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Summary

II National Hydration Congress

Abstract Book

Place: Auditorio José Mª Cagigal
Faculty of Physical Activity and Sport Sciences INEF
Technical University of Madrid
Ciudad Universitaria
C/Martín Fierro 7. 28040 Madrid

II National Hydration Congress

Madrid, November, 28th - 29th, 2011

Organized by:

Coca-Cola Iberia

With the collaboration of Nutrition Societies:

european hydration institute

The Coca-Cola Company Beverage Institute For Health & Wellness

With the participation of Medical and Pharmaceutical Societies:

Sociedad Española de Geriatría y Gerontología

Consejo General de Colegios Oficiales de Farmacéuticos

Fundación Española del Corazón

With the support of Universities and Research Centres:

Universitat de Barcelona

Universidad de Granada

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Speaker: Prof. Dr. Javier Aranceta

Hydration for nutrition in the elderly. Why and how?
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Measuring water balance in the population
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Presentation

This monograph brings together all the scientific content of the II International Hydration and Health Congress that took place in Madrid on November 28 and 29 2011, to present and discuss the latest developments in the field of health and hydration.

Hydration is an area linked to the intake of liquids that aims at creating a homogeneous balance in relation to the needs and physical losses with the aim of achieving optimal body composition.

Water, liquids, and anything that is made up of water in more than 70% of its composition can influence in state of hydration. To this we have to add metabolic water. In general between 2.7 and 3 liters of water balance, of which we should give special focus to children, the elderly, people with chronic diseases, athletes, pregnant women, nursing mothers, workers with physical exertion and any person in a hot environment.

From the available supply to meet the water demand water can choose various formats and other beverages of various features that you can choose according to taste or personal circumstances.

The Pyramid of Healthy Hydration proposed from a consensus of experts coordinated by the Spanish Society of Community Nutrition is a reference to achieve and maintain an adequate hydration status at any time.

People with special needs or that require some control of energy intake should seek advice from a health professional about the most appropriate choice profile. Non caloric drinks can be a good choice in situations of weight control where diet and physical activity play a key role in achieving a healthier weight.

Throughout the different sections of this monograph you will find a scientific review of all these points of interest that we are sure will be very useful.

Our thanks to the initiative of Coca-Cola Spain that aims towards promoting continuing education of health professionals in the field of healthy hydration, nutrition and physical activity.

Dr. Javier Aranceta
President
SENC

Madrid Declaration by the Scientific Committee

Scientific Committee

- **Prof. Dr. Ángel Gil.** Professor of Biochemistry and Molecular Biology. University of Granada. Granada. Spain.
- **Prof. Dr. Andreu Palou.** Professor of Bioquemistry and Molecular Biology. University of Baleares. Palma de Mallorca. Spain.
- **Prof. Dr. Arturo Anadón.** Professor of Toxicology and Pharmacology. Complutense University of Madrid. Madrid. Spain.
- **Dr. Carmen Gómez Candela.** Head of the Clinic Nutrition and Dietetics Unit. Universitary Hospital La Paz. Madrid. Spain.
- **Dr. Claudio Maffeis.** Head of the Unit of Clinical Nutrition and Obesity, of the Regional Centre for Juvenile Diabetes. University of Verona. Verona. Italy.
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- **Prof. Dr. Gregorio Varela Moreiras.** Professor of Nutrition and Bromatology. San Pablo CEU University. Madrid. Spain.
- **Prof. Dr. Isabel Polanco.** Professor of Paediatric. Autónoma University of Madrid. Head of Gastroenterology Paediatric and Nutrition Service. Universitary Hospital La Paz. Madrid. Spain.
- **Prof. Dr. Javier Aranceta.** Associate Professor at University of Navarra. Pamplona. Spain.
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- **Prof. Dr. María Kapsokefalou.** Assistant Professor in Human Nutrition. Agricultural University of Athens. Athens. Greece.
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Scientific secretariat

- **Prof. Dr. Elena Alonso.** Associate Dean of School of Pharmacy. San Pablo CEU University. Madrid. Spain.
- **Prof. Dr. Teresa Partearroyo.** Associate Professor of Nutrition and Bromatology. San Pablo CEU University. Madrid. Spain.

