

---

## Nursing Assessment and Management of Dehydration in Older Adults

**Manal Musalem S. Albarak<sup>1</sup>, Ebtihal Mohammad Alzobeday<sup>2</sup>, Rawan Abdullah Refaei<sup>3</sup>, Adelah Ahmed A. Alruwaili<sup>4</sup>, Muna Bunder Alshammari<sup>5</sup>, Latifah Lafi Dhahi Alhazmi<sup>6</sup>, Al Sharaef Dalal Ahmad Abdullah<sup>7</sup>, Daniyah Farhan Alanazi<sup>8</sup>, Khalid Essa Hameed Aljaloud<sup>9</sup>, Entisar Sufuq Alrowaili<sup>10</sup>**

<sup>1</sup> Nursing Technician, Hail, Hail Region, Saudi Arabia.

<sup>2</sup> Nursing, Primary Health Care (P.H.C) Al-Mudilef, Al-Qunfudhah, Makkah Region, Saudi Arabia.

<sup>3</sup> Specialist-Nursing, Al-Aziziyah Maternity and Children Hospital, Jeddah, Makkah Region, Saudi Arabia.

<sup>4</sup> Specialist-Nursing, Maternity and Children's Hospital - Al-Jouf, Sakaka, Al-Jouf Region, Saudi Arabia.

<sup>5</sup> Specialist-Nursing, Eradah Mental Health Complex, Hail, Hail Region, Saudi Arabia.

<sup>6</sup> Nursing Technician, North Tower Medical Hospital, Arar, Northern Border Region, Saudi Arabia.

<sup>7</sup> Nursing specialist, Aseer Health Cluster, Aseer Region, Saudi Arabia.

<sup>8</sup> Nursing specialist, Prince Abdullah Bin Abdulaziz Bin Musaed Cardiac Center, Arar, Northern Border Region, Saudi Arabia.

<sup>9</sup> Technician-Nursing, Sharaf Hospital, Hail, Hail Region, Saudi Arabia.

<sup>10</sup> Nursing technician, Maternity and Children's Hospital, Sakaka, Al-Jouf Region, Saudi Arabia.

---

### **Abstract:**

Dehydration in older adults is a significant concern due to physiological changes, decreased thirst perception, and potential comorbidities. Nurses play a critical role in the thorough assessment of dehydration, which involves evaluating patients' hydration status through a combination of patient history, physical examination, and observation of clinical signs. Key assessment components include monitoring vital signs such as blood pressure and heart rate, assessing skin turgor, checking mucous membranes for moisture, and evaluating urine output and concentration. Additionally, cognitive function should be assessed, as confusion or altered mental status may indicate severe dehydration. Regular assessments, especially in those at higher risk, can help in early identification and intervention. Management of dehydration in older adults focuses on rehydration and addressing the underlying causes. Nursing interventions may include administering oral rehydration solutions or adjusting intravenous fluid therapy based on the severity of dehydration. It is crucial for nurses to educate patients and caregivers about the importance of adequate fluid intake, especially during illness or periods of high heat. Monitoring electrolyte levels and renal function is also essential, as imbalances can exacerbate dehydration and complicate treatment. Collaborative care, including dietary consultations and potentially adjusting medications, is beneficial in creating effective management plans tailored to the individual needs of older adults.

**Keywords:** dehydration, older adults, nursing assessment, vital signs, skin turgor, oral rehydration, intravenous fluids, cognitive function, electrolyte balance, patient education.

---

### **Introduction:**

As the global population ages, healthcare professionals are increasingly confronted with the complexities associated with caring for older adults. One critical aspect of geriatric care is the assessment and management of dehydration, a condition that can pose serious, often life-threatening health risks in this age group. Dehydration in older adults is not merely a consequence of inadequate fluid intake; it is a multifactorial condition influenced by

physiological changes, comorbidities, and polypharmacy [1].

Older adults are particularly susceptible to dehydration due to various physiological and environmental factors. As people age, their total body water content decreases, and the kidney's ability to concentrate urine diminishes, making it more challenging for older adults to maintain optimal hydration levels. Moreover, age-related changes in thirst perception can lead to reduced fluid intake, complicating the matter further. Comorbid

conditions such as diabetes, heart failure, and cognitive impairments can also influence hydration status and make common symptoms of dehydration—from dry mucous membranes to confusion—more difficult to recognize. Consequently, nurses play a pivotal role in recognizing these symptoms and implementing appropriate interventions [2].

Given the significant ramifications of dehydration—ranging from increased risk of urinary tract infections to altered mental status—it is imperative that nursing practitioners are equipped with effective assessment tools and management protocols. They must not only identify those at risk through comprehensive assessments but also develop and execute intervention plans that can mitigate the consequences of dehydration. This requires proficiency in both the clinical symptoms of dehydration and the understanding of risk factors associated with specific patient populations [3].

Assessment methods for dehydration in older adults can be multifaceted, encompassing both subjective and objective dimensions. Nurses must conduct thorough health histories and consider patients' medications, dietary habits, and fluid intake. Objective tools may include vital sign monitoring, urine specific gravity assessments, and laboratory tests that can provide insight into a patient's hydration status. Furthermore, the use of validated assessment scales and checklists can streamline the evaluation process, ensuring that no critical indicators are overlooked [4].

Management strategies for dehydration must be tailored to the individual needs of older adults, accounting for their unique health concerns and preferences. Interventions may vary from encouraging oral fluid intake to the administration of intravenous (IV) fluids in more severe cases. Implementing effective education strategies for both patients and their caregivers about the importance of hydration, recognizing early signs of dehydration, and devising practical fluid intake plans can enhance overall care and prevent future episodes [5].

In this research paper, we will explore the complex nature of dehydration in older adults, examining both the assessment and management practices employed by nursing professionals. We will delve into the physiological underpinnings of dehydration, the risk factors specific to older adults, and the

critical role of nursing assessments. Furthermore, we will highlight evidence-based management strategies that can be utilized to effectively address dehydration, including both preventative measures and intervention techniques [6].

### **Physiological Changes Affecting Hydration Status:**

Hydration is an essential aspect of maintaining overall health, influencing everything from physical performance to cognitive function. For the elderly population, however, physiological changes associated with aging can significantly impact hydration status [6].

#### **1. Introduction to Aging and Hydration**

As individuals age, their bodies undergo numerous changes that can compromise physiological systems. The alterations in body composition, renal function, thirst perception, and other factors play a crucial role in how the elderly manage hydration. Despite a significant portion of the elderly population being at risk for dehydration, many are unaware of its implications. Understanding these physiological changes is vital in addressing hydration needs in older adults [7].

