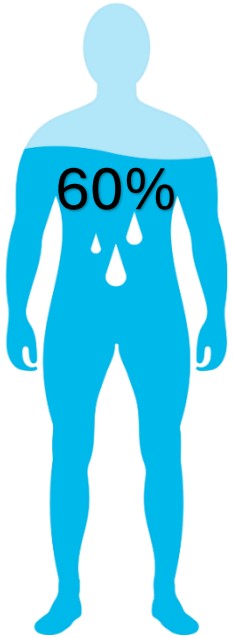
# Module 4
## Hydration

# Module coverage

| Topic | Sub-topics covered | Learning objectives |
|---|---|---|
| 4) Hydration | • Importance of hydration.<br>• Daily fluid intake for adequate hydration.<br>• Sources of hydration. | ✓ Clarity regarding the role of water as a nutrient in the body, its sources and necessity. |

# Water

**Water is an essential nutrient that is fundamental for maintaining homeostasis. [66]**




## Total Body water

- The human body contains 60% of body water, considering a 60kg healthy man.
- TBW is about 42 litres and varies with age, gender, body size and composition.

**Distribution of water in various body tissues and organs by weight range (10%-95%)**

| Tissues & organs | Distribution of water by weight range (%) |
|---|---|
| Adipose Tissue | 10% |
| Bone | 25% |
| Skin | 75% |
| Muscle | 75% |
| Brain | 80% |
| Lungs | 85% |
| Kidneys | 83% |
| Blood | 94% |
| Eyes | 95% |

Source: 66) https://www.sciencedirect.com/science/article/pii/S2161831322005191?via%3Dihub
8) Table source: https://drive.google.com/file/d/1GtjbaUlQ8HOPLfQjnfuXjwNZOt2hWFho/view page 289

# Source of hydration

**Water intake can happen through multiple sources but hydration through adequate consumption of plain water is recommended.[8]**

**1. Primary source: plain water**

- Plain water is the most readily available and cost-effective source of hydration.
- It's calorie-free and helps flush out toxins.

**2. Food**

- Many fruits and vegetables have high water content. Examples: watermelon, cucumber, lettuce, strawberries, tomatoes, spinach, and celery.
- Soups and broths can also contribute to hydration.

**3. Beverages**

- Milk: provides hydration and essential nutrients.
- Fruit juice (in moderation): offers vitamins and minerals.
- Coconut water: rich in electrolytes.

Source: 8) https://drive.google.com/file/d/1GtjbaUlQ8HOPLfQjnfuXjwNZOt2hWFho/view page 292

# Water requirement for different age groups

## Water requirement for different age groups with specific body weights

| Age group | Body Weight (kg) | Energy requirement (kcal) | Total water requirement* (ml) | Water from food* (ml) | Water from beverages (ml) | Water requirement from Beverages (ml/kg BW) |
|---|---|---|---|---|---|---|
| **Children** | | | | | | |
| 1-3 y | 12.9 | 1110 | 1650 | 800 | 850 | 66 |
| 4-6 y | 18.3 | 1360 | 2050 | 850 | 1200 | 66 |
| 7-9 y | 25.3 | 1700 | 2550 | 1000 | 1550 | 61 |
| **Boys** | | | | | | |
| 10-12 y | 34.9 | 2220 | 3300 | 1200 | 2100 | 60 |
| 13-15 y | 50.5 | 2860 | 4200 | 1300 | 2900 | 57 |
| 16-18 y | 64.4 | 3320 | 4500 | 1500 | 3000 | 47 |
| **Girls** | | | | | | |
| 10-12 y | 36.4 | 2060 | 3050 | 1250 | 1800 | 49 |
| 13-15 y | 49.6 | 2400 | 3500 | 1550 | 1950 | 39 |
| 16-18 y | 55.7 | 2500 | 3700 | 1350 | 2350 | 42 |
| **Adult Man** | | | | | | |
| Sedentary | 65.0 | 2110 | 3150 | 1100 | 2050 | 32 |
| Moderate | 65.0 | 2710 | 4050 | 1250 | 2800 | 43 |
| Heavy | 65.0 | 3470 | 5200 | 1450 | 3750 | 58 |
| **Adult Woman** | | | | | | |
| Sedentary | 55.0 | 1660 | 2500 | 1000 | 1500 | 27 |
| Moderate | 55.0 | 2130 | 3200 | 1100 | 2100 | 38 |
| Heavy | 55.0 | 2720 | 4100 | 1250 | 2850 | 52 |
| Pregnant | 55.0 + GWG[a] | +350 | 3700 | 1100 | 2600 | - |
| Lactating | 55.0+[b] | +600 | 4100 | 1250 | 2850 | - |

Values are rounded off to the nearest 50. BW = Body Weight; [a]Gestational weight gain; [b]Gestational weight gain remaining after delivery

To be continued…

Source: 8) https://drive.google.com/file/d/1GtjbaUlQ8HOPLfQjnfuXjwNZOt2hWFho/view page 293

# Water requirement for different age groups

## Water requirement for different age groups with specific body weights (elderly person)

| Age group | Body Weight (kg) | Energy requirement (kcal) | Total water requirement* (ml) | Water from food* (ml) | Water from beverages (ml) | Water requirement from Beverages (ml/kg BW) |
|---|---|---|---|---|---|---|
| **Elderly Man** | | | | | | |
| Sedentary | 65 | 1883 | 2800 | 850 | 1950 | 33 |
| Moderate | 65 | 2216 | 3300 | 1000 | 2300 | 38 |
| **Elderly Man** | | | | | | |
| Sedentary | 55 | 1706 | 2550 | 750 | 1800 | 33 |
| Moderate | 55 | 2007 | 3000 | 900 | 2100 | 38 |

Values are rounded off to the nearest 50. BW = Body Weight

**Nearly all major systems in the body depend upon water .**(ACG)

## Functions of water(ACG)

- Integral part of cellular structure.
- Acts as a solvent and a reactant.
- Lubricant.
- Thermo regulation.
- Carrier of dietary minerals.