The Importance of Adequate Hydration for Health

Given the growing awareness of the importance of hydration in the global nutritional and scientific spheres, the II National Hydration Congress was held recently in Spain. The event has meant a continuation of the 1st National Hydration Conference held in 2008 within the International Water Exhibition at Zaragoza (in the frame of the EXPO). During this 2nd Congress, Madrid became the European "capital of hydration". More than 400 specialists attended the two day Conference and a total of 23 national and international experts presented, analysed and discussed the latest scientific evidence on hydration and its multidisciplinary benefits for health. Twenty five scientific research papers were in addition presented for the first time on the topic hydration and health.

In recent years, the scientific community has started to promote a higher awareness of the importance of adequate hydration as an essential nutritional element for optimal health. At present, it is a major area of study that requires an all encompassing approach and from different perspectives. Therefore, the II National Hydration Congress gathered experts/specialists from different disciplines and areas related to hydration, health, nutrition, physical activity and sports.

For decades, most health professionals have focused their attention on the needs and contribution of nutrients, leaving water mostly at a secondary level. Nevertheless, we cannot overlook the importance of water as the essential nutrient, second only to the air we breathe. About sixty percent (60%) of our body is water, although with marked differences regarding age and gender. These differences between individuals may be from about 4070%. Without water, the other nutrients cannot fulfil their goals. The water we consume from food and beverages act as a transport for nutrients and a vehicle to eliminate toxins and other substances. Without a doubt, there is now a greater understanding of the benefits of liquid intake. This is reinforced by the recommendations of international institutions and organizations which state that water intake must come from different sources: food and drinks.

But as mentioned during the Congress, there is still a scientific gap in many aspects related to hydration and a need for target research. Therefore, we must continue delving into one of the most relevant and new study areas of nutrition, and broaden our current knowledge in order to contribute to the health and wellbeing of the population but also to their quality of life. In this respect, several studies have shown that a substantial part of the population does not know the amount of liquid they should consume to ensure they meet their liquid requirements (60% of Spaniards admit hydrating only when thirsty and that could well mean already some dehydration).

For all those reasons, the Scientific Committee in charge of the II National Hydration Congress has drawn up a declaration to guide and cover the most relevant and commonly agreed critical issues discussed during the conference with a view to gathering the main recommendations offered by national and international experts during this global forum of knowledge.

The II National Hydration Congress was organised by Coca-Cola Spain and received support from the most important Medical and Nutrition Societies and Foundations, and Universities of Spain. In particular, the Technical University of Madrid (UPM) and the Faculty of Physical Activity and Sports Sciences INEF (hosts of the conference), the Spanish Nutrition Society (SEN), the Spanish Society for Community Nutrition (SENC), the Spanish Nutrition Foundation (FEN), the Iberian American Nutrition Foundation (FINUT), the Spanish Academy of Nutrition and Food Science (AEN), the Foundation for Nutritional Research (FIN), and the Network for Research on Physical Activity and Health for Special Populations (EXERNET). In addition the European Hydration Institute (IEH) and the Beverage Institute for Health & Wellness of The Coca-Cola Company contributed to the Conference.

Moreover, the II National Hydration Congress featured the participation of the Spanish Association of Gastroenterology (AEG), the Spanish Society of Digestive Disease (SEPD), the Spanish Society of Gynaecology and Obstetrics (SEGO), the Spanish Society of Geriatrics and Gerontology (SEGG), the Spanish Society of Primary Care Doctors (SEMERGEN), the Spanish Society of Family and Community Medicine (SEMFYC), the Spanish Federation of Sports Medicine (FEMEDE), the General Council of Official Pharmacists Association (CGCOF), the Spanish Heart Foundation (FEC) and the Diabetes Foundation (FD).

Other institutions providing support included the University of Las Palmas de Gran Canaria (ULPGC), the Autonoma University of Madrid (UAM), San Pablo CEU University from Madrid, the University of Barcelona (UB), the University of Granada (UGR), the University of Castilla La Mancha (UCLM), Camilo Jose Cela University of Madrid (UCJC), Complutense University of Madrid (UCM), the National Sports Council (CSD), the Research Institute of La Paz Hospital, the Foundation Institute of Biomedical Research and Technology Development (INBIOMED), the Alzheimer CITA Foundation, Centre for Research and Advanced Therapies for Alzheimer's Disease, Biopolis S.L. and the Nutrition and Food Technology Institute of UGR.

Fundamentals Principles of the Madrid Declaration

Adequate liquid intake

Adequate hydration is a prerequisite for life and quality of life at any age.

In order to maintain the adequate hydration levels and to prevent a potential dehydration case, people must drink regularly and not wait to feel thirsty. When thirst appears, there may be already a certain degree of dehydration in the body.

