

## Special Article - Anti Aging

# Educated African Americans and their Understanding of Hydration for Health

**Britt R<sup>1</sup>, Picetti D<sup>1</sup>, George M<sup>1</sup>, Kumar R<sup>1</sup>, Pangle AK<sup>1</sup>, Gibson R<sup>1</sup>, Thomas BR<sup>1,2</sup>, Wei JY<sup>1</sup> and Azhar G<sup>1\*</sup>**

<sup>1</sup>Department of Geriatrics, Donald W Reynolds Institute on Aging, USA

<sup>2</sup>Department of Pediatric Neonatology, Arkansas Children's Hospital, USA

**\*Corresponding author:** Azhar G, Department of Geriatrics, University of Arkansas for Medical Sciences Reynolds Institute on Aging, 4301 West Markham, Little Rock, AR 72205, Arkansas, USA

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## Abstract

Dehydration and over-hydration both play major roles in US healthcare. Due to healthcare disparities among different ethnic groups, we hypothesized there may be knowledge gaps regarding proper hydration among African Americans. We administered an anonymous hydration health survey to community-dwelling African American adults (n=66). Participants were divided into two groups: <50 years old, or ≥50 years old. Women accounted for 64% of survey participants and 45% of surveyed individuals had a college degree or higher education. Those <50 appeared to have a better understanding of physiological processes associated with hydration (64% vs. 59%). However, while 74% of both groups understood the role of water in waste elimination, approximately 40% of the participants had limited understanding of the importance of water in other physiological functions. The majority of participants in both groups overestimated the fluid loss amount associated with development of clinical dehydration by ~10%. In general, hydration health knowledge was similar between young and older adults, however the older adults appeared to be better informed about heart failure and the use of diuretics. A most concerning knowledge gap was the lack of awareness of the life-threatening consequences of suboptimal hydration by all participants. In summary, we identified significant gaps in current hydration literacy levels in a cohort of African Americans residing in Arkansas. Healthcare professionals and policy makers should design better strategies for increasing health literacy in order to reduce hydration-related morbidity and mortality and improve the quality of life and health of African Americans.

**Keywords:** Dehydration; Aged; Health literacy; African American

## Abbreviations

IRB: Institutional Review Board; IV: Intravenous; UAMS: University of Arkansas for Medical Sciences; US: United States

## Introduction

The human body is composed of approximately 60% water, with some vital organs composed of even greater percentages [1,2]. Therefore a proper understanding of the human body includes knowledge that adequate hydration is a fundamental requirement for every organ to function well [1]. An imbalance in adequate fluid intake may create a state of either dehydration or over-hydration [1].

Dehydration is defined as a depletion of total body fluid that disturbs body homeostasis, whether due to excessive fluid loss or decreased fluid intake [1,3]. Excess fluid loss may be the result of illness, exposure to high temperature, exertion with inadequate fluid intake, or due to medications such as diuretics [1,4]. Reduced intake of fluids is a common issue found in the elderly, dementia patients, and nursing home patients [1,5,6]. The elderly population is also at increased dehydration risk due to decrease in the thirst sensation, decrease in renal perfusion, altered sensitivity to anti diuretic hormone, and neurocognitive deficit [6-8]. There are numerous consequences of dehydration among the elderly, including delirium, confusion, infections, falls, and fractures [1,3,9]. Clinically, presentation of dehydration can vary from dizziness and confusion to seizures and death, and physical signs may include sunken eyes,

dry axillae, low blood pressure, and delayed capillary refill [10-13]. Additionally, dehydration results in ionic imbalances in the body, the most important of which is sodium. If not corrected within an appropriate amount of time, this can result in potentially fatal outcomes [12]. Dehydration has also been attributed as a major predictor of morbidity and mortality, and is itself the second most common comorbidity, being present in 14% of all hospitalizations [6,14,15].