#### **2. Changes in Body Composition**

One of the most fundamental physiological changes associated with aging is the alteration in body composition. As people age, there is typically a decrease in total body water percentage, primarily due to a reduction in lean body mass. This decline can be attributed to factors such as decreased muscle mass and an increase in adipose tissue, which contains less water compared to muscle. In younger adults, water represents about 60% of total body weight, whereas in older adults, it can drop to around 50% or less.

This reduction in total body water means that older adults have a lower fluid reserve, placing them at greater risk for dehydration. Furthermore, as the percentage of body fat increases and muscle mass decreases, the distribution of water within the body changes. This can complicate the physiological mechanisms responsible for fluid balance and can impair the ability of elderly individuals to respond adequately to hydration needs [8].

### 3. Impaired Renal Function

Aging is often associated with a decline in renal function, characterized by reduced glomerular filtration rate (GFR) and alterations in kidney structure. The kidneys play a critical role in maintaining fluid balance and electrolyte homeostasis. With age, blood flow to the kidneys decreases, leading to reduced ability to filter blood efficiently. This impairment can result in a lower capacity to concentrate urine, which can contribute to increased fluid loss.

Additionally, the ability of kidneys to respond to hormonal signals that regulate fluid retention diminishes with age. For example, the effectiveness of antidiuretic hormone (ADH), which promotes water retention, may be altered, leading to inappropriate diuresis or an inability to concentrate urine appropriately. Consequently, elderly individuals may experience fluid loss that their aging kidneys cannot replace effectively, increasing the risk of dehydration [9].

### 4. Diminished Thirst Sensation

Thirst perception is crucial for regulating hydration status. In younger adults, the sensation of thirst is a reliable prompt to encourage fluid intake; however, in older adults, this sensory response often diminishes. Research indicates that the thresholds for thirst can increase with age, meaning that older individuals may not feel thirsty until they are already clinically dehydrated.

This diminished thirst sensation can be influenced by several factors, including changes in brain function and hormonal regulation. The hypothalamus, which plays a vital role in fluid regulation and thirst, may become less responsive with age. Additionally, some medications commonly prescribed to elderly patients, such as diuretics, can further impair thirst responses or lead to increased fluid loss. Consequently, without the prompt to drink, elderly individuals may not adequately meet their hydration needs, leading to a higher prevalence of dehydration [10].

### 5. Comorbid Conditions and Medication Effects

Elderly individuals often have multiple comorbid conditions, including diabetes, heart failure, and chronic kidney disease, which can complicate hydration status. For instance, those with heart failure may be on fluid-restricted diets, limiting their

overall water intake. Similarly, diabetes can increase fluid loss through osmotic diuresis, further complicating hydration needs.

Moreover, various medications commonly taken by elderly patients can influence hydration status. Diuretics, antihistamines, and some antidepressants can lead to increased urine output or decreased thirst sensation, exacerbating the risk of dehydration. Additionally, medications that affect cognitive ability may also reduce awareness of the need to drink fluids, compounding the problem [11].

### 6. Consequences of Dehydration

The consequences of dehydration in the elderly can be severe and multifaceted. Even mild dehydration can lead to negative outcomes such as confusion, dizziness, and decreased cognitive function. Severe dehydration can result in urinary tract infections, kidney stones, and acute kidney injury, which can pose significant health risks and may necessitate hospitalization.

Furthermore, dehydration can exacerbate existing health conditions. For example, it can worsen symptoms of chronic obstructive pulmonary disease (COPD) by thickening respiratory secretions, making it difficult to breathe. In patients with heart failure, dehydration can strain the cardiovascular system, leading to worsened symptoms and hospital readmissions [11].

### 7. Strategies for Maintaining Hydration

Recognizing the factors that contribute to the risk of dehydration among older adults, it becomes essential to implement strategies to maintain hydration. Caregivers, healthcare providers, and family members can play vital roles in promoting fluid intake. Here are some strategies:

1. **Education:** Educating elderly individuals about the importance of hydration and recognizing signs of dehydration is crucial [12].
2. **Encouraging Regular Fluid Intake:** Creating a schedule for regular hydration, such as drinking a glass of water with each meal or setting reminders, can facilitate fluid consumption.
3. **Fluid Variety:** Offering a variety of fluid sources, including water, herbal teas, and broths, may help stimulate interest and consumption.

4. **Monitoring:** Regularly monitoring fluid intake and signs of dehydration can help catch issues early.

5. **Food Choices:** Incorporating high-water-content foods, such as fruits and vegetables, into the diet can also contribute to hydration [12].

#### **Risk Factors for Dehydration in the Aging Population:**

Dehydration is a significant health concern that affects individuals of all ages; however, the aging population is particularly vulnerable. As people age, various physiological, behavioral, and socio-environmental changes contribute to an increased risk of dehydration, which can lead to severe health complications, including kidney failure, urinary tract infections, and cognitive decline. Understanding the risk factors associated with dehydration in older adults is crucial for caregivers, healthcare providers, and families to promote adequate fluid intake and maintain overall health and well-being [13].

One of the most notable aspects of aging is the physiological changes that occur in the body, including alterations in the body's water composition. As individuals age, their total body water decreases; generally, older adults have less lean body mass and more fat tissue, which does not store water. This reduction in body water means that the older population has a lower reserve of fluid that can be drawn upon, making them more susceptible to dehydration [14].

Furthermore, the ability of the kidneys to concentrate urine diminishes with age, reducing their efficiency in retaining water. This means older adults may excrete urinated water more rapidly, thus losing fluids faster than they can replace them. Compounding this issue is the decreased sensation of thirst that often accompanies aging. Many older adults may not recognize their body's need for fluids, which can lead to them not consuming enough liquids voluntarily [14].

Polypharmacy, or the concurrent use of multiple medications, is common among the elderly and can significantly contribute to dehydration. Many medications, such as diuretics, which are commonly prescribed for hypertension and heart conditions, can lead to an increased urine output. Furthermore, certain medications may have side effects that

contribute to dry mouth, leading to a decreased intake of fluids. Older adults may also take fewer fluids to avoid frequent bathroom trips, which can further exacerbate dehydration [15].

Chronic health conditions prevalent in older adults can also increase dehydration risk. For instance, diabetes can lead to increased urination, while conditions such as heart failure may limit fluid intake due to fluid restrictions implemented as part of medical management. Additionally, cognitive impairments, such as dementia or Alzheimer's disease, can hinder an older adult's ability to recognize thirst or adhere to hydration regimens. When older adults are unable to remember to drink or to communicate their hydration needs, the risk of dehydration rises significantly [16].

