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Conclusions of the II International and IV Spanish Hydration Congress. Toledo, Spain, 2nd-4th December, 2015

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Water is the major component of our organism representing about 60% of total body weight in adults and has to be obtained through the consumption of different foods and beverages as part of our diet. Water is an essential nutrient performing important functions, including transport of other nutrients, elimination of waste products, temperature regulation, lubrication and structural support. In this context, hydration through water has an essential role in health and wellness, which has been highly acknowledged in recent years among the health community experts such as nutritionists, dietitians, general practitioners, pharmacists, educators, as well as by physical activity and sport sciences experts and the general population.

- Water needs depend on individual aspects such as age, sex, physical activity, genomic profile and environmental conditions. Seasonality, climate (temperature and humidity), geographical and cultural environment influence the quantity of liquid required to maintain a proper hydration status.
- The daily water requirements set by the European Food Safety Authority (EFSA) are 2 and 2.5 liters per day for adult women and men, respectively, depending on their physiological status, physical activity and environmental conditions. However, the available scientific evidence suggests that most European populations do not meet the recommendations for adequate intakes.
- Hydration status depends on total body water, which is determined by the amount of liquid ingested from food and drinks

as well as the endogenous water production in balance with body losses due to either physiological or pathological status. There is no gold biomarker standard for hydration status but plasma osmolality, urine specific gravity and acute changes in body weight are frequently used but have limitations. There are specific questionnaires to evaluate liquid intakes and outcomes considering at the same time food and drink consumption, dietary habits, pharmaceutical drugs and pathological events, but these have not been scientifically validated yet.

- Common liquid intake measurement methods involve dietary and beverage questionnaires such as beverage frequency, 24-hour recall, diet history over a specific period, food and drink records, classical and photographic beverage record or specific beverage visual guides.
- Hydration status can be estimated among others by urine samples to determine volume (mL/d) and osmolality (mOsm/kg), blood samples, bioelectrical impedance analysis (BIA), equations to predict total body water (TBW) and extracellular water (ECW), and assessment of free water reserve (FWR), which measures urine volume minus the obligatory urine volume. These measures have severe limitations and there is a need for a valid easier and rapid measure of body hydration status.
- Bioelectrical impedance spectroscopy was found by some to predict individual values of total body water (TBW),

extracellular water (ECW), and intracellular water (ICW) more accurately than single frequency bioelectrical impedance analysis at 50 kHz, and may be possibly considered as a suitable methodological approach to estimate these water compartments in very active males and elite athletes, however, considerable more validation is needed.

- Other beverage composition factors should be considered in addition to simple volume of liquid ingested. Alcoholic and non-alcoholic drinks, apart from plain water, contribute to the daily energy intake. The consumer needs to be informed about the nutritional facts of the beverages they consume. Education on labeling interpretation and nutritional needs is required to improve dietary habits. Low- and no-calorie beverages alternatives are better choices for specific populations.
- Consumption preference patterns of different beverages vary considerably depending on age, socioeconomic status (SES), and culture levels. Whichever the factor, they all require an educational approach to spread proper liquid consumption recommendations.
- Education on hydration is an emerging research area that comprises nutritional, exercise, behavioral and biochemical sciences. Due to the demonstrated importance of a proper hydration status for health, life and socioeconomics, hydration educational programs should be included in the health care system as well as in schools and families.
- Special attention should be paid to groups of population at a major risk of dehydration as active athletes, children and adolescents, pregnant and breastfeeding women and the elderly.
- Some children and adolescents may fail to meet their hydration needs due to habitual dietary choices (e.g., low consumption of fruits, limited access to fluids during school day) or because of increased energy requirements from environmental living conditions or heavy physical activity, which may consequently influence mood as well as their performance in curricular and extracurricular activities.
- Pregnant women may be at greater risk of dehydration by not drinking water due to nausea and vomiting. Hydration during pregnancy plays a crucial role to maintain an adequate body water content and for the renewal of amniotic fluid. During breastfeeding liquids intake also influences milk osmolality.
- The normal ageing process is associated with several physiological changes that may affect thirst and drinking behavior, making them more susceptible to dehydration. Studies in hospitalized elderly people suffering from dehydration show an increase in morbidity-mortality of up to 40-70%, while proper hydration reveals considerable improvements in health and hospitalization quality/welfare. It has been shown that 95% of injuries such as pressure ulcers are preventable with proper nutrition and adequate water intake.
- Water consumption affects brain structure and functions and perhaps cognitive performance, particularly when involving motor skills. A better hydration status might help improve mood, attention and mental concentration scores.
- The variety of components (e.g., caffeine, sugar, protein, electrolytes) that are found in popular beverages results in considerable differences in post-consumption urine production. Recent development of a hydration index (HI) classification system estimates the expected fluid retention from 13 common beverages and may be useful in promoting euhydration in the general population. However, only young healthy male subjects have been observed.
- Adequate liquid intake also helps to achieve body weight loss as it has been suggested that it could suppress appetite before meals and be associated with adequate dietary habits (high consumption of fruits and vegetables). Thus, adequate liquid intake could be important for overweight/obese people as a means of weight management attenuating the risk of cardiovascular diseases or diabetes.
- Dehydration has been defined as the second most common comorbidity factor, occurring in 14% of all hospitalizations. In addition to its individual clinical impact, dehydration also represents an important public health issue imposing a significant economic burden: this represents a potential target for intervention to reduce healthcare expenditures and improve patients' quality of life.
- Physical activity has a direct impact on fluid intake. Water needs can increase substantially for more physically active individuals compared to those who have a sedentary lifestyle. Water and electrolyte losses during training and competition reduce the capacity for physical activity, make exercise feel more difficult, and adversely affect sports skills. For those reasons, there is a need for athletes to maintain a good level of hydration by consuming an adequate volume of fluids before, after and during exercise to support sports performance and avoid health risks linked to disruptions in fluid and electrolyte balance, particularly in warm environments, such as dehydration, hyperthermia, and hyponatremia.
- Dehydration accelerates the decline in cerebral blood flow during prolonged and incremental maximal exercise in the heat without affecting the cerebral metabolic rate for oxygen. The reason for this is that the concomitant reductions in cerebral oxygen supply are compensated by increases in oxygen extraction from the brain circulation. Thus, fatigue during prolonged and incremental maximal exercise in the heat is related to a reduction in cerebral blood flow rather than suppression in cerebral aerobic metabolism.
- Fluid ingestion maintains cerebral and extracranial perfusion throughout non-fatiguing prolonged exercise in the heat. During exhaustive exercise, however, maintenance of euhy-

dration via fluid ingestion during exercise delays but does not prevent the decline in cerebral perfusion.

- Although genomic studies on hydration and health are at an early stage and more research is needed, some studies have shown that certain genetic markers are associated with higher fluid intake needs; such is the case of mutations in genes involved in cystinuria and increased water intake for the prevention of kidney stone formation. New research results may provide more data about inter-individual variability in fluid

intake recommendations applied to the so-called precision medicine.

- The majority of food guidelines focused the recommendations of liquid intake on drinking 8 glasses (64 oz/day). These guidelines do not specify for fractioning liquids during a day, for hot environments periods and the life-course approach. Food and hydration guidelines need to be based on daily requirements, with more specificity to age, gender, and environment changes.