Liquid balance is essential for adequate thermoregulation and maintaining healthy cognitive and physical functions according to the European Food Safety Authority (EFSA). It is advisable that liquid balance is obtained through various sources. All food and drink with water content are a source of hydration. Variety in liquid intake can easily help people to reach adequate levels of hydration. Besides water, it is recommended to drink other liquids and drinks of different flavours as their consumption is easier and more pleasant, such as non-caloric and caloric soft drinks, fruit juices, tea, coffee, milk, soups and foods with a high liquid content such as fruit and vegetables.

The concept of hydration is a new element in eating habits. It is imperative to educate the population and train them on how to maintain a hydration state that meets their individual needs and which will vary according to gender, physiological state, physical activity and sports. The environment and each person's state of health..

Population groups which require special attention

Several life stages (or physiological states) are particularly important for adequate hydration such as childhood, pregnancy, breastfeeding and elderly people (especially when presenting an illness).

- Children: In early life, breast milk covers most of the infant's water requirements for the first six months of life. But additional water requirements are required, especially during the warmer periods of the year. For toddlers and children, water and other liquids must be offered during the day to prevent dehydration, especially in hot periods or environments. Contrary to previous thinking, children do not have a lower tolerance to heat. But they should be aware of the risk factors, especially when playing or when doing physical activities in hot environments and therefore drink properly.
- Elderly: Older people are encouraged to drink water and other liquids regularly. The thirst sensation diminishes with age and it is not possible to reach a correct state of hydration only through water in the food. Hydration in the elderly is especially important as now 10% of emergency medical visits in this population are related to dehydration problems with associated ailments or complications of preexisting pathologies. Therefore, it is necessary to supervise and promote their liquid intake. A good way to do it is through the variability of the liquids they take, since a pleasant taste can help reach optimum levels.

  The sweat pattern depends on the individual's physiology and therefore the hydration pattern must adapt to each person's makeup and will also depend on the environment, the ambient temperature and the practice of physical activities and sports. Relative humidity and clothing or equipment used must also be taken into account.

  Heat stroke poses a risk to the health and the life of individuals, mainly children, the elderly and especially professional athletes or highly trained sports people. Nevertheless, training does not prevent hyperthermia and it is necessary to increase liquid intake in those cases.

Hospital setting

In the hospital setting, the protocols for maintaining adequate hydration are not working, mainly in the at-risk population. Hospital protocols must be improved in order to reduce the degree of dehydration in patients who arrive and are admitted to the hospital and of those already admitted due to other pathologies and who must maintain adequate hydration. Changes in these protocols are likely to be of benefit to hospital patients.

Alzheimer's disease develops after a long preclinical phase with a deposit in the cerebral cortex and subcortical grey matter of betaamyloid and neurofibrillary tangles consisting of tau protein but no symptoms. The cognitive performance of these patients is influenced by their level of hydration.

Physical activity and sport

Athletes must hydrate properly before, during and after practising sports. Dehydration during physical exercise is frequent because many athletes only consume liquids when thirst reminds them that they need to drink. During intense physical exercise, the body can reach a certain degree of dehydration before the sensation of thirst appears and there already has been a considerable loss of fluid.

Together with water and in lengthy competitions, athletes must hydrate with specific drinks that contain an adequate composition of carbohydrates and electrolytes. These enable accelerated rehydration, stimulate liquid absorption, provide carbohydrates for the muscle function and help with recovery after exercise.

Athletes must pay particular attention to the necessary intake of sodium, the electrolyte most lost in sweat and fundamental for cell fluid balance. Drinks with sodium help prevent hyponatremia, the decrease of sodium concentration in the plasma below 136 mEq/L that can appear after intense physical exercise and exclusive hydration with water.

To fight the feeling of fatigue and reach optimum performance, liquid containing between 4 and 10% carbohydrate with a high glycemic index is recommended.

For elite athletes in general and those who carry out team sports in particular, hydration is one of the parameters that medical experts analyse day-to-day. Liquid intake in these athletes is constant during training and competition and after them for an adequate recovery. Adequate hydration favours the physical and mental performance of the athlete.

While exercising, it appears that the priority is to send blood to the active muscle to enable the right degree of hydration in that muscle rather than carry heat to the skin.

