12th

HYDRATION FOR HEALTH

ANNUAL SCIENTIFIC CONFERENCE

June 24th, 2020 at 13:00 (GMT/UTC)

Digital conference

WATER ACROSS THE LIFESPAN

FROM PHYSIOLOGY TO EDUCATION PROGRAM AND POLICY MAKING

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Welcome to H4H 2020

'This year we have the opportunity to share the latest and greatest in hydration science with a much larger audience via technology.'

Professor Stavros Kavouras

Cyberspace has been buzzing with chat following the 12th annual Hydration for Health (H4H) scientific conference, held on 24 June 2020. Undeterred by the restrictions caused by the coronavirus pandemic, the H4H 2020 conference provided a digital platform for members of the hydration community to come together for their landmark annual event on the key role of water in maintaining good health. Almost 500 scientists, doctors and other health professionals were drawn to their screens to see leading world experts share latest research in this exciting and fast-moving area of science.

This year the conference focused on 'Water across the lifespan: from physiology to education programme and policy making'. Multi-disciplinary topics were as diverse as hydration in school children, how waters acquire their taste, functional water myth-busting, and the potential for hydration in the prevention and treatment of diseases such as stroke and recurrent urinary tract infections.

The H4H initiative, begun in 2008, comprises scientists and medical experts with a passion to boost awareness of hydration as a vital but often overlooked health need, and to lead the way in encouraging healthier hydration. It also aims to nurture future generations of researchers and catalyse new collaborations in hydration science. This year for the first time, each speaker at the conference was introduced by members of the H4H alumni community, representing an innovative programme for young researchers set up in 2012 by the scientific committee.

Welcoming delegates to the conference on behalf of the scientific committee, Stavros Kavouras, Professor of Nutrition at Arizona State University, explained that the event would provide a unique opportunity to exchange ideas and information on how water intake influences health and wellbeing. 'For the past 11 years the lake and mountains of Evian created a unique vibe in this conference,' he said. 'However, this year we have the opportunity to share the latest and greatest in hydration science with a much larger audience via technology.'

This report brings you summaries of the H4H 2020 presentations. You can discover more at **Hydration for Health** – or watch **video recordings** of the presentations given at the conference.

Stay tuned and spread the latest on hydration science around the world with us:

HYDRATION FOR HEALTH.

1. Water physiology from an evolutionary perspective

– Asher Rosinger, Department of Biobehavioural Health Department and Department of Anthropology, Pennsylvania State University, USA

- **Over 2 billion people around the world lack access to safe drinking water within 30 minutes from their home**
- **Water needs have provided a strong selective pressure throughout human evolution**
- **Early exposure to water scarcity could affect the development of the foetus and explain why some people tend to drink very little water**

Water has shaped the path of human evolution and continues to have a profound influence on us even before we're born, according to Professor Asher Rosinger.

He told the conference that water insecurity remains a challenge for the human race, figures from 2015 showing that as many as 2.1 billion people lack access to a safe drinking water supply within 30 minutes of their home.

Throughout evolution, humans have adapted to become highly versatile in their water intake and to cope with difficult environmental conditions including humidity, aridity and extreme heat.

'To understand human water needs it is imperative to consider our evolutionary past and early life environments.'

Professor Asher Rosinger

Natural selection

By affecting survival, water needs have been a major selective force in human evolution, explained Professor Rosinger. The success of the genus *Homo* was partly due to more efficient water use by the body that allowed people to spend more time foraging. Between 4 and 1.5 million years ago, changes in body size and form between *Australopithecus* and *Homo erectus* made them less vulnerable to the sun and wind, reducing sweat rates and water needs by 15-20%.

The human nose is a further morphological change – an adaptation to arid environments. By trapping moisture in the nose from exhaled air, we can use it to humidify the next breath, and so conserve water.

Such adaptations meant early hominids could hunt their prey until the animal dropped from heat exhaustion. Modelling studies have suggested that *Homo erectus* would have been able to chase their prey for over 5 hours without needing water, before reaching 10% of body mass loss.

Early life priming

The human body has multiple systems to return it to a normal hydrated state. Among them is the release or inhibition of the antidiuretic hormone vasopressin, which regulates body water.