Over-hydration is a fluid overload condition that may be due to either excessive fluid intake or an organic failure in the body, resulting in disturbance of the body's homeostasis. Excessive fluid buildup may occur as a result of excess intravenous (IV) fluid administration, blood transfusions, or steroid use [16]. Organ failure such as heart failure, renal failure, or liver failure, or other health conditions such as protein deficiency, may also result in over-hydration [17]. Additionally, excess fluid buildup may itself lead to heart failure or pulmonary edema, increase in blood pressure, seizures, confusion, or sometimes even death [18,19]. Over-hydration may also be a trigger for electrolyte imbalance, particularly in critically ill patients or patients that have recently undergone surgery. Thus, over-hydration is an independent risk factor for morbidity and mortality, especially for individuals with heart failure, acute or chronic renal failure, or those on dialysis [7,20].

Although there is a wealth of information regarding hydration in the clinical setting, one important piece of information is that

Table 1: Demographics.

Demographics (Total N=66)					
	Younger (N=33)	Older (N=33)		Younger (N=33)	Older (N=33)
<b>Age</b>			<b>Gender</b>		
Under 30	21%		Male	45%	27%
30-39	30%		Female	55%	73%
40-49	48%				
50-59		39%	<b>Education</b>		
60-69		42%			
70-79		18%	Less than High School Diploma	3%	3%
<b>Income</b>			High School Diploma	21%	24%
Less than \$15,000	6%	9%	Some College	24%	27%
\$15,001 - \$20,000	9%	18%	College Degree	27%	15%
\$20,001 - \$30,000	18%	15%	Vocational School	3%	3%
\$30,001 - \$45,000	24%	18%	Some Graduate School	3%	0%
\$45,001 - 60,000	15%	15%	Graduate Degree	12%	18%
\$60,001 - \$75,000	9%	6%	Postgraduate Degree	3%	6%
More than \$75,001	15%	15%	(Doctor or Professional)		
No Answer	3%	3%	No Answer	3%	3%

dehydration and over-hydration, and their consequences, are preventable conditions. Thus, better hydration health literacy may potentially improve clinical outcomes and reduce healthcare costs [21-23]. Due to existing variances in the social determinants of health among different ethnic groups [24-26], we hypothesized there may be knowledge gaps regarding hydration's role in health among ethnic groups in the state. African Americans are the largest ethnic minority in the state making up 15.4% of the population. Additionally, there is a higher prevalence of hydration-related health conditions among African Americans compared to White, non-Hispanics, such as stroke, cardiovascular disease, and kidney disease [27-29].

## Materials and Methods

### Study design

This was a cross-sectional study, conducted using an anonymous survey and convenience sample methodology. The questionnaire used in the study was designed to evaluate the health literacy of the local community-dwelling African American population regarding the significance of hydration in health. The survey was comprised of 5 demographic questions and 8 structured hydration-related questions. The questions were designed to evaluate the comprehension of the target population regarding quantity of fluids, importance of fluids and problems associated with dehydration or over-hydration. The study was approved by the Institutional Review Board at University of Arkansas for Medical Sciences (UAMS IRB Protocol #202607).

### Method of survey collection

The survey was completed by 66 community dwelling African American adults. Participants were approached in various locations, such as the Reynolds Institute on Aging at UAMS, beauty salons, grocery and videos stores, the UAMS campus, etc. A trained research technician administered the survey to participants. The participants completed the survey by themselves or the research technician

read the questions and possible answers to them, and participants indicated the answers verbally. These surveys were conducted in person and were not phone or mail surveys. The survey instrument was immediately collected by the research technician and data was entered into the database for analysis.

### Analysis

The SAS Software (Version 9.3, SAS Institute Inc.) was utilized to analyze the results of survey. Categorical variables are presented as counts and percentages that were calculated with PROC FREQ SAS procedure. Responses to questions were compared by group with either the chi-square test or Fisher's exact test for contingency tables with cells having expected frequencies of 5 or less. The chi-square and Fisher's exact tests were performed with the PROC FREQ SAS procedure with the options "chisq" and "fisher". The  $\alpha$  cut-off for significance was accepted as  $p < 0.05$ .