Hydration at the workplace and cognitive performance

Among the different nutrients known to affect brain performance are the level of hydration, the concentration of plasma sodium (with risks of hyponatraemia caused by lengthy exercise), B group vitamins (especially folic acid and vitamin B12, which in case of subclicnic deficiency raise the levels of homocysteine) and omega3 polyunsaturated fat and other substances such as antioxidants and caffeine.

Being dehydrated by as little as 2% can affect negatively the attention span and work performance, impairing productivity and the risk of accidents. Mild and moderate dehydration states affect the cognitive execution of attention tasks (alertness and psychomotor). Immediate or short term memory and subjective assessments (alertness, fatigue, strain to perform) are affected with dehydration being doses-dependent.

It is important to consume liquid and water from food periodically and during short breaks throughout the working day.

Identified research needs

Dehydration can be mild, moderate, or severe based on how much of the body's fluid is lost or not replenished. When it is severe, dehydration is a life-threatening emergency. It is classified according to weight: mild (less than 5%) and severe (more than 10%). Dehydration has been thoroughly studied, but not moderate dehydration (5-10%). We need intervention studies in order to establish specific recommendations. There aren't any studies that have assessed the impact of moderate dehydration when carrying out physical activity, at higher temperatures.

In normal situations and while doing physical activities or sports, thermoregulation in cold environments has been much less studied than in hot atmospheres. The liquid intake requirements to maintain adequate hydration in these cases is unknown.

It is necessary to study the physical strain needed for a specific professional activity in addition to the environment (temperature and humidity) and equipment (which in many cases does not allow transpiration and favours fluid loss through increased sweat levels). All these factors added to individual features dictate the liquid requirements of each person and position.

New research which enables us to be more precise with respect to the flexibility limits of the response to water loss mostly due to sweat and urine, and the thresholds considered healthy is necessary. On the other hand, we need studies which enable us to set the recommended maximum intake that does not alter or modify the levels of electrolytes or minerals in plasma.

For all those reasons, it is important also to identify new fluid status biomarkers that can offer reliable information on the state of hydration and the good functioning of the relevant homeostatic systems. It is also necessary to continue deepening our knowledge of the variability sources (genetic and epigenetic) related to individual requirements.

Hydration in a football team: elite sportsmen

Chairman: Prof. Dr. Daniel Ramón

Hydration in a football team: elite sportsmen

Luis Serratosa

Sanitas Real Madrid FC Sport Medicine. Department Head of Rehabilitation and Sports Medicine at Quirón Hospital. Madrid, Spain

Abstract

In order for all the metabolic pathways to work to perfection, an adequate state of hydration is crucial. A moderate degree of dehydration of only 2% of the body weight can affect the players' physical performance, technical abilities and movement patterns.
Therefore, it is necessary to insist that the players drink enough liquid (water or sports drinks with carbohydrates and electrolytes) mainly in between the main meals and during training and matches. In team sports, the negative effects of dehydration are higher than in other specialities, since they can affect both the physical performance and the mental qualities related to concentration and decision making. Also, insufficient hydration poses a clear health risk to athletes, who can be more prone to suffer hyperthermia or heat stroke.

Although it is true that in most sports the risk of dehydration is higher in hot settings, it has been shown that athletes of both open air and indoor sports can reach significant levels of dehydration at colder temperatures. This is because in those conditions the athlete does not drink a sufficient quantity of liquid. We should also bear in mind the possibility that the athlete may start a training session or match already dehydrated to a certain degree.

As a general rule, the following recommendations can help: 1/2 litre of water in the hour or hour and a half prior to the training session or match, 150 ml every 20 minutes during training or at game stops during matches and 400 to 500 ml at statutory rest periods. Simple strategies such as to individualise the players' bottles allow monitoring of their liquid intake and reduce the risk of transmitting infectious diseases. During training sessions, it is not difficult to establish rest periods every 20 minutes and in fact the players themselves promote adequate rehydration practices during those periods which are also useful for recovery and instructions.

Nevertheless, the matches are subject to certain rules and players must benefit from time-outs and stops for injuries or other causes in order to drink. After training sessions or matches, the best method for sufficient replacement is to drink a volume equal to 1.2 to 1.5 times the lost body weight. The colour of urine can also serve as an indicator for monitoring the return to an adequate state of hydration. As the state of hydration improves, the urine becomes clearer and less dense. Over the last few years, some football teams have started monitoring the density of their players' urine before training sessions in order to guarantee optimum performance and to prevent risks to their health. As per the type of drink, we will simply recommend water or preferably sports drinks with carbohydrates and electrolytes when the exercise extends over 1 hour or 45 minutes of sufficient intensity. Although it is true that in shorter sessions and less straining or intense sports it might not be necessary the use of sports drinks, it has also been shown that these are frequently more useful when it comes to motivating athletes to hydrate better. When talking about electrolytes we must highlight the importance of sodium since it favours the retention of the liquid consumed and for the role that it can play in the predisposition to suffer muscle cramps in athletes with high concentrations of sodium in their sweat.