But what primes these systems and their response to water deficit? Research suggests that early life experience may play a key role, said Professor Rosinger. If women experience a prolonged water shortage while pregnant, the developing foetus may be exposed to increased cortisol levels released by the mother in response to the water-related stress.[1]

Evidence suggests that this may affect water needs in later life by altering thirst cues and vasopressin release – this cue of dehydration in utero may prime the offspring to 'expect' a water-scarce environment.[2] It could explain why some people tend to drink very little water and others have a high average water intake compared with the general population.[3]

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2. Obesity: behavioural and psychological aspects

– Jason Halford, School of Psychology, University of Leeds, UK

- **Healthy hydration is a key part of weight management which must also take account of what is known about the biology and psychology of obesity**
- **Biological systems that normally regulate appetite are disrupted in patients living with obesity**
- **In a vicious circle, obesity has an impact on mental health including depression and stress, which in turn can lead to overweight and obesity**

We must broaden our horizons if we are to achieve successful management of people living with obesity. This means tackling other biological and psychological challenges to weight management as well as addressing energy balance.

Professor Jason Halford said that healthy hydration as part of weight management for people living with obesity must be put in the context of what is known about the biology and psychology of the disease.

Studies have highlighted the importance of the interaction between the biology underlying obesity – such as the hormones that regulate hunger and satiety – and the food environment – cultural influences on food choices and the easy access to energy-dense foods that often come in large portions.

'Drinking water rather than sugary drinks allows us to reduce our daily consumption of sugars, a contributor to weight gain.'

Professor Jason Halford

Uncontrollable drive to eat

Professor Halford explained that in people living with obesity, the systems that normally regulate appetite are disrupted. The control mechanisms (such as the tonic and episodic systems) are in deficit while the reward (hedonic) systems are unchecked, he said.

Image: © World Obesity Federation

Dieting, whatever your weight status, undermines appetite control through up-regulation of ghrelin and down-regulation of GLP-1 and leptin hormones. This increases preferences for energy-dense foods that are high in fats and sugar – so-called 'reward' foods. At the same time, the feedback mechanisms that tell us when we've eaten enough are weakened in obesity. Hence people living with obesity have an inadequate response to food consumed. They can feel an uncontrollable drive to eat that is not held in check by satiety.

Traumatic events

Obesity is well known to be strongly linked with mental health, said Professor Halford. Research reveals a vicious circle in which obesity increases the risk of depression and depression increases the risk of obesity.[1] Life events can also have an impact on body weight. Personal illness, bereavement, a stressful job, and moving house are all associated with periods of dynamic weight gain. Mood and stress can affect individuals' coping strategies, which can lead to loss of dietary restraint – and weight management fails.[2]

Water plays a key role

Addressing these issues should go hand-in-hand with advice to drink more water, eat healthily and exercise more, said Professor Halford. Water consumption plays a key role in the energy balance equation. Consuming water is a good strategy for replacing energy from sugar and may aid satiety.

Image: © World Obesity Federation

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3. School policy on drinking and toilets: weaknesses and relation with children's hydration status

– Nathalie Michels, Department of Public Health and Primary Care, University of Ghent, Belgium

- **Over half of Belgian primary school children are under-hydrated during the school day, and the picture could be even worse in some other countries around the world**
- **Education on good drinking and toilet use should be introduced early in the curriculum; water should be available during the school day, and adequate and private toilet facilities provided so children aren't put off going to the toilet**
- **Drinking should be made fun – with clean and attractive water points, ideally away from the toilets**

Over half of primary school children are under-hydrated during the school day, research in Belgium by Dr Nathalie Michels and colleagues has revealed. A lack of education on hydration, poor adherence to schools' hydration policies and unattractive toilet facilities are the main causes, said Dr Michels.

Calling for schools and governments to pay greater attention to children's fluid intake at school, Dr Michels told delegates it is well known that children are at high risk of being poorly hydrated. As children spend a large part of the day at school, it's important to boost their hydration during the school day.