Behavioral factors contribute to fluid intake and overall hydration status among the elderly. Many older adults have structured daily lives, including meal patterns that may not incorporate adequate fluid consumption. Activities of daily living, such as eating and drinking, may become challenging. Additionally, physical limitations may hinder older adults from accessing fluids independently; they may have difficulty reaching for a drink, opening containers, or may require assistance to obtain fluids [17].

Social factors also play a crucial role in hydration. For instance, living alone can lead to isolation and a reduced incentive to drink regularly. Older adults who reside in assisted living facilities or nursing homes are not immune, as staff may prioritize other health needs over hydration, leading to lapses in regular fluid intake. Moreover, cultural norms and personal preferences regarding beverages can limit hydration if water or hydrating fluids are not readily available or if sugary or caffeinated beverages are preferred over healthier options [17].

Age-related physiological changes impact an individual's ability to regulate body temperature, which can further increase hydration needs. Older adults are often less able to adapt to heat and may not sweat as effectively, which decreases their ability to cool down and leads to faster dehydration in hot weather. Conversely, cold environments may combine with reduced motivation to drink fluids due to a perceived lack of thirst. Seasonal changes in temperature can significantly affect hydration;

therefore, attention must be given to external conditions and their influence on fluid intake [18].

### Prevention and Management Strategies

Understanding the risk factors associated with dehydration is essential for preventing its occurrence in the aging population. Caregivers, family members, and healthcare professionals can implement several strategies to mitigate risks:

1. **Education and Awareness:** Educating older adults about the importance of hydration is crucial. They should be encouraged to drink fluids regularly, regardless of their thirst levels. Simple guidelines, such as carrying a water bottle or setting reminders to drink, can promote consistent fluid intake [19].
2. **Monitoring:** Caregivers should monitor fluid intake and output, looking for indicators of dehydration such as dry mouth, decreased urine output, or extreme fatigue. Regular assessments can help to identify at-risk individuals before severe dehydration occurs.
3. **Adaptation:** Meals can be designed to include hydrating foods, such as fruits and vegetables, which can provide both nutritious options and additional fluids. Additionally, offering a variety of appealing beverages can encourage fluid consumption — water, herbal teas, and diluted fruit juices are good choices [19].
4. **Social Engagement:** Encouraging regular social interactions can promote hydration, as group meals can provide cultural traditions surrounding drinking and snacks while enhancing social engagement [20].
5. **Take Advantage of Routine:** Incorporating drinking into daily routines can help older adults remember to hydrate. For instance, establishing a habit of drinking a glass of water with each meal or snack can ensure consistent fluid intake [20].

### Comprehensive Nursing Assessment Techniques:

Dehydration is a serious health concern for the elderly, primarily due to the physiological changes that occur with aging, comorbidities, and medication use. As the body ages, the total body water content decreases, making older adults more susceptible to dehydration, which can lead to a cascade of health

complications, including urinary tract infections, renal failure, and cognitive impairments. Therefore, comprehensive nursing assessment and management of dehydration in this vulnerable population are critical components of geriatric care [21].

### Comprehensive Nursing Assessment

#### 1. Clinical Assessment:

The first step in the assessment of dehydration is through a thorough clinical evaluation. Nurses should begin by collecting a complete health history, including the patient's fluid intake, dietary habits, medication use, and recent illnesses or changes in health status. Questions about recent diarrhea, vomiting, fever, or increased urination should also be included. Moreover, evaluating the patient's ability to self-report their hydration status is crucial since cognitive impairments can affect their perception of thirst [22].

#### 2. Physical Examination:

A meticulous physical examination is essential for identifying signs of dehydration. Key indicators include:

- **Skin Turgor:** A common method for assessing dehydration involves pinching the skin on the back of the hand or forearm. In a well-hydrated individual, the skin quickly returns to its normal position; however, in a dehydrated person, the skin may remain tented or return slowly to its original position, indicating reduced elasticity [23].
- **Mucous Membranes:** The nurse should assess the moisture level of the oral mucosa. Dry and sticky membranes are a strong indicator of dehydration.
- **Vital Signs:** Monitoring vital signs is critical. Tachycardia, hypotension, and elevated respiratory rates can suggest significant dehydration. A drop in blood pressure, particularly orthostatic hypotension, can indicate volume depletion.
- **Weight Monitoring:** Regular weight checks provide valuable information about fluid retention or loss. A sudden drop in weight can signal acute dehydration [23].

### 3. Laboratory Assessment:

Laboratory tests can provide quantifiable data confirming dehydration. Commonly utilized tests include:

- **Serum Electrolytes:** Checking sodium, potassium, and chloride levels can help determine the type of dehydration—hypotonic, hypertonic, or isotonic [24].
- **Blood Urea Nitrogen (BUN) and Creatinine Levels:** Elevated BUN and creatinine levels can indicate kidney impairment often associated with dehydration.
- **Urinalysis:** A urinalysis can reveal concentrated urine, high specific gravity, and electrolyte imbalances, which are consistent with dehydration.
- **Arterial Blood Gases (ABGs):** In cases of severe dehydration, ABGs may be warranted to assess for metabolic acidosis or alkalosis [24].

### Management of Dehydration

The management of dehydration in the elderly requires a multi-faceted approach. The primary goal is to restore the patient's hydration status and prevent future occurrences.

#### 1. Fluid Replacement:

- **Oral Rehydration:** If the patient is alert and able to drink, oral rehydration is typically the first course of action. Offering clear fluids, electrolyte solutions, or specially formulated oral rehydration therapies can be effective in mild to moderate cases of dehydration.
- **Intravenous Fluids:** In cases of severe dehydration or if oral intake is contraindicated, intravenous (IV) fluids may be necessary. Isotonic solutions like normal saline (0.9% NaCl) are often used initially to quickly restore intravascular volume. Subsequent electrolyte solutions may be administered based on laboratory results [25].

#### 2. Monitoring:

After initiating treatment, continuous monitoring of the patient's vital signs, fluid intake, and output is imperative. This includes tracking daily weights, assessing the efficacy of fluid replacements, and adjusting the treatment plan as necessary. Utilizing the "bubble chart" method can assist nurses in

visualizing input and output over time, ensuring comprehensive tracking of the patient's hydration status [26].