Key words: hydration, dehydration, sweat, sports, performance.

Nutrition, hydration and health

Chairman: Prof. Dr. Ángel Gil

Hydration in infancy and childhood

Isabel Polanco

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Abstract

Between 60 and 80 per cent of the infant body weight is water, which explains its high requirements (150 ml/kg/day). At the same time the amount of water relates to the calories at the rate of 100 ml for each 100 kcal. This carries the infant need a water intake of between 10 and 15% of their body weight, while in the adult it is only 2 to 4%. In fact, proportionately an infant needs 2 to 3 times more water than an adult. The main sources of water are milk, breast milk or reconstituted formula milk, the water of drinks, juices and water used in food preparation.

The water consumed by infants, as well as absence of pathogenic organisms, must meet certain characteristics as regards its composition, primarily with regard to minerals.

In infants less than 3-4 months sodium excretion capacity is reduced, due to their lower speed of glomerular filtration. For this reason, and to prevent saline overload is necessary to restrict the salt content of the start formulas, so that it must be less than the cow's milk content and similar to breast milk.

For formulations of adapted milk, the ESPGHAN recommends as limits values of 12 mEq/l (1.76 mEq/100 kcal) for sodium and 50 mEq/l for the total amount of chlorine ions, sodium and potassium.

It must be borne in mind that the final composition of the reconstituted milk is determined by both the formulation and the water used for its reconstitution. The maximum value for the concentration of sodium in the water that ensures to properly reconstitute all start formulas in Spain is 25 mg/l. In a high percentage of populations, the tap water exceeds this maximum amount of sodium, especially in coast locations.

Natural mineral water of low mineralization is a good option to ensure that the reconstitution of milk remains low levels of sodium, and the rest of mineral salts. So, this water shall contain less than 25 mg/l of sodium. The importance of nitrates lies in its reduction to nitrite. These have as main toxic effect the oxidation of haemoglobin to methaemoglobin, unable to transport oxygen. The highest concentration of nitrates established by the World Health Organization in drinking water is 50 mg/l.

Water from boiled vegetables contains a high concentration of nitrates; therefore the preparation of infant formulas with this water poses a risk of methaemoglobinemia. Therefore, that this custom is totally discouraged.

The purification of tap water achieves a reduction of 99.9% of the risk of infection from E. coli, rotavirus, hepatitis A and poliovirus type 1, but fails to inactivate possible cysts of Giardia lamblia and Cryptosporidium. That is why the WHO recommends boiling water for 1 minute, adding 1 minute for every 1,000 m above sea level. An alternative to the boiling of drinking water is the use of bottled natural mineral water of low mineralization as it is free from viruses, bacteria and protozoa, as well as ensuring a proper concentration of salts.

Key words: childhood, hydration, infancy, water.

Hydration at the work site

Javier Aranceta

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Abstract

The water in drinks and in the food we eat must guarantee adequate hydration at any age or circumstance as a key element for a good state of health. Water requirements vary greatly according to the age, sex, environmental conditions and different circumstances such as physical activity and sports practice, workplace and health condition. There must be a balance between the input of water through drinks, foods, metabolic or oxidation water and the loss of water through the kidneys, lungs, skin and stools. All types of food contain water but those with the highest content are fruit and vegetables, and dishes with high water content (soup, stock, puree, shakes, etc.).

The biggest losses come from the kidneys and can be calculated to around 1,500 ml/day. In certain conditions, sweat can be very important, depending on factors such as high temperature, high humidity, physical exercise, clothes and fever. Water loss of between 300 and 400 ml/day through the lungs is considered normal although other factors such as physical exercise, cold climate, fever and sweat can increase that quantity. There are occasional losses due to certain pathological conditions either through the digestive pathway (diarrhoea and vomits), lungs (fever and hyperventilation) and the skin (burns and septic processes with hyperthermia). The intake and loss of liquid is compensated daily. Nevertheless, there are certain situations where physical work

can mismatch the balance and many hours are needed to replace the lost liquid.