Research carried out in two phases by Dr Michels' team looked at the link between schools' policies on fluid intake, toilet use and children's hydration status in 17 Belgian primary schools. In the first phase, they collected urine samples at the start and at other times during the school day. The children were asked to record what they drank during the school day, including tea, coffee, soup, water, fruit juice, vegetable juice, soft drinks and sugar-free versions.

'Drink and toilet policy should be clearly developed and [hydration] topics should be included in the curriculum.'

Dr Nathalie Michels

In the second phase of the research, each school completed a questionnaire of 59 questions, previously developed by the Belgium Health Institute. The children were also asked to answer three questions about water availability and toilet use at school.

Dehydrated

The children's mean daily fluid intake was only 911 mL* over the whole day, both at school and out of school. Only 12% of children reached the recommended daily amount of fluid intake, said Dr Michels. Urine osmolality showed that 54% of children were under-hydrated during school time, and likewise urination frequency was also low.

Results from the schools' questionnaire showed some weaknesses in school policy.[1] One factor was found to be poor participation by children or parents in the school's policy on drinking. Others were insufficient communication of the policy to staff, and an absence of education on drinking and toileting in the curriculum. To make matters worse, many schools lack adequate toilet facilities.

Results from the kids' questions showed that only 65% of children reported being able to drink in class and 63% reported being able to use the toilet during classes. Only 8% of children said that they 'liked' their school's toilet facilities.

These results emphasise the need for easy-to-follow, clear school policies on drinking and toilet use among children. It's time for schools, governments and other representative bodies to act, Dr Michels said, adding that it would be interesting to replicate this study in other countries.

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Additional notes

* EFSA recommendations on drinks only are equivalent to 1.1-1.3 litres per day for 4-8 year olds, 1.3-1.5 litres per day for 9-13 year old girls and 1.5-1.7 litres per day 9-13 year old boys.

Research has suggested that increased water intake improves **cognitive performance** in children.

4. How Earth geology shapes various water tastes

– Lodovico di Gioia, Water Science and Technology, Danone Nutricia Research, France and Isabelle Francius, User Experience, Danone Nutricia Research, France

- **The taste of natural waters depends on their specific mineral composition, created by the interaction of water and rocks**
- **Water from different geographical regions has different tastes**
- **Taste diversity could be a lever in encouraging patients to drink healthily considering that taste is the key driver of choice for consumers of natural mineral waters**

Our enjoyment of water is following in the footsteps of fine wines, with scientists unravelling the complexities of water content that give rise to unique tastes on the palate.

Although water is primarily H_2O, it also contains minerals, dissolved gases, pollutants, and even microorganisms.

Volcanic filtering

Volcanoes are the best water filters; rainwater that falls on volcanic rock is purified and re-mineralised as it percolates through the rock, absorbing minerals including calcium, magnesium, sodium, and bicarbonates. It is these minerals present in mg/L quantities that are responsible for giving water its flavour; their influence is both subtle and complex.

Low mineral content is associated with bitter/astringent/acid descriptors of flavour while high mineral content can be described as chalky/salty/mineral in taste.

Global water map

Dr Lodovico di Gioia and Isabelle Francius revealed techniques that allow the worldwide mapping of water from different geographical regions and the sensory profile associated with drinking water.