#### 3. Education and Prevention:

A vital component of managing dehydration is patient education. Nurses should provide education on the signs and symptoms of dehydration, the importance of adequate fluid intake, and encourage older adults to drink water regularly, particularly during hot weather or periods of illness. Additionally, caregivers should be educated on these factors to help monitor and encourage fluid intake [27].

#### 4. Dietary Adjustments:

Dietary modifications can also pump up hydration levels. Nurses can collaborate with dietitians to promote diets rich in water-based fruits and vegetables, such as cucumbers, melons, and oranges. Providing meals that are not only nutrient-dense but also high in moisture content can help increase overall fluid consumption [27].

#### 5. Medication Review:

Since some medications can diurese or contribute to dehydration, a systematic review of the patient's medications and dosage adjustments may be necessary. Collaborating with physicians to consider alternatives to diuretic medications or optimizing the timing of medication administration can be helpful [28].

#### Clinical Signs and Symptoms of Dehydration:

Dehydration is a critical and often under-recognized health issue affecting older adults, whose physiological responses to fluid loss can differ significantly from those of younger populations. As individuals age, the body's mechanisms for maintaining hydration become less efficient, and several factors, including comorbidities, medication use, and changes in thirst perception, further complicate hydration status [29].

Dehydration occurs when the body loses more fluids than it takes in, leading to a deficiency that can impair normal physiological functions. In older adults, this condition can stem from various causes, such as inadequate fluid intake, increased loss of fluids due to acute illnesses, or chronic conditions. The elderly are particularly vulnerable due to age-related changes in body composition, hormonal

regulation, and renal function, which all play significant roles in fluid balance [29].

### Clinical Signs of Dehydration

1. **Thirst and Dry Mouth:** One of the earliest and most noticeable signs of dehydration is increased thirst. While younger individuals may respond more swiftly to feelings of thirst, the elderly often fail to recognize and respond to this cue as effectively. Consequently, dry mouth—characterized by an uncomfortable sensation of dryness and a lack of saliva—is a common clinical manifestation that may signal the onset of dehydration [30].

2. **Skin Changes:** Assessing skin turgor is a traditional method for evaluating hydration levels. As dehydration progresses, skin elasticity diminishes, and the skin may appear dry and less pliable. A simple test involves pinching the skin on the back of the hand: in a well-hydrated person, the skin should immediately return to its normal position. In a dehydrated individual, the skin may take longer to bounce back, signifying volume depletion.

3. **Urinary Changes:** Dehydration often leads to changes in urinary output. In elderly patients, decreased urine volume and dark, concentrated urine can indicate inadequate hydration. Frequent urination can also occur in cases of mild dehydration. Monitoring voiding patterns can provide valuable insight into the individual's hydration status [30].

4. **Vital Sign Alterations:** Changes in vital signs are significant indicators of dehydration. Heart rate may increase, compensating for reduced blood volume, leading to tachycardia—an elevated heart rate of over 100 beats per minute. Blood pressure may decrease, particularly in a standing or sitting position, which can raise concerns about orthostatic hypotension and dizziness [31].

5. **Cognitive Changes:** Cognitive function can be severely affected by dehydration in older adults. Confusion, lethargy, and decreased alertness are common neurological signs, indicating that the brain is not receiving adequate hydration. This alteration in mental status can sometimes be mistaken for other conditions, such as dementia, underscoring the need for healthcare providers to

consider hydration status in their differential diagnoses [31].

6. **Fatigue and Weakness:** Individuals may also experience generalized fatigue and weakness. These symptoms can be misattributed to age or chronic illnesses, making it crucial for caregivers and healthcare providers to maintain a high level of suspicion regarding dehydration, recognizing that it can exacerbate existing fatigue [32].

7. **Fever and Dry Skin:** In some cases, dehydration may accompany fever, particularly during illness. An elevated temperature can contribute to additional fluid losses through perspiration, leading to further dehydration. Dry and flaky skin is also a physical sign that the body may be lacking the necessary moisture [32].

### Consequences of Dehydration

The consequences of dehydration in elderly individuals are far-reaching, impacting both physical and cognitive health. Severely dehydrated individuals may face complications such as urinary tract infections, kidney stones, and even acute kidney injury. The risk of falls increases due to weakness, dizziness, and confusion, further heightening the potential for injury and hospitalization. Additionally, dehydration can lead to electrolyte imbalances, which can cause arrhythmias and other serious health complications [32].

Given the significant clinical signs and symptoms associated with dehydration in the elderly, prevention is key. Caregivers, family members, and healthcare providers should work collaboratively to monitor fluid intake. Encouraging regular consumption of fluids throughout the day, rather than waiting for thirst to drive this behavior, is essential. Moreover, providing a variety of hydrating options, such as water, broths, juices, and fruits with high water content, can enhance fluid intake [33].

Education on recognizing the signs of dehydration is equally important. Training caregivers and families to observe changes in thirst, skin turgor, urinary output, and cognitive function can lead to earlier identification of dehydration. This proactive approach can help to implement strategies for rehydration before complications arise.

For those already experiencing dehydration, prompt treatment is essential. Mild cases may be managed with oral rehydration solutions, while more severe cases may require intravenous fluids to restore hydration status effectively. Regular assessment of fluid balance should be integrated into the care plans of elderly patients, particularly those in long-term care facilities or with chronic illnesses [33].

### **Management Strategies for Dehydration:**

Dehydration is a serious health concern, particularly among older adults. The aging process brings about several physiological and environmental changes that can increase the risk of dehydration, making effective management strategies essential for maintaining health and well-being in this population [34].

Dehydration occurs when the body loses more fluids than it takes in, leading to an imbalance that can impair normal functioning. Older adults are particularly susceptible due to several factors. Firstly, as individuals age, their total body water percentage decreases, making it harder to maintain adequate hydration levels. Concurrently, the thirst sensation diminishes, leading to reduced fluid intake. Additionally, chronic medical conditions such as diabetes and dementia can complicate hydration by either increasing fluid loss or impairing the ability to recognize and respond to thirst.

The risks associated with dehydration in older people cannot be overstated. Dehydration can lead to a range of health complications, including urinary tract infections (UTIs), renal failure, electrolyte imbalances, falls, and even increased mortality. Furthermore, such complications can exacerbate existing health issues, leading to a cycle of declining health that is difficult to break [34].

### **Strategies for Prevention and Management**

To effectively manage dehydration in older adults, caregivers, health professionals, and the individuals themselves can implement various strategies. These approaches can be grouped into education and awareness, routine hydration practices, dietary considerations, environmental adaptations, and close monitoring of health conditions [35].