Besides the water loss and in case of severe losses, there is also an important loss of electrolytes. The secretion of sweat during exercise in a hot climate can surpass 1 litre/hour with an additional loss of sodium of between 35 and 50 mmol/l (0.8 g/l to 1.1 g/l) and other electrolytes. Thirst allows the individual to replace the lost fluid over short periods of time. But this mechanism is not an adequate guide for the intake of water in babies, athletes, workers and the most ill and older people. In these cases it is recommended that times and formats for the intake of water and liquids are established. The National Academy of Sciences has established the correct daily intake of water at 3.7 L and 2.7 L in men and women, respectively, an amount that can vary depending on other factors already described. The amount of sweat loss during physical exercise in a hot climate depends on the intensity and duration. The greater heat, the greater the amount of liquid the body needs to keep cool.

There are many work activities that demand a level of high effort and on many occasions are done in hard and extreme climate conditions. Important fluid and electrolyte losses can be observed in jobs in the mines and certain construction trades, farming, the steel industry and fishing. Therefore, it is highly recommendable to replace the adequate amount of liquids during the day with a pattern included in the work protocols according to the type and intensity of work. The Healthy Hydration Pyramid of Spanish Society of Community Nutrition (SENC) can help us establish an adequate and convenient hydration strategy.

Key words: hydration, water, liquids, nutrition workplace.

Hydration for nutrition in the elderly. Why and how?

Gregorio Varela-Moreiras

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Abstract

The world's population of adults aged 60 years and over is increasing predicting older people to outnumber the young by 2050.Overall dietary and drinking patterns have been associated with health and longevity. The enjoyment of food & beverages and nutritional well-being, along with other environmental factors, has a clear impact on health-related quality of life. Nutrition is one of the major determinants of successful aging: low risk of disease and disease-related disability, high mental and physical function, and active engagement of life. The consumption of poor-quality diets can result in inadequate energy and essential nutrient intakes, resulting in malnutrition. The key predictors of malnutrition are loss of appetite and anorexia. Dehydration, a form of malunutrition, is a major problem in older adults. Fluid intake is critical for maintaining vascular volume, regulating body temperature, removing waste from the body, and supporting cellular homeostasis. Dehydration is a frequent etiology of morbidity and mortality in elderly people. With the increase in life expectancy, the leading causes of death have shifted from infectious diseases to non-communicable diseases and from younger to older individuals. Dehydration is one of these causes, resulting in the hospitalization of many patients and often in fatalities. Dehydration is often linked to infection and if it is overlooked, mortality may be over 50%. Maintaining hydration is important because of the close relationship between cell hydration and cell function. Two factors are involved in dehydration: diminution of liquid intakes and augmentation of liquid losses, since the quantity of water is adjustable by thirst and since the thirst sensation diminishes with aging. Apart from these physiological modifications, the most frequent risk factors are all difficulties limiting access to drink: diminution of functional status, also of mobility; visual problems; confusion or other cognitive alterations that lessen communication capacities; medications that increase dehydration risk (diuretics, laxatives, and sedatives); acute pathologies with fever or those that cause difficulties in swallowing or provoke diarrhea and/or vomiting. Two lesser-known etiologies must be also emphasized: the decrease of dietary intakes in the elderly and water is taken in as food water content, water produced by food oxidation, and drinking. The other etiology is the fear of incontinence.

How to achieve a good hydration status?. It is necessary to inform elderly people about the necessity to drink enough, even if they think it is not necessary. Elderly people should be informed about the wide variety of beverages available. They can also be instructed to increase fluid intake by consuming water-containing foods such as fresh vegetables, fruit, fresh cheese, and yogurt. The elderly should be advised to drink often more rather than drinking large amounts at one time, since gastric distension quickly decreases the sensation of thirst. In cases of swallowing or dysphagia problems, flavoured gelatine is an option. When the elderly person is dependent, the role of caregivers and health care professionals is extremely important. The main problem, at home as in the hospital, is to have access to water for patients who have poor mobility or altered cognitive status. In the hospital or nursing home, the role of the medical staff is very important and consists of preventing dehydration by giving water and food regularly and increasing the amounts given as soon as an event occurs that could be a dehydration risk factor. In spite of efforts to encourage the elderly to drink and to adapt to the person's needs, it can still be impossible to achieve sufficient fluid intake. The same problem is encountered with food and appetite dysfunction. And important to remember: the key for a successful aging is a good hydration status.

Key words: elderly, hydration, dehydration, aging, nutritional status.