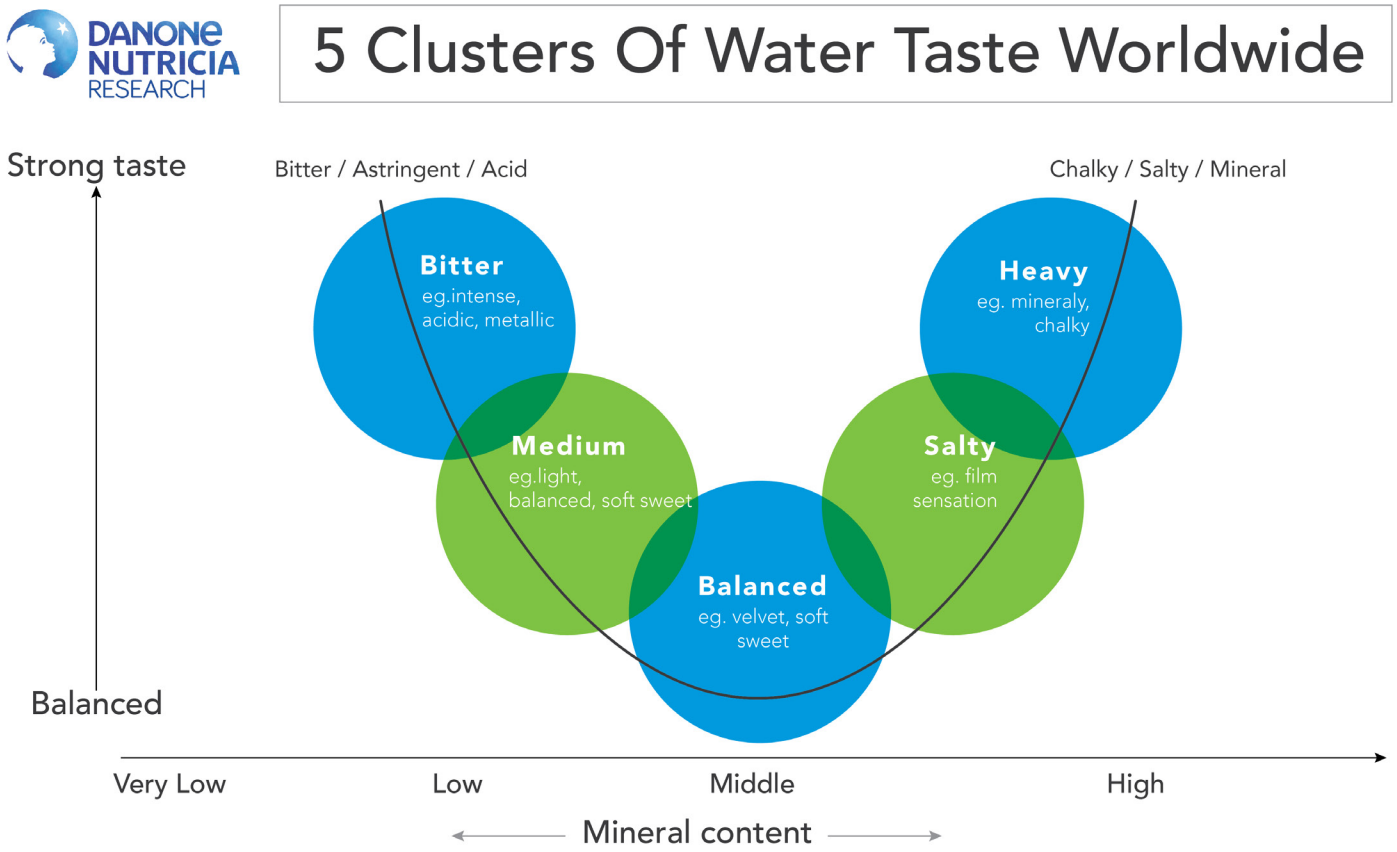
'Taste diversity could be an efficient lever to encourage [water] drinking behaviour considering that taste is the key driver of choice for consumers of natural mineral waters.'

Isabelle Francius

They've developed a predictive model that shows a sensory profile based on the mineral composition of natural groundwaters to explain the taste of water. The model relies on scoring 16 sensory characteristics and has been used to compare more than 1,000 natural mineral waters worldwide. Results have shown that the Earth's geology shapes different water tastes. Using the model, the researchers have identified five separate clusters of water taste: bitter, medium, balanced, salty, and heavy (see Figure).

The researchers also looked at defining the minimum combination of salts that are needed to simulate the composition of natural groundwater. They discovered that just five mineral salts are needed to re-create the composition of a large panel of natural groundwaters.

These data may help scientists in future to assess a new water source and to understand the elements of taste that drive healthy water drinking behaviours.



