 litres (\approx 6 cups)
Men (19 years and above)	2.6 litres (\approx 10 cups)
Women (19 years and above)	2.1 litres (\approx 8 cups)
Pregnant girls (14-18 years)	1.8 litres (\approx 7 cups)
Pregnant women (19 years and above)	2.3 litres (\approx 9 cups)
Lactating girls (14-18 years)	2.3 litres (\approx 9 cups)
Lactating women (19 years and above)	2.6 litres (\approx 10 cups)

14.7 Water Balance

Water balance may be defined as the daily relation between the total amount of water entering the organism through the ingestion of liquids and food and the total output of water lost from the body by way of the kidneys, bowels, lungs, and skin. Water is essential to the life and function of every living cell.

14.7.1 Water Intake and Loss

Water is lost continuously from the body in the following ways:

- Via kidney as urine
- Via the skin in the form of insensible perspiration and as sweat.
- Via the lungs in the expired air.
- To a small extent via the large intestine in the faeces.
- In the lactating women in the form of breast feed.

		Temperature climate (ml)	Tropical climate(ml)
<u>Water intake</u>			
Drinking water		1000	2000-5000
In food		1000	1000-2000
By oxidation of carbohydrates, fats and proteins in tissues		300	300
	Total	2800	3300-7300
<u>Water loss</u>			
In urine		1500	1000-1500
Via skin		800	1800-5200
Via lungs		400	400-500
Via faeces		100	100-200
	Total	2800	3300-7300

Table 14.1: Water intake and loss from the body of an adult

Water Intake

Water intake varies widely depending on the climate; As drinking water, about 1500 to 5000 ml and in food 1000 to 2000 ml.

Loss

Water loss from the body varies depending on the climate: In urine about 1000 to 5000 ml; via skin 800 to 5200 ml; via Lungs 400 ml and in faeces 100 to 200 ml. In a normal individual, the water intake is approximately equal to the water lost from the body and the water content of the body is maintained fairly constant.

14.7.2 Exchange of Water in the Body

Water is absorbed rapidly from the small intestines through the portal vein to the general circulation. It rapidly passes to the tissue space as tissue fluid. A greater part of the ingested water is excreted by the kidneys within an hour. The mechanism of exchange of water between blood and tissues is briefly discussed below : Water exchange between plasma and interstitial fluid is controlled by the osmotic pressure of proteins in the plasma which is 25 mm Hg and the arterial capillary pressure (32 mm Hg) and the capillary pressure at the venous end (12 mm Hg). At the arterial end, the capillary blood pressure is greater than the protein osmotic pressure of plasma by 7 mm Hg. Hence, fluid passes from capillaries to tissue space. At the venous end, the capillary blood pressure is less than the protein osmotic pressure by 13 mm Hg. Therefore, fluid passes from tissue space into the capillaries. This plasma-interstitial fluid exchange takes place on a large scale, i.e., at about 3 litres per minute.

The kidneys can adjust the concentration of the urine to reflect the body's water needs, conserving water if the body is dehydrated or making urine more dilute to expel excess water when necessary. ASH is a hormone that helps the body to retain water by increasing water reabsorption by the kidneys. Vasopressin, also called antidiuretic hormone, hormone that plays a key role in maintaining osmolality (the concentration of dissolved particles, such as salts and glucose, in the serum) and therefore in maintaining the volume of water in the extracellular fluid (the fluid space that surrounds cells).

14.7.3 Effect of Excess Water Intake on Water Balance in the Body

If 2 litres of water are taken, the water is distributed rapidly throughout the body. The kidney responds to the increased water intake the after about 15 - 30 minutes. The flow of the urine rises from the normal value of 50 ml per hour to its peak of 1500 ml per hour. The extra water is excreted by the kidney within 3 hours. The excess urine output may (in temperate climate) be almost equal to the water ingested. In tropical climate, a greater part of the ingested water is lost in the sweat.

14.7.4 Effects of Water Deprivation on Water Balance

Water is being constantly lost from the body in urine, sweat, expired air and faeces. If corresponding amounts of water are not ingested, water depletion occurs in the body leading to change in body fluids. A reduction in volume of the extracellular fluid (ECF) and intracellular fluid (ICF) takes place. The urine output is reduced. There is a rapid decrease in body weight and a state of dehydration of the cells occurs. After a few days, a decrease in plasma volume (and also in blood volume) occurs which will reduce cardiac output and lead to circulatory failure. An adult who has lost 5—10 litres of water from the body will be seriously ill and death will occur when the water loss from the body is about 15 litres.

*****THE END*****