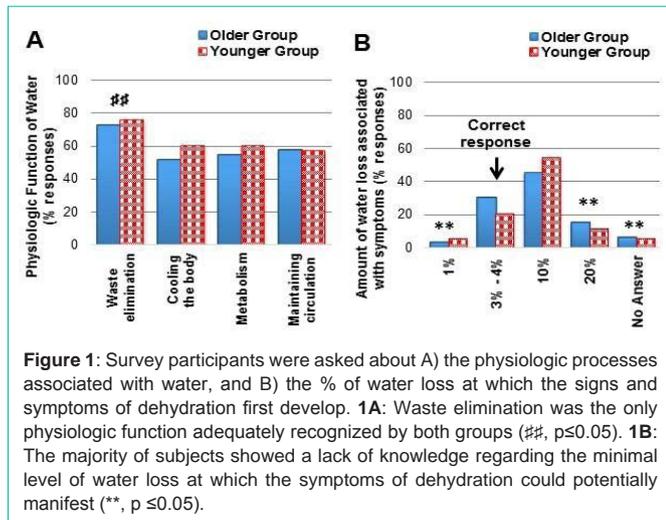
## Result

### Demographics

Participants were divided into two groups: under 50 years of age (younger group,  $n=33$ ), or 50 years of age and older (older group,  $n=33$ ). In the younger group, nearly 50% were between 40 to 49 years of age. In the older group, over 40% were 60 to 69 years of age. Female participants accounted for more than half of each group, averaging 63.6% of the entire study cohort. Individuals with a college degree or higher level of education made up 42.4% of the older group and 48.4% of the younger group, whereas those with a high school diploma or less accounted for only 27.2% and 24.2% of the older and younger groups, respectively. More than 39% of the younger group had an annual household income of \$45,000 or more, as did more than 36% of the older group (Table 1).

### Importance of hydration

While investigating the survey participants' knowledge regarding



**Figure 1:** Survey participants were asked about A) the physiologic processes associated with water, and B) the % of water loss at which the signs and symptoms of dehydration first develop. **1A:** Waste elimination was the only physiologic function adequately recognized by both groups (##, p≤0.05). **1B:** The majority of subjects showed a lack of knowledge regarding the minimal level of water loss at which the symptoms of dehydration could potentially manifest (\*\*, p ≤0.05).

the importance of hydration, we found that the younger group appeared to have a slightly better grasp overall of the physiological processes associated with hydration. However, while both groups (younger: 75.8% and older: 72.7%) understood the importance of water for body waste elimination, more than 40% of the survey participants had limited understanding regarding the importance of adequate fluid intake for other physiological functions in the body (Figure 1A).

In addition to the physiologic necessities of hydration in the body, we assessed the knowledge of our target population regarding fluid loss from the body. There was a significant knowledge gap regarding the amount of fluid loss required for symptom of dehydration to become apparent and 70% or more of the respondents in both groups over or underestimated this value (p <0.001). Approximately 25% of the older aged individuals selected the appropriate answer of 3-4% fluid loss being associated with symptomatic dehydration (Figure 1B).

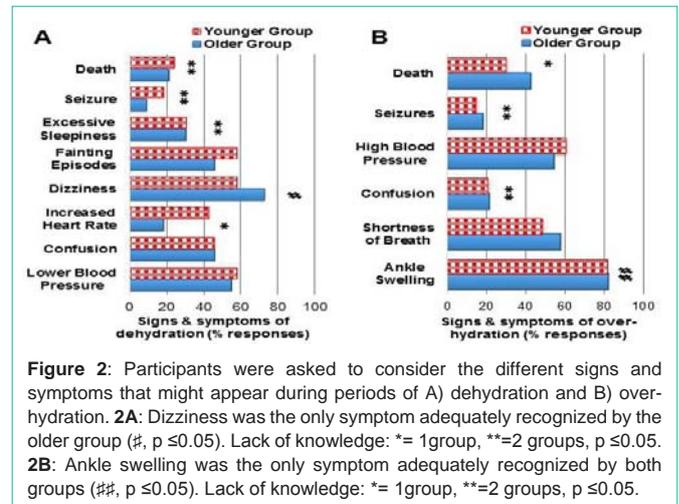
**Recognition of signs and symptoms of dehydration**