For further information please contact Isabelle Francius (**isabelle.francius@danone.com**) or Lodovico Di Gioia (**lodovico.di-gioia@danone.com**)

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5. Functional waters, performance and health: facts and myths

– Evan Johnson, University of Wyoming, USA

- **The evidence for health benefits associated with functional waters is weak at present; identification of a putative mechanism does not equal efficacy**
- **However, drinking functional waters as a replacement for sugar-sweetened beverages could have an indirect impact on health**

'Functional waters' represent a booming consumer health industry, with the market value of flavoured and functional waters reaching US$37 billion in 2019.

The market is largely driven by sales in North America and Asia, regions of high disposable income and low regulation of health supplements.[1] What accounts for the growth of these products? Dr Evan Johnson sought to investigate the scientific data and reasoning behind the global success of these relative newcomers in the health and wellness market.

What is functional water?

We all know that drinking water is good for us. Water is essential for life and has an important role in the physiology of the human body, involved in temperature regulation, joint lubrication, organ protection, waste removal, and nutrient transport. But what is 'functional water' and what is the added benefit of its consumption?

Functional water can be described as modified water that most likely has ingredients added with associated health claims, such as vitamins, minerals, acids, herbs, fruit, vegetable extracts, and other chemicals.

'If there is one health claim that they could put on these bottles, it would be: This functional water is guaranteed to replace one sugar-sweetened beverage in your daily diet.'

Dr Evan Johnson

Benefits claimed

Some examples of functional waters include:

1) Alkaline water from which hydrogen ions have been removed, with purported anti-ageing and cancer-prevention properties
2) Oxygenated water claimed to promote exercise recovery, flush toxins, and improve alcohol metabolism
3) Coconut water with added electrolytes (potassium) to improve hydration.

Evidence is lacking

In investigation of the published literature, Dr Johnson found that any evidence supporting the health claims associated with these functional waters is currently weak.[2-4] While mechanistic rationale may be found to justify use of such products, this does not equate to proof of efficacy, he said.

Hence we can see that direct-to-consumer marketing works, said Dr Johnson. The burgeoning market for functional waters may be driven in part by a desire to move away from sugar-sweetened drinks and their associated contribution to obesity, diabetes and tooth decay.

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HYDRATION FOR HEALTH.

6. Impact of hydration status in the pathogenesis of exercise-induced acute kidney injury

– Loris Juett, School of Sport, Exercise and Health Sciences, Loughborough University, UK

- **Acute kidney disease (AKI) is diagnosed by changes in serum creatinine**
- **AKI biomarkers may prove useful to improve diagnosis of the disease**
- **Dehydration exacerbates changes in biomarkers of AKI following prolonged exercise**

Latest research by an H4H alumni member has highlighted dehydration as a major risk factor in acute kidney injury, a potentially serious condition that can follow extreme physical exercise.

Acute kidney injury (AKI) requires fast detection and treatment to prevent kidney damage. The condition is diagnosed by raised levels of the muscle breakdown product, serum creatinine. However, muscle breakdown can occur during exercise, raising serum creatinine levels without necessarily signifying a change in renal function.

'We have demonstrated that dehydration during exercise appears to increase proximal tubular injury and this may be mediated by serum hyper-osmolality.'

Loris Juett

Speaking at the H4H 2020 conference, PhD student Loris Juett underlined the potential role of AKI biomarkers, such as urinary N-GAL and urinary KM-1, as candidates to help

diagnose AKI accurately. An increase in these biomarkers has been seen during prolonged endurance events and could be associated with renal tubular injury.

Exercise tests

Loris Juett has carried out two clinical trials to evaluate the impact of hydration status on these biomarkers. In the first, he asked participants to do a 2-hour programme shuttling between walking, jogging and sprinting at room temperature. This form of exercise produces muscle damage.

In the second trial, participants performed a cycling exercise which produces less muscle damage than the shuttling programme, again for 2 hours but this time in conditions of high temperature.

Both studies had a crossover design: in the first half of the programme participants' sweat losses were replaced by drinking plenty of water; in the second half they received only small amount of water.

Hypo-hydration exacerbated damage

The results indicated that urinary KM-1 and urinary N-GAL were elevated post exercise, suggesting renal tubular injury.[1] But the results suggested that hypo-hydration exacerbated injury to the proximal renal tubule. The effects may be mediated by myoglobin, which may reduce renal blood flow and is thought to be toxic to the kidney, said Loris Juett.