#### **1. Education and Awareness**

One of the first steps in managing dehydration is education. Both elderly individuals and their

caregivers should understand the signs and symptoms of dehydration, which include dry mouth, fatigue, dizziness, confusion, and decreased urination. Increased awareness can lead to prompt action when symptoms arise. Furthermore, older adults should be educated about the importance of hydration, especially during hot weather or when engaging in physical activity, as they may be unaware of their bodies' changing signals [35].

#### **2. Routine Hydration Practices**

Establishing regular hydration practices is crucial in preventing dehydration. Health caregivers and family members can encourage older adults to drink water at scheduled intervals throughout the day, rather than waiting for thirst to prompt them. Setting goals for daily fluid intake—generally, older adults should aim for about 6-8 cups of fluids per day, depending on individual health conditions—can provide a guide for caregivers in assisting with hydration. Additionally, offering a variety of fluids, including water, herbal teas, and broths, can make hydration more appealing and enjoyable [36].

#### **3. Dietary Considerations**

Diet plays a significant role in hydration. Foods with high water content, such as fruits and vegetables (e.g., cucumbers, oranges, and melons), can contribute to overall fluid intake. Incorporating soups and stews into the diet can also enhance hydration while providing essential nutrients. Caregivers should work with dietitians to design meal plans that balance hydration and nutrition, thereby addressing both the thirst and dietary needs of older adults [36].

#### **4. Environmental Adaptations**

Improving the living environment of older adults can also help manage hydration levels. During particularly hot weather, it is vital to create a cool indoor environment. Air conditioning or fans can prevent overheating, which increases the risk of dehydration. Furthermore, caregivers should ensure that drinking water is easily accessible. Utilizing water reminders, such as timers or water-bottle marking systems, can serve as effective cues for older adults to drink regularly [37].

#### **5. Monitoring and Intervention**

Regular monitoring of hydration status is necessary, especially for those with chronic conditions or



cognitive impairments. Blood tests can assess electrolyte levels and kidney function, while caregivers can observe signs of dehydration. Prompt intervention is critical once dehydration is suspected. In severe cases, intravenous (IV) fluids may be necessary, but this should be a last resort. Instead, encouraging oral rehydration solutions that contain electrolytes can help restore hydration levels more safely and effectively [37].

## 6. Utilizing Assistive Technologies

The rise of technology presents an opportunity to enhance hydration management among older adults. Use of smartphone apps that remind individuals to drink water throughout the day can be particularly useful for those who enjoy technology or are accustomed to using smartphones. Additionally, some devices are designed to monitor hydration levels and alert caregivers when someone's fluid intake is insufficient, allowing for timely intervention [38].

## 7. Addressing Medications and Health Conditions

Many medications commonly prescribed to older adults, such as diuretics, can increase the risk of dehydration. Healthcare providers should regularly review medications to identify medications that can affect hydration and adjust them when necessary. Developing clear plans for managing medications during periods of illness or increased physical activity can also help reduce dehydration risk [38].

### Preventive Measures and Patient Education:

Dehydration, defined as a significant loss of bodily fluids, poses a critical health risk to elderly individuals. It is a common yet serious condition that can lead to a host of complications, including urinary tract infections, kidney stones, and even hospitalization due to more severe conditions like heat-related illnesses or confusion. With the aging process, physiological changes, concurrent health issues, and medications can increase the susceptibility of older adults to dehydration. Consequently, effective preventive measures and robust patient education are crucial in safeguarding the health and well-being of the elderly population [39].

Elderly individuals are particularly vulnerable to dehydration due to multiple factors, including diminished thirst perception, age-related decline in

kidney function, and common coexisting health conditions like diabetes or heart disease. Additionally, many## Preventive Measures and Patient Education for Dehydration in the Elderly.

Dehydration is a common but often overlooked health issue among the elderly population, posing significant risks to their overall well-being. Older adults are particularly susceptible to dehydration for a variety of reasons, including physiological changes that occur with aging, the presence of chronic health conditions, and the effects of chronic medications. It is imperative to implement preventive measures and provide comprehensive patient education to mitigate the risks associated with dehydration in this vulnerable demographic [39].

Dehydration occurs when the body loses more fluids than it takes in. For the elderly, the risk factors for dehydration are manifold. Firstly, age-related physiological changes result in a decreased sense of thirst and alterations in renal function, causing older adults to be less aware of their hydration needs. Secondly, medical conditions such as diabetes, kidney disease, and heart conditions can exacerbate fluid loss. Furthermore, medications such as diuretics, laxatives, and certain antihypertensives can also contribute to increased fluid excretion, increasing the risk of dehydration.

Signs and symptoms of dehydration may range from mild to severe and can include dry mouth, fatigue, dizziness, confusion, and in more severe cases, delirium or coma. In the elderly, these symptoms can be easily misattributed to other medical conditions, leading to delayed treatment and worsening health outcomes [39].

## Preventive Measures Against Dehydration

### 1. Regular Hydration Monitoring

Healthcare providers should assess hydration status during routine check-ups. Regular monitoring can be achieved by documenting fluid intake and output, conducting physical examinations, and assessing symptoms of dehydration. Family members and caregivers must also be educated to recognize early signs of dehydration and to keep an eye on older adults' fluid consumption [40].

## 2. Encouraging Fluid Intake

To counteract the physiological decline in thirst perception, it is crucial to encourage a proactive approach to fluid intake. Healthcare providers, caregivers, and family members should suggest regular fluid intake even when the elderly individual may not feel thirsty. Establishing a daily hydration goal, such as eight 8-ounce glasses of fluids, can be a practical guideline.

Flavoring water with fruits or herbs, such as lemon, mint, or berries, can make hydration more appealing. Additionally, providing a variety of fluids, including water, herbal teas, and broths, can help older adults meet their hydration needs while allowing for individual preferences [40].

## 3. Nutritional Strategies

Foods can be an important source of hydration. Incorporating water-rich foods such as fruits (e.g., watermelon, oranges) and vegetables (e.g., cucumbers, celery) into the elderly diet can help maintain hydration levels. Nutritional counseling may also emphasize the importance of balanced meals to ensure adequate fluid intake and nutritional status [41].

## 4. Modifying Medications

For older patients on medications that contribute to increased fluid loss (e.g., diuretics), healthcare providers should consider potential alternatives or adjustments to dosing regimens. Regularly reviewing medication lists with a focus on hydration side effects can lead to better management of patients' concurrent health issues without compromising fluid balance [41].