We found that the average knowledge deficit regarding signs and symptoms of dehydration was more than 40% in both age groups. The most widely recognized signs and symptoms of dehydration was dizziness, for which the older group appeared better informed (72.7% vs. 57.6%). The second and third common signs of dehydration selected by young and older participants were fainting episodes (57.6% vs. 45.4%) and low blood pressures (57.6% vs. 54.6%) (Figure 2A).

Other relevant and often serious signs and symptoms of dehydration were under-appreciated by both young and older adults and these included confusion (both groups: 45.4%), increase in heart rate (42.4% vs. 18.2%), excessive sleepiness (both groups: 30.3%), death (24.2% vs. 21.2%) and seizures (18.2% vs. 9.1%), (Figure 2A).

**Recognition of signs and symptoms of over-hydration**

Swelling of ankles was the most widely recognized marker of over-hydration, as it was correctly selected by 81.8% of individuals, followed by high blood pressure by approximately 60% of both young and older adults (Figure 2B). In general, the older group appeared to be equally or better informed with regards to most of the signs and symptoms of over-hydration as compared to the younger group,



**Figure 2:** Participants were asked to consider the different signs and symptoms that might appear during periods of A) dehydration and B) over-hydration. **2A:** Dizziness was the only symptom adequately recognized by the older group (#, p ≤0.05). Lack of knowledge: \* = 1group, \*\* = 2 groups, p ≤0.05. **2B:** Ankle swelling was the only symptom adequately recognized by both groups (##, p ≤0.05). Lack of knowledge: \* = 1group, \*\* = 2 groups, p ≤0.05.

including shortness of breath (57.6% vs. 48.5%), death (42.4% vs. 30.3%), confusion (both groups: 21.2%) and seizures (18.2% vs. 15.1%). The younger group appeared to have greater understanding than the older group about high blood pressure (60.6% vs. 54.6%). On average, 40% or more of the entire study cohort failed to recognize 5 of the 6 signs and symptoms of over-hydration that were addressed in the survey (Figure 2B).

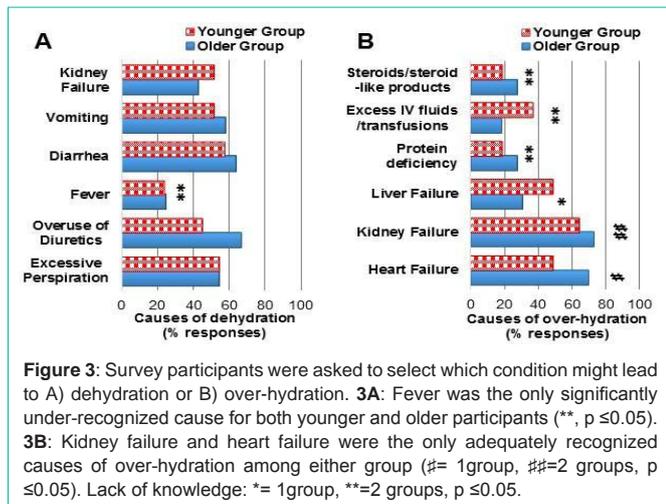
**Conditions associated with dehydration and over-hydration**

We also asked survey respondents about health conditions and iatrogenic causes of dehydration and over-hydration (Figure 3). The older group also seemed to have an equal or greater understanding about the many causes of dehydration such as excessive perspiration (both groups: 54.6%), overuse of diuretics (66.7% vs. 45.4%), diarrhea (63.6% vs. 57.6%), and vomiting (57.6% vs. 51.5%). Interestingly, fever was under appreciated and less than 25% of individuals in either age group selected it as a cause of dehydration, even though it is a very common condition (Figure 3A). The older adults were also better informed compared with younger adults about over-hydration associated with heart failure (69.7%, vs. 48.5%), kidney failure (72.7% vs. 63.6%), protein deficiency (27.3%, vs. 18.2%), and steroid treatment (27.3%, vs. 18.2%). However, the younger group correctly selected over-hydration as a problem related to liver failure (48.5% vs. 30.3%), and excess IV fluids (36.4% vs. 18.2%) whereas there was a knowledge deficit exhibited in these areas by the older adults (Figure 3B).