Body mass change, plasma volume change, serum osmolality and urine osmolality were all significantly different between hypo-hydration and eu-hydration following exercise.

If water is lost through sweat during exercise, blood becomes more concentrated and this

was reflected by a rise in serum osmolality in the hypo-hydrated part of the trial. In contrast, in the eu-hydration trial, there was a fall in serum osmolality, Loris Juett said.

This finding is important because an increase in serum osmolality causes a rise in arginine vasopressin, decreases renal blood flow and increases renal oxygen consumption and the potential for renal ischaemia – leading to an increased risk on AKI.

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HYDRATION FOR HEALTH.

7. Hydration and immune health: what do we know today and what have we still to learn?

– Neil Walsh, School of Sport and Exercise Sciences Liverpool John Moores University, UK

- **Dehydration may impair our immune defences**
- **Hydration status might influence immunity via two main pathways:**
  - **Poor hydration may increase stress hormones, such as cortisol, that are involved in regulating the immune system**
  - **Dehydration reduces levels of saliva and tear fluid, which contain antimicrobial proteins that are involved in immune defence**

Research suggests that dehydration may have a harmful impact on our immune system, according to Professor Neil Walsh. He outlined two main pathways by which hydration status might influence immunity.

Dehydration causes a reduction in blood volume, an increase in plasma concentration, and an increase in the antidiuretic hormone arginine vasopressin – leading in turn to raised levels of the immunoregulatory stress hormone cortisol. Studies have suggested a correlation between fluid intake restriction and elevated plasma cortisol levels.[1,2] While a little cortisol can be a good thing to instigate a healthy immune response, chronic raised levels over many hours, days or longer may be harmful to the immune system, said Professor Walsh.

Dry mouth

Dehydration may also compromise mucosal immunity by reducing saliva and tear fluid production, an important part of host defence. Dehydration induced by exercise and subsequent overnight fluid restriction, for example, leads to a reduction in salivary antimicrobial proteins (secretory IgA, α-amylase, and lysozyme).[3]

'It is pretty clear now that dehydration could influence immunity, firstly by increasing the immunoregulatory stress hormones, […and secondly] through saliva and tear fluid output.'

Professor Neil Walsh

Antimicrobial proteins reduce the likelihood of pathogens entering via the mouth and ocular surface. A reduced level of the salivary protein lysozyme – known to aggregate a variety of microorganisms so helping to remove them from the mouth – has been associated with an increased likelihood of acute exacerbations among patients with bronchitis.[4]

Clinical significance

Professor Walsh said that while this research reveals intriguing insights into the role of dehydration in immunity, further studies are required to determine whether hydration status has a clinically meaningful effect on immunity.

See you at H4H 2021!

Don't miss next year's Hydration for Health conference, to be held on 22-23 June 2021. We hope to be back in our usual popular venue of Evian, France. Keep an eye out for further announcements at **Hydration for Health**. See you there!

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HYDRATION FOR HEALTH.

8. Water intake, hydration and cardiometabolic risk in older Americans (Framingham Study)

– Paul Jacques, USDA Human Nutrition Research Center on Aging, Tufts University, USA

- **Under-hydration due to low daily water intake is linked to higher cardiometabolic risk; but this is yet to be determined in older adults and is the focus of this new study**
- **Examining drinking patterns in older adults may help us understand better the role of beverage consumption in adequate hydration**

Mounting evidence is suggesting a link between under-hydration due to low daily water intake and an increased risk of cardiometabolic disease.[1]

However, so far there is only limited evidence for this association in older adults. Dr Paul Jacques and colleagues have addressed this knowledge gap by examining the role of water intake and hydration on biomarkers of cardiometabolic health in older adults taking part in the Framingham Heart Study. This large-scale US study has followed three generations of families from the town of Framingham, Massachusetts since 1948.

Dr Jacques and his colleagues correlated water intake and hydration levels with cardiometabolic markers in over 2,000 participants – and found some unexpected results.

Full details of Dr Jacques' study are due to be published soon. Keep an eye out for it on the H4H website, **Hydration for Health**.