Evaluation of the hydration status Requirements, diet surveys and biomarkers

Chairman: Prof. Dr. Andreu Palou

Measuring water balance in the population

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Abstract

Water balance is linked with optimal physical and cognitive performance, while dehydration or hyperhydration, i.e. deviations from water balance, have important health implications. It follows that water balance, consisting of estimations of water intake and water loss, is a measurement of public health interest far more important than the measurement of water intake alone.

Water intake includes approximately a 20% contribution from solid foods and 80% contribution from fluid foods and drinking water. This suggests that although water intake is mostly driven by thirst, it depends to some extent on dietary choices and eating and drinking habits. Water loss consists mainly from excretion of water in urine, feces and sweat. The contribution of sweat in water loss is higher in a physically active person and in hot climates. Therefore this component is highly variable depending on the lifestyle of the individual and on environmental conditions. This suggests that seasonality maybe an important factor that must be taken into account in studies on hydration.

Information regarding water balance in various population groups is limited. One reason may be that the methodology available for the direct measurement of water intake and loss is rather complicated and therefore not easily applicable in large number of volunteers. A practical research tool that facilitates the collection of such data is the Water Balance Questionnaire that thoroughly evaluates water intake and loss through appropriately designed questions. Despite errors linked to recalling or to estimating of portions of intake, or amount of water lost in sweat, urine and feces, the WBQ records relatively accurately water balance as shown by validation against urine hydration indices (24h volume, osmolality, specific gravity, pH, colour) and by testing of repeatability in 175 participants.

The Water Balance Questionnaire (WBQ) was used to evaluate water balance, estimating water intake and loss in summer (n=480) and in winter (n=412) on a stratified sample of the general population in the area of Athens, Greece. In winter the mean water balance was -63±1478 ml/day, water intake was 2892 ± 987 ml/day and water loss 2637 (1810, 3922) ml/day. In summer water balance was -58 ± 2150 ml/day, water intake was 3875 ± 1373 ml/day and water loss 3635 (2365, 5258) ml/day. In winter, approximately 24% of water intake comes from solid foods, 50% from drinking water and 26% from beverages. Regarding water intake from beverages in particular, approximately 13% comes from fruit juice, 14% from refreshments, 13% from milk/chocolate milk, 9% from tea/herbal infusions, 25% from coffee, 1% from isotonic/energy drinks, 1% from milkshakes/sherbets and 23% from alcoholic drinks. In summer, approximately 15% of water intake comes from solid foods, 61% from drinking water and 24% from beverages. Regarding water intake from beverages in particular, approximately 14% comes from fruit juice, 11% from refreshments, 22% from milk/ chocolate milk, 9% from tea/ herbal infusions, 33% from coffee, 1% from isotonic/energy drinks and 1% from alcohol.

This study showed that in summer water needs were higher than those in winter because in summer water loss, mainly through sweat, was approximately 1000 mL more than that in winter. This amount was balanced, on average, by increased water intake from various sources. Moreover, there was difference in the data distribution in winter and summer: in summer more participants were falling in the low and high water balance categories suggesting that it was more difficult to achieve water balance in summer than in winter.

The differences in data reported for summer and winter in water intake, water loss and water balance suggest that seasonality is an important factor when conducting water balance research, particularly in Mediterranean countries.

Key words: water balance, liquid intake, water loss, winter, summer.

Methods for evaluating of hydration status

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Abstract

Hydric balance is regulated through complex mechanisms based on interaction between neuroendocrine and renal responses, established over hundreds of thousands of years of evolution as hunter-gatherers in extremely difficult environment settings. Our evolutional origin in areas with intense African heat, together with the need to carry out an intensive physical activity for hunting

and, obviously, the high quality protein found in game meat, increased dopamine (key for thermoregulation) and triggered the expansion of the most modern and complex areas of the human brain (dopamine is the most highly concentrated neurotransmitter in the prefrontal cortex) (Previc FH and *cols.,* 2009). Thermoregulation was an indispensable factor of our adaptation to the environment. In fact, the increase in size, from the most primitive primates, (Australopithecus), to Homo habilis and heidelbergensis, was based linearly on better thermoregulation (Ruff CB and *cols.,* 2005). This special feature of our species (the ability to cope with high ambient heat) allowed us to hunt during the day without having to compete with more specialised hunters (with nocturnal habits).