**Discussion**

Researchers over the centuries have identified the key role of water in the human body. In light of the high mortality and morbidity associated with imbalances in hydration in the elderly, this topic remains relevant for health and education [14]. Because of the enormous magnitude of healthcare disparity experienced by African Americans, we decided to conduct a survey to assess their hydration health literacy. Therefore, we attempted to identify the current level of hydration health knowledge, specifically in the African American community.

Our survey results demonstrated an overall dearth of knowledge regarding the common signs and symptoms as well as conditions



associated with an imbalance of hydration among both young and older individuals. This knowledge gap was particularly evident with under-recognition of a common condition such as fever as a cause of dehydration. Fever is a very common symptom, occurring with high frequency in community-dwelling adults and hospitalized patients. It may occur secondary to a variety of conditions or unknown etiologies and a lack of awareness may predispose individuals to dehydration [30]. The three most common signs and symptoms of dehydration recognized by both the age groups included dizziness, fainting episodes and low blood pressure. However, the more uncommon but serious consequences of dehydration and over-hydration, such as seizures or death, were significantly underappreciated by the respondents. Additionally, the information deficit regarding how little fluid loss may be required before dehydration symptoms occurred was alarming. As little as 3% to 4% loss of body fluids can lead to the beginning signs of dehydration and some studies have reported that even a loss of only 1% to 2% may impair cognition, making even mild dehydration of the utmost concern for elderly individuals [31].

Dehydration has been independently identified as an “ambulatory care-sensitive condition” [32,33]. A report from 2015 highlighted that ~\$1.4 billion were spent to treat elderly patients hospitalized for dehydration [21]. The elderly are at risk for dehydration due to a variety of age-related changes including less fluid intake due to urinary incontinence, ambulation issues, as well as decreases in dexterity and cognition [34,35]. Physiological degenerative changes in the hypothalamic thirst center and the peripheral baroreceptors occur during aging which not only reduces the sensation of thirst but also the ability to respond to hypovolemia [33,36]. These age-related changes are compounded by the fact that the signs and symptoms of dehydration in the elderly are often vague and might only be compromised of fatigue and mental confusion which could be attributed to aging or other co-morbid conditions.

Dehydration is also of concern for younger individuals, as it may increase the risk of developing certain health conditions, or may exacerbate current conditions, leading to increased treatment costs and loss of productivity [37]. Additionally, loss of productivity due to illness-related work absences is an indirect burden to the current economic structure. According to a 2013 report published by the Arkansas Department of Health, the cost to treat seven chronic

conditions (cancer, asthma, diabetes, hypertension, stroke and mental health problems) in Arkansas was \$2.6 billion, and the loss of productivity was \$11.3 billion [38].

Health literacy regarding over-hydration was approximately equal between the groups. While most of our survey participants appeared to understand that heart failure and renal failure may lead to excess fluid retention, <30% of participants were aware of other medical conditions that may increase fluid retention. Additionally, other than swollen ankles, this study population appeared to have significant knowledge deficits regarding the effects of over-hydration. Over-hydration is not only a consequence of heart or renal failure, but is also due to iatrogenic intravenous fluids administered in hospitalized patients. Moreover, a common complication of over-hydration is precipitation of heart failure, which occurs at a lower threshold and greater frequency in the elderly [17]. An increase of more than 7% positive fluid balance can increase morbidity and mortality independently of other factors [18,39]. Reducing hydration-related complications and improving quality of life will ultimately reduce the burden on the healthcare system and economic structure of the country [21].