'Emerging evidence links under-hydration due to habitual low daily water intake to higher cardiometabolic risk. However, this evidence is limited in community-drinking older adults.'

Dr Paul Jacques

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9. Aqua@brain: hydration in acute ischaemic stroke patients

– Alex Buoite Stella, Department of Medicine, Surgery and Health Sciences, University of Trieste, Italy

- **Under-hydration is independently associated with more severe ischaemic stroke at admission and worse outcome at discharge**
- **Over half of patients may be under-hydrated at the time of admission for ischaemic stroke**
- **Stroke patients may not be getting enough fluid intake while in hospital**
- **Sub-optimal fluid intake during hospitalisation may be associated with worse outcomes and higher mortality**

Hydration may play a key role in the recovery of patients who have suffered an acute ischaemic stroke, the H4H 2020 conference heard. Not only is under-hydration associated with more severe ischaemic stroke at admission, but it is also linked to worse outcomes at discharge, research by Dr Alex Buoite Stella has revealed.

Pointing to the rising incidence of stroke as our population ages,[1] Dr Buoite Stella underlined the need to identify and evaluate factors that could affect patients' recovery. Evidence has been emerging to suggest that hypo-hydration is associated with poorer functional and clinical outcome from ischaemic stroke.[2]

'Under-hydration is independently associated with more severe ischaemic stroke at admission and worse outcomes at discharge.'

Dr Alex Buoite Stella

Most of the previous studies have used serum biomarkers to assess hydration. But Dr Buoite Stella and his colleagues have carried out a study using urine osmolality to assess the effects of under-hydration on the outcomes following acute ischaemic stroke. They also measured fluid intake of these stroke patients during their acute hospitalisation phase.

Under-hydration signals worse outcome

Of the 119 patients included in the study, 52% were under-hydrated at the time of admission. The findings suggested that under-hydration was independently associated with more severe stroke at admission, and a worse clinical and functional outcome at discharge, patients being more dependent when they left hospital if they had been under-hydrated.