## 5. Environmental Considerations

It is essential to account for environmental factors that may escalate fluid loss. Older individuals are more prone to dehydration in hot weather or during intense physical activity. Caregivers should facilitate suitable environments, perhaps by holding indoor activities during peak heat and planning for hydration breaks [41].

### Patient Education: A Cornerstone of Prevention

Equipping older adults and their caregivers with knowledge about hydration is vital in preventing dehydration. Patient education should encompass various facets, including understanding the risks

associated with dehydration, recognizing symptoms, and knowing how to mitigate fluid loss [42].

## 1. Workshops and Informational Sessions

Organizations such as nursing homes, community centers, and healthcare facilities can hold educational workshops that focus on the importance of hydration, especially during the summer months or during illness. These sessions can offer practical tips on increasing fluid intake and demonstrate strategies to maintain easier access to fluids [42].

## 2. Resource Materials

Providing accessible informational materials, such as brochures or newsletters, can help reinforce the message of hydration. These materials should include tips on hydrating foods and easy-to-prepare recipes that promote fluid intake. They should also highlight specific times when hydration is especially crucial, such as following illness, during times of stress, or when engaging in physical activities [43].

## 3. Family and Caregiver Involvement

Involving family members and caregivers in patient education will further strengthen the initiatives aimed at preventing dehydration. It is vital to teach caregivers how to recognize early signs of dehydration and stress the importance of promoting regular hydration. Understanding the role of hydration can significantly enhance the support network for older adults [43].

## 4. Utilizing Technology

With the rise of telehealth and mobile applications, technology can be leveraged to assist in hydration management. Mobile apps can remind older adults to drink water or track fluid intake, helping to build habits that promote regular hydration. Additionally, online support communities can provide both education and emotional support, creating a holistic system of care [44].

### Interdisciplinary Collaboration in Dehydration Management:

Dehydration is a significant health risk for older adults, often leading to severe complications such as urinary tract infections, kidney failure, and even increased mortality. The aging population is particularly susceptible to dehydration due to physiological changes, comorbidities, medications, and the often-inadequate intake of fluids.

Addressing this pressing issue requires a comprehensive approach tailored to the unique needs of older adults, wherein multidisciplinary collaboration plays a crucial role [45].

Dehydration occurs when the body loses more fluids than it takes in, leading to a deficit that can disrupt normal physiological functions. Older adults are at an increased risk for dehydration for several reasons. Firstly, the physiological aging process results in diminished thirst sensation and a decrease in total body water, making it harder for the elderly to recognize their need for hydration. Secondly, many older people are managing chronic illnesses such as diabetes, hypertension, or heart disease, which can influence fluid balance. Additionally, medications commonly prescribed to seniors — diuretics for heart conditions or certain antihypertensives — can further exacerbate fluid loss [45].

### **The Role of Multidisciplinary Collaboration**

Multidisciplinary collaboration involves the integration of various healthcare professionals, each contributing their expertise to create a harmonious patient-centered care plan. In the context of managing dehydration in older adults, an effective team typically consists of physicians, nurses, dietitians, pharmacists, social workers, and physical therapists. Each professional plays a unique role, creating a comprehensive support system designed to tackle the complexities of dehydration [46].

1. **Physicians:** Physicians serve as the primary decision-makers in assessing the underlying causes of dehydration. They evaluate the medical history, perform physical examinations, and conduct necessary laboratory tests to determine the severity and possible causes. Importantly, they also prescribe appropriate rehydration therapies, which could involve oral rehydration solutions or intravenous fluids in cases of severe dehydration [46].

2. **Nursing Staff:** Nurses are often on the front lines of patient care, monitoring hydration status through careful observation of fluid intake and output, vital signs, and changes in cognitive function. They are also instrumental in educating patients and caregivers about the signs of dehydration and the importance of maintaining adequate fluid intake. Furthermore, nurses can advocate for dietary changes and prompt timely interventions when necessary.

3. **Dietitians:** A clinical dietitian contributes nutritional expertise by assessing dietary habits and recommending fluid-dense foods. They can create meal plans that include hydrating fruits and vegetables, discuss the importance of electrolyte balance, and identify any special dietary needs that might predispose the patient to dehydration. A dietitian's input is particularly valuable for patients with conditions such as dysphagia or those on specialized diets, as they can suggest safe yet hydrating food options [47].

4. **Pharmacists:** Pharmacists provide critical input on the medications that may be contributing to dehydration. They can review a patient's medication regimen, identify medications that cause diuresis, and engage with the healthcare team regarding optimal medication management. Moreover, pharmacists can educate patients about potential side effects of their medications, including those related to fluid balance [48].

5. **Social Workers:** Social workers play an essential role by addressing psychosocial factors that could influence a patient's ability to maintain proper hydration. They can assess living conditions, provide access to community resources, and facilitate support systems for individuals who may need assistance with daily hydration management due to mobility issues or cognitive decline. Social workers also contribute to family education, offering strategies to create a supportive environment that promotes hydration.

6. **Physical Therapists:** Physical therapists can contribute by designing a physical activity program tailored to an older adult's abilities, ensuring that mobility is maintained [48]. Exercise can stimulate thirst, thus encouraging increased fluid intake. They can also develop strategies to enhance functional independence, facilitating the individual's ability to access water and encourage hydration throughout the day [48].

### **Effective Communication and Coordination**

Effective communication and coordination are vital for ensuring that all team members work towards common goals in the management of dehydration. Regular team meetings, the use of shared patient records, and the establishment of clear communication protocols can facilitate ongoing dialogue regarding patient progress. Coordination of care is particularly essential in transitions between

settings — for example, when an older adult moves from a hospital to a rehabilitation facility or home, ensuring continuity of care that addresses hydration needs [49].

### Benefits of Multidisciplinary Collaboration

The multidisciplinary approach to managing dehydration in older adults results in myriad benefits. Firstly, it promotes a holistic understanding of the patient's needs, leading to more personalized care plans. Each team member's perspective allows for a more extensive evaluation of potential barriers to hydration, whether they are medical, nutritional, or psychosocial in nature [50].

Secondly, a collaborative approach often enhances patient education and engagement. With various professionals contributing to education, patients and caregivers are more likely to gain a comprehensive understanding of hydration's importance. Empowering older individuals to take charge of their hydration can significantly improve outcomes.

Lastly, collaboration can lead to better health outcomes and decreased healthcare costs. By preventing the complications associated with dehydration, such as hospitalization, healthcare systems can realize the benefits of early intervention and comprehensive management [51].