Hydration-related health conditions are prevalent in African Americans [17,27,28]. Stroke is one of the leading causes of morbidity and mortality among African Americans in the US [27]. In 2013, the African American/Caucasian mortality ratio for stroke was 3.7 in men between 45 to 54 years of age [28]. Additionally, a higher prevalence of cardiovascular conditions has been reported in African Americans [27]. This is of great concern to us, as Arkansas is one of 5 states in the US that form the cardiovascular disease belt, and one of 8 states that form the stroke belt [40]. Furthermore, both dehydration and over-hydration are strong contributors to renal diseases. US kidney disease statistics showed that 17% African Americans developed chronic kidney disease from 1999 – 2012, 3% higher than the Caucasian population [29]. The higher prevalence of these health conditions among the African American population is part of a larger trend noted by the Agency for Healthcare Research and Quality, who reported that African Americans had the highest number of potentially avoidable hospitalizations [41].

The best possible solution to reduce preventable conditions, including suboptimal hydration, is through improving health literacy [42,43]. Health literacy is defined as the capacity to seek, understand, and act on health information. Therefore, health literacy is strongly dependent on the education and other social determinants of health of the individual with regards to healthcare access [44]. Baker, et al. found that inadequate health literacy is an independent risk factor for hospital admissions among the elderly [45]. Furthermore, one year-long study regarding the hospitalization of nursing home residents found 3.5% patients had two or more admissions secondary to dehydration [46]. A single hospital admission due to dehydration increases the risk of multiple admissions due to similar reasons [21]. Williams, et al. concluded that African Americans typically have relatively lower education and socioeconomic status, revealing the healthcare discrepancies this population faces [47]. Havranek, et al. reported in their study that socio-demographic differences are one of the primary factors for increased cardiovascular mortality for African Americans as compared with Caucasians [48]. Rikard, et al. supported this by showing that African Americans have significantly lower

health literacy as compared to Caucasians [26]. While the population of African Americans in this study tended to be well educated, their hydration health literacy was found to be significantly insufficient, suggesting that the general population of African Americans may have even greater hydration health literacy deficiencies. Additionally, Kenney, et al. reported the prevalence of inadequate hydration among US children and disparities by gender and race/ethnicity, discovering that African American children are more likely to be under-hydrated [49]. However, studies have shown that increased health literacy can improve clinical outcomes and reduce the healthcare burden, thus reducing the economic health burden [21,42,45].

Although there is considerable literature on the futility of artificial feeding and hydration towards the end-of-life and the complications associated with artificial hydration in patients who are terminally ill, there is a dearth of data in the African American population [50-55]. A few studies have observed that African American healthcare providers and caregivers tend to request continued hydration and feeding for terminally ill patients more than Caucasians [50, 53-55]. Hydration needs of the palliative care and hospice patients is an important area that requires targeted research and education especially in people of different ethnicities, social and cultural backgrounds [53,54]. Healthcare providers need to realize the important contributions they can make towards improving the quality of care and health span of their patients through enhancing education and hydration health literacy [56].

## Limitations of Study

This study cannot be generalized to all ethnicities or rural areas. Our study included only the African American community of Central Arkansas. We did not include in this analysis the fluid preferences of the participants. Our study was designed for understanding the hydration needs of relatively healthy or ambulatory patients and did not address hydration issues towards the end-of-life, which is a complex topic and will require a separate investigation. Additionally, these study participants tended to be well-educated, as <70% had attended college at some point, a nearly 18% increase over the national average for African Americans [57].

## Summary and Future Directions

Dehydration and over-hydration are important health care issues. We have identified significant gaps in the current level of hydration literacy in the African American population residing in the South Central region of the US. Although our numbers are very small, we think that, regardless of any statistical significance, these gaps in health literacy are important and clinically relevant. Healthcare professionals and policy makers need to design better strategies for increasing hydration health literacy to potentially reduce morbidity and mortality in African Americans secondary to hydration-related medical conditions.

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