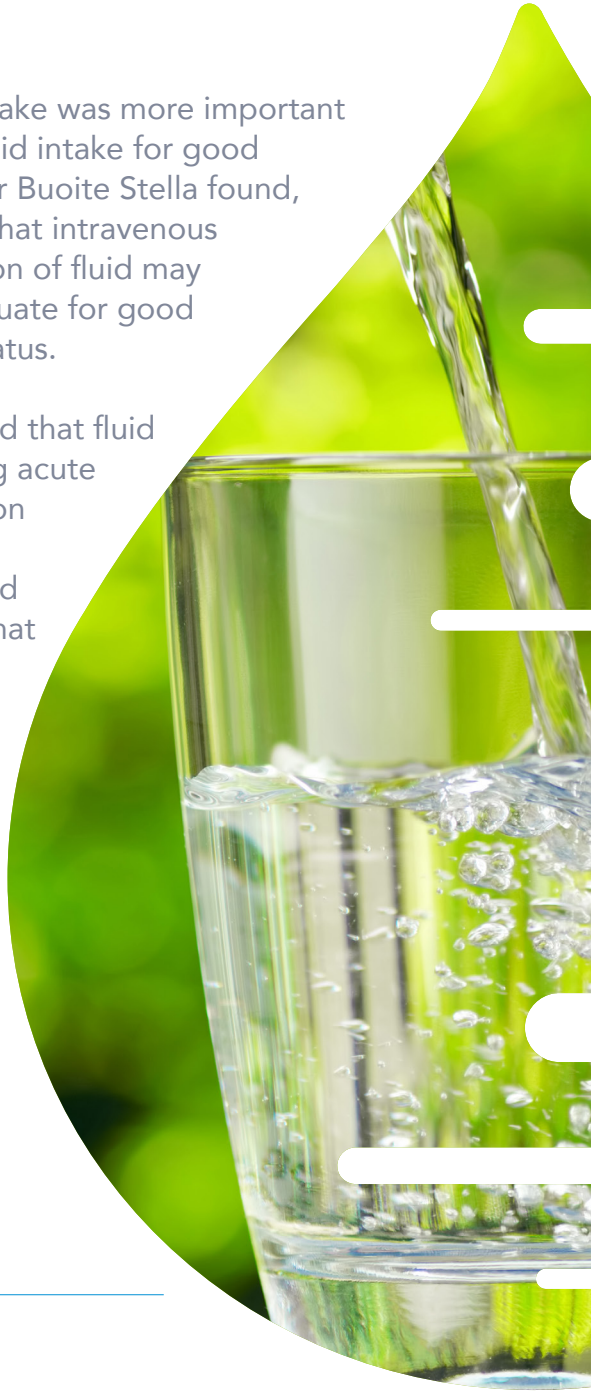
Poor fluid intake while in hospital

Next the researchers assessed hydration status of the patients during their hospital stay. They monitored the patients for up to 10 days in the stroke unit during which time the patients' food and fluid intakes, orally and intravenously, were recorded and all fluid intake was calculated.

Results from 95 patients showed that 56% of those with dysphagia and 41.7% without dysphagia had inadequate fluid intake.

Oral fluid intake was more important than total fluid intake for good hydration, Dr Buoite Stella found, suggesting that intravenous administration of fluid may not be adequate for good hydration status.

He concluded that fluid intake during acute hospitalisation may not be sufficient, and he warned that sub-optimal fluid intake during hospitalisation may be associated with worse outcomes and higher mortality for these patients.[3]



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10. The impact of an increase in water intake to prevent recurrent urinary tract infections in premenopausal women and the benefits for healthcare cost

– Yair Lotan, UT Southwestern Medical Center, USA

- **Recurrent urinary tract infections (UTIs) not only cause pain and distress to patients, but they also take a heavy toll on healthcare resources**
- **Encouraging women to drink water every day is a simple but effective way of reducing recurrent UTIs and the need for antibiotic treatment**
- **A study, as yet unpublished, has investigated the healthcare cost savings that could be gained if healthcare professionals promote increased water consumption with resulting reduction in UTI events**

Regularly drinking water can have exceptional health benefits for women who face major disruption to their lives due to recurrent urinary tract infections (UTIs), according to Professor Yair Lotan.

Drinking plenty of water can reduce the frequency of recurrent UTIs and the use of antimicrobial drugs by nearly 50%.[1] An added bonus from drinking plenty of water may be the subsequent major savings in healthcare costs, Professor Lotan said.

As many as half of women will experience a UTI in their lifetime and one-quarter have recurrent UTIs.[2] In the USA, one-third of women by the age of 24 will have had at least one physician-diagnosed UTI that was treated with prescription medication of antibiotics,[3] and there are concerns that frequent prescribing may contribute to rising antibiotic resistance.

Although they're usually uncomplicated, recurrent UTIs can impair quality of life and carry a risk of more serious infections, such as pyelonephritis.[2]

'In women at high risk for recurrent urinary tract infection, additional water intake over a 12-month period resulted in a 48% reduction in rUTI…'

Professor Yair Lotan

Economic burden

Recurrent UTIs also impose a major economic burden through loss of work productivity and through GP consultations and healthcare costs. Professor Lotan and colleagues have carried out a 12-month study to assess the effect of increased water intake on recurrent UTIs among premenopausal women who usually drink less than 1.5 litres of fluid daily. As a secondary outcome, the cost-effectiveness of increasing water intake for the management of recurrent UTI events was evaluated.

The study has already shown that increasing water consumption can reduce the rate of UTI recurrence in these patients by 48%. Presenting the cost-effectiveness results, as yet unpublished, to the H4H 2020 conference, Professor Lotan said that a significant reduction in cost as well as morbidity associated with recurrent UTIs might be expected by encouraging women to increase their daily water intake.

The cost components of treating UTIs included in the analysis were for urinalysis, urine culture, physician consultation, antibiotic use, and loss of work days. Cost savings per patient of increased water intake was calculated by country, including for the USA, Canada, European countries, Mexico and Indonesia.

Full results of Professor Lotan's study are due to be published soon – look out for details on the H4H website, **Hydration for Health**.

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