### Conclusion:

In conclusion, the nursing assessment and management of dehydration in older adults are critical components of ensuring optimal health and well-being in this vulnerable population. The unique physiological changes and increased risk factors associated with aging necessitate a thorough and proactive approach to hydration assessment. By utilizing comprehensive assessment techniques and recognizing the clinical signs of dehydration, nurses can identify at-risk individuals early and implement effective management strategies.

Education and preventive measures play a vital role in promoting adequate fluid intake and minimizing the risk of dehydration. Collaboration with interdisciplinary teams enhances the quality of care delivered to older adults, ensuring that both medical and environmental factors are addressed. Ultimately, by prioritizing hydration and employing best practices in assessment and management, nurses can significantly improve health outcomes

and enhance the quality of life for older adults facing dehydration.

### References:

1. El-Sharkawy A.M., Sahota O., Maughan R.J., Lobo D.N. The pathophysiology of fluid and electrolyte balance in the older adult surgical patient. *Clin. Nutr.* 2014;33:6–13. doi: 10.1016/j.clnu.2013.11.010.
2. Yamada Y., Zhang X., Henderson M., Sagayama H., Pontzer H., Watanabe D., Yoshida T., Kimura M., Ainslie P.N., Andersen L.F., et al. Variation in human water turnover associated with environmental and lifestyle factors. *Science.* 2022;378:909–915. doi: 10.1126/science.abm8668.
3. Jéquier E., Constant F. Water as an essential nutrient: The physiological basis of hydration. *Eur. J. Clin. Nutr.* 2010;64:115–123. doi: 10.1038/ejcn.2009.111.
4. Hooper L., Bunn D., Jimoh F.O., Fairweather-Tait S.J. Water-loss dehydration and aging. *Mech. Ageing Dev.* 2014;136–137:50–58. doi: 10.1016/j.mad.2013.11.009.
5. Lacey J., Corbett J., Forni L., Hooper L., Hughes F., Minto G., Moss C., Price S., Whyte G., Woodcock T., et al. A multidisciplinary consensus on dehydration: Definitions, diagnostic methods and clinical implications. *Ann. Med.* 2019;51:232–251. doi: 10.1080/07853890.2019.1628352.
6. Petracchia L., Liberati G., Masciullo S.G., Grassi M., Fraioli A. Water, mineral waters and health. *Clin. Nutr.* 2006;25:377–385. doi: 10.1016/j.clnu.2005.10.002.
7. Volkert D., Beck A.M., Cederholm T., Cruz-Jentoft A., Goisser S., Hooper L., Kiesswetter E., Maggio M., Raynaud-Simon A., Sieber C.C., et al. ESPEN guideline on clinical nutrition and hydration in geriatrics. *Clin. Nutr.* 2019;38:10–47. doi: 10.1016/j.clnu.2018.05.024.
8. Dimaria-Ghalili R.A., Nicolo M. Nutrition and hydration in older adults in critical care. *Crit. Care Nurs. Clin. N. Am.* 2014;26:31–45. doi: 10.1016/j.ccell.2013.10.006.
9. Stookey J.D., Pieper C.F., Cohen H.J. Is the prevalence of dehydration among community-

- dwelling older adults really low? Informing current debate over the fluid recommendation for adults aged 70+ years. *Public Health Nutr.* 2005;8:1275–1285. doi: 10.1079/PHN2005829.
10. Grandjean A.C., Reimers K.J., Buyckx M.E. Hydration: Issues for the 21st century. *Nutr. Rev.* 2003;61:261–271. doi: 10.1301/nr.2003.aug.261-271.
11. Hooper L. Why, Oh Why, Are So Many Older Adults Not Drinking Enough Fluid? *J. Acad. Nutr. Diet.* 2016;116:774–778. doi: 10.1016/j.jand.2016.01.006.
12. Marra M.V., Simmons S.F., Shotwell M.S., Hudson A., Hollingsworth E.K., Long E., Kuertz B., Silver H.J. Elevated Serum Osmolality and Total Water Deficit Indicate Impaired Hydration Status in Residents of Long-Term Care Facilities Regardless of Low or High Body Mass Index. *J. Acad. Nutr. Diet.* 2016;116:828–836. doi: 10.1016/j.jand.2015.12.011.
13. Wald R., Jaber B.L., Price L.L., Upadhyay A., Madias N.E. Impact of hospital-associated hyponatremia on selected outcomes. *Arch. Intern. Med.* 2010;170:294–302. doi: 10.1001/archinternmed.2009.513.
14. Liska D., Mah E., Brisbois T., Barrios P.L., Baker L.B., Spriet L.L. Narrative Review of Hydration and Selected Health Outcomes in the General Population. *Nutrients.* 2019;11:70. doi: 10.3390/nu11010070.
15. Johnson L., Holyday M. How Do We Stop Starving and Dehydrating Our Patients on Dysphagia Diets? *Nutr. Diet.* 2017;74:64.
16. Vivanti A.P., Campbell K.L., Suter M.S., Hannan-Jones M.T., Hulcombe J.A. Contribution of thickened drinks, food and enteral and parenteral fluids to fluid intake in hospitalised patients with dysphagia. *J. Hum. Nutr. Diet.* 2009;22:148–155. doi: 10.1111/j.1365-277X.2009.00944.x.
17. Bunn D., Jimoh F., Wilsher S.H., Hooper L. Increasing fluid intake and reducing dehydration risk in older people living in long-term care: A systematic review. *J. Am. Med. Dir. Assoc.* 2015;16:101–113. doi: 10.1016/j.jamda.2014.10.016.
18. Wotton K., Crannitch K., Munt R. Prevalence, risk factors and strategies to prevent dehydration in older adults. *Contemp. Nurse.* 2008;31:44–56. doi: 10.5172/conu.673.31.1.44.
19. Hooper L., Bunn D.K., Abdelhamid A., Gillings R., Jennings A., Maas K., Twomlow E., Hunter P.R., Shepstone L., Potter J.F., et al. Water-loss (intracellular) dehydration assessed using urinary tests: How well do they work? Diagnostic accuracy in older people. *Am. J. Clin. Nutr.* 2016;104:121–131. doi: 10.3945/ajcn.115.119925.
20. Menten J.C., Kang S. Hydration Management. *J. Gerontol. Nurs.* 2020;46:19–30. doi: 10.3928/00989134-20200108-03.
21. Hodgkinson B., Evans D., Wood J. Maintaining oral hydration in older adults: A systematic review. *Int. J. Nurs. Pract.* 2003;9:S19–S28. doi: 10.1046/j.1440-172X.2003.00425.x.
22. Thomas D.R., Cote T.R., Lawhorne L., Levenson S.A., Rubenstein L.Z., Smith D.A., Stefanacci R.G., Tangalos E.G., Morley J.E., Council D. Understanding clinical dehydration and its treatment. *J. Am. Med. Dir. Assoc.* 2008;9:292–301. doi: 10.1016/j.jamda.2008.03.006.
23. Anjo I., Amaral T.F., Afonso C., Borges N., Santos A., Moreira P., Padrao P. Are hypohydrated older adults at increased risk of exhaustion? *J. Hum. Nutr. Diet.* 2020;33:23–30. doi: 10.1111/jhn.12702.
24. Vivanti A., Harvey K., Ash S., Battistutta D. Clinical assessment of dehydration in older people admitted to hospital: What are the strongest indicators? *Arch. Gerontol. Geriatr.* 2008;47:340–355. doi: 10.1016/j.archger.2007.08.016.
25. Armstrong L.E. Assessing hydration status: The elusive gold standard. *J. Am. Coll. Nutr.* 2007;26:575S–584S. doi: 10.1080/07315724.2007.10719661.
26. Xiao H., Barber J., Campbell E.S. Economic burden of dehydration among hospitalized elderly patients. *Am. J. Health-Syst. Pharm.* 2004;61:2534–2540. doi: 10.1093/ajhp/61.23.2534.