Source: 8) https://drive.google.com/file/d/1GtjbaUlQ8HOPLfQjnfuXjwNZOt2hWFho/view page 293
67) https://pubmed.ncbi.nlm.nih.gov/19724292/

# Fluid intake and output balance

**Water balance: Body water balance depends on the net difference between water gain and water loss. .[8]**

## Total Water Losses

The majority of fluid is excreted through the kidneys as urine, and a smaller amount through faeces.

### Total Daily Water Intake

Beverages (60-65%) and food (25-30%) are the major contributors to total fluid requirements.

### Water Loss through various activities in different organs

| Activities | % of water loss | ml of water loss |
|---|---|---|
| Urine | 60% | 1000-2000 |
| Faeces | 4% | 50-100 |
| Insensible losses | | |
| Lungs | 12% | 250-350 |
| Sweat and non-sweat diffusion | 24% | 600 |

Source: 8) https://drive.google.com/file/d/1GtjbaUlQ8HOPLfQjnfuXjwNZOt2hWFho/view page 304

# Fluid intake and output balance

## Insensible Water Loss

- Some of the water losses cannot be precisely regulated. For example, there is a continuous loss of water by evaporation from the respiratory tract and diffusion through the skin, which together account for about ~700ml/day of water loss under normal conditions. This is termed insensible water loss because we are not consciously aware of it, even though it occurs continually in all living humans.

## Fluid Loss in Sweat

- The amount of water lost by sweating is highly variable, depending on physical activity and environmental temperature. The volume of sweat normally is about ~100ml/day, but in very hot weather or during heavy exercise, water loss in sweat occasionally increases to ~1 to ~2L/hour.

## Water Loss in Faeces

- Only a small amount of water (~100ml/day) normally is lost in the feces. This can increase to several litres a day in people with severe diarrhea. For this reason, severe diarrhea can be life-threatening if not corrected within a few days.

## Water Loss by the Kidneys

- The remaining water loss from the body occurs in the urine excreted by the kidneys.

Source: 8) https://drive.google.com/file/d/1GtjbaUlQ8HOPLfQjnfuXjwNZOt2hWFho/view page 291

# Dehydration and water intoxication

**Water Depletion (Dehydration)**

- Causes: Inadequate fluid intake.
- Excessive fluid loss (diarrhea, vomiting, sweating, fever).
- Certain medications.
- Signs and Symptoms: Thirst, dry mouth.
- Headache, dizziness.
- Fatigue.
- Decreased urine output.
- In severe cases: confusion, seizures, coma.

**Prevention:** Consume adequate fluids throughout the day. Replace fluid losses during exercise and hot weather. [68]

**Water Intoxication(Excess consumption of water)**

A condition resulting from excessive water intake over a short period, leading to a significant decrease in serum sodium concentration in certain medical conditions (e.g., kidney disease).[69]

**Signs and Symptoms:** Headache, nausea, vomiting, confusion, seizures and swelling (edema).

Source: 68) https://www.ncbi.nlm.nih.gov/books/NBK555956/
69) https://www.sciencedirect.com/topics/pharmacology-toxicology-and-pharmaceutical-science/water-intoxication

# Conclusion

Some water-rich fruits like watermelon (approximately 95% water), muskmelon (around 92% water), and papaya (about 91% water) can serve as excellent sources of hydration, particularly during warmer seasons.[70]

Tender coconut water is a good hydrating beverage that contains several minerals and provides 15 Kcal/ 100ml. However, diabetic patients prone to hyperkalemia (abnormally high levels of potassium in the blood) can avoid excess intake.(71)

Consume fresh fruits rather than in juice form. Prefer buttermilk, tender coconut water, lemon water, etc., as beverages in hot weather. Avoid synthetic soft drinks and carbonated beverages. Synthetic soft drinks are not substitutes for water or fresh fruits and therefore should be avoided.[11]

Adequate water is important for maintaining good health. A normal, healthy person needs to drink about eight glasses (approximately two litres) of water, including beverages, per day.[11]

Suggested read:
Nutrition science, B. Srilakshmi, Sixth edition, 2018, Chapter 2, water and electrolyte balance page 377-391

Source: (70) https://www.researchgate.net/publication/301569940_Coconut_water_drink_and_the_risk_of_hyperkalaemia_in_diabetes)
(71) https://www.researchgate.net/publication/301569940_Coconut_water_drink_and_the_risk_of_hyperkalaemia_in_diabetes
11) https://www.nin.res.in/dietaryguidelines/pdfjs/locale/DGI24thJune2024fin.pdf

# Upcoming…

## Module 5

Nutrition throughout the life cycle