27. Hooper L., Abdelhamid A., Attreed N.J., Campbell W.W., Channell A.M., Chassagne P., Culp K.R., Fletcher S.J., Fortes M.B., Fuller N., et al. Clinical symptoms, signs and tests for identification of impending and current water-loss dehydration in older people. *Cochrane Database Syst. Rev.* 2015.
28. Thomas D.R., Tariq S.H., Makhdomm S., Haddad R., Moinuddin A. Physician misdiagnosis of dehydration in older adults. *J. Am. Med. Dir. Assoc.* 2004;5:S31–S34. doi: 10.1016/S1525-8610(04)70088-2.
29. Handu D., Moloney L., Wolfram T. Academy of Nutrition and Dietetics Methodology for Conducting Systematic Reviews for the Evidence Analysis Library. *J. Acad. Nutr. Diet.* 2016;116:311–318. doi: 10.1016/j.jand.2015.11.008.
30. Howard M.M., Nissenon P.M., Meeks L., Rosario E.R. Use of Textured Thin Liquids in Patients With Dysphagia. *Am. J. Speech-Lang. Pathol.* 2018;27:827–835. doi: 10.1044/2018\_AJSLP-16-0140.
31. Begum M.N., Johnson C.S. A review of the literature on dehydration in the institutionalized elderly. *e-SPEN Eur. E-J. Clin. Nutr. Metab.* 2010;5:e47–e53. doi: 10.1016/j.eclnm.2009.10.007.
32. Stachenfeld N.S., Mack G.W., Takamata A., DiPietro L., Nadel E.R. Thirst and fluid regulatory responses to hypertonicity in older adults. *Am. J. Physiol.* 1996;271:R757–R765.
33. Danziger J., Zeidel M.L. Osmotic homeostasis. *Clin. J. Am. Soc. Nephrol.* 2015;10:852–862.
34. Sawka M.N., Chevront S.N., Carter R.R. Human water needs. *Nutr. Rev.* 2005;63:S30–S39.
35. Epstein M. Aging and the kidney. *J. Am. Soc. Nephrol.* 1996;7:1106–1122.
36. Phillips P.A., Rolls B.J., Ledingham J.G., Forsling M.L., Morton J.J., Crowe M.J., Wollner L. Reduced thirst after water deprivation in healthy elderly men. *N. Engl. J. Med.* 1984;311:753–759.
37. Lorenzo I., Serra-Prat M., Yébenes J.C. The Role of Water Homeostasis in Muscle Function and Frailty: A Review. *Nutrients.* 2019;11:1857.
38. Volkert D., Beck A.M., Cederholm T., Cruz-Jentoft A., Hooper L., Kiesswetter E., Maggio M., Raynaud-Simon A., Sieber C., Sobotka L., et al. ESPEN practical guideline: Clinical nutrition and hydration in geriatrics. *Clin. Nutr.* 2022;41:958–989.
39. Luckey A.E., Parsa C.J. Fluid and electrolytes in the aged. *Arch. Surg.* 2003;138:1055–1060.
40. Koshy R.M., Jamil R.T. Physiology, Osmoreceptors. StatPearls Publishing; Treasure Island, FL, USA: 2023.
41. Davies I., O'Neill P.A., McLean K.A., Catania J., Bennett D. Age-associated alterations in thirst and arginine vasopressin in response to a water or sodium load. *Age Ageing.* 1995;24:151–159.
42. Leiper J.B., Seonaid P.C., Primrose W.R., Phillimore J., Maughan R.J. A comparison of water turnover in older people in community and institutional settings. *J. Nutr. Health Aging.* 2005;9:189–193.
43. Ritz P., Berrut G. The importance of good hydration for day-to-day health. *Nutr. Rev.* 2005;63:S6–S13.
44. Perrier E., Demazières A., Girard N., Pross N., Osbild D., Metzger D., Guelinckx I., Klein A. Circadian variation and responsiveness of hydration biomarkers to changes in daily water intake. *Eur. J. Appl. Physiol.* 2013;113:2143–2151.
45. Bankir L., Bichet D.G., Morgenthaler N.G. Vasopressin: Physiology, assessment and osmosensation. *J. Intern. Med.* 2017;282:284–297.
46. Gizowski C., Bourque C.W. The neural basis of homeostatic and anticipatory thirst. *Nat. Rev. Nephrol.* 2018;14:11–25.
47. Leib D.E., Zimmerman C.A., Knight Z.A. Thirst. *Curr. Biol.* 2016;26:R1260–R1265.
48. EFSA Panel on Dietetic Products Nutrition and Allergic (NDA) Scientific Opinion on Dietary reference values for water/European Food Safety Authority. *EFSA J.* 2010;8:48.

49. Chinese Nutrition Society Dietary Guide for Elderly Adults. WS/T 556-2017.
50. Institute of Medicine Dietary Reference Intakes for Water, Potassium, Sodium, Chloride and Sulfate.
51. Watso J.C., Farquhar W.B. Hydration Status and Cardiovascular Function. *Nutrients*. 2019;11:1866.