Key elements of the presentation

- The evaluation of the state of hydration is most important in athletes and warrants appropriate attention.
- It should be understood that all techniques for evaluating the state of hydration only offer a singular measurement to represent complex and dynamic matrix of fluids interconnected in different compartments.
- There is no ideal standard measurement.
- In the laboratory, precision and reproducibility of the measurement must be observed in particular.
- For field measurements there are easily used, portable, secure and economic techniques.
- The most efficient measurement, and one that comprises the elements above is the serial measurement of morning weight. Light yellow urine, of normal volume, is a useful indicator of hydration that complements the subsequent weight measurement.

Lab techniques

Measurement of total body water and fat free mass through isotopic dilution techniques. The indicator is D2O, deuterium oxide or heavy water. This method achieves results with an error factor lower than 1 litre.

Field techniques

Shirreffs (2000) mentions several markers with which we can estimate the level of hydration of a person:

- Body mass (Grandjean and *cols.,* 2003). To estimate the level of hydration, we can assume that a change of 1 g in body mass represents a change of 1 ml in the state of body water (taking into consideration the sweat density equals 1.0). Different methods have been described to collect excreted sweat from specific areas of the skin through gauzes during physical exercise (Alvear and *cols.*, 2003).
- Urine indexes (Grandjean and *cols.,* 2003). Mainly volume, osmolarity and specific density. Athletes have used the measurement of the volume of excreted urine and observation of the frequency of urination. The colour of urine is also used to assess the level of hydration of a person although it can be affected by other factors such as food, medicine or disease.
- Blood indexes (Kargotich and *cols.,* 1998; Mitchell and cols., 2002). The relationship between the level of hydration and the concentration of haemoglobin, hematocrit, osmolarity of plasma, sodium concentration, protein and several hormones such as testosterone, adrenaline, noradrenaline and cortisol has been subject to study.
- Bioelectric impedance (BIA) (Thompson and *cols.,* 1991). This technique can offer a quick estimate of total body water and its intracellular division when using a multi frequency device. Changes in the state of hydration during exercise can be detected if the process is carefully regulated but the precision and sensitivity of this method is not yet standard.
- Heart rate and blood pressure (Rizzatti and Romero, 2001). There have been alterations in both parameters due to posture changes in clinical dehydration and rehydration settings. Nevertheless, they do not seem to be sufficiently sensitive now to be a value associated to exercise-induced dehydration.

Against all these measurements, body weight has proven to be a sensitive, precise and easily measured indicator of the state of hydration when measured periodically and in standard conditions. Quick losses of body mass are almost always due to changes in total body water. Nevertheless, it should be kept in mind that in athletes several factors such as a surcharge of carbohydrates can alter this concept. On the other hand, mild alterations in the state of hydration are difficult to measure because the body is constantly straining to maintain the plasma volume and recover homeostasis (Grandjean and *cols.,* 2003).

Key words: hydration status, body water balance.

Different hydration recommendations around the world

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Abstract

While evaluating the state of hydration of individual and groups, one of the simplest methods would be to compare actual fluid intake with what is recommended. Although the use of biomarkers is a very reliable method in terms of the specific state of hydration, the vicinity or the distance between usual consumption and recommended intake is undoubtedly interesting even if it requires fluid intake recommendations.

A major official effort at recommending water intake for different subpopulations occurred as part of the efforts to establish Dietary Reference Intakes in 2005, as reported by the Institute of Medicine of the National Academies of Science. Nevertheless, given the extreme variability in water needs that are not solely based on differences in metabolism, but also on environmental conditions and activities, there is not a single level of water intake that would assure adequate hydration and optimum health for half of all apparently healthy persons in all environmental conditions. This makes it impossible to estimate an average requirement for water, which is a necessary step to determine recommended intakes (RI). Thus, an adequate intake (AI) level was established in place of a RI for water. This reference represents the average intake in a healthy population with specific characteristics that maintains an apparently adequate and healthy hydration.

The Food and Nutrition Board Panel on Dietary Reference Intakes for Electrolytes and Water (2005) established that the adequate water intake for adults >19 years of age is 3.7 L/day for men and 2.7 L/day for women, which is associated to a fluid intake pattern of 3 L/day and

2.2 L/day, respectively. The recommended intake in men of 14-18 years of age, pregnant and nursing mothers is slightly higher.

Another approach to the estimation of water requirements, beyond the limited usefulness of the AI, is to express water intake requirements in relation to energy requirements in mL/kcal, keeping in mind that both body size and activity level are crucial determinants of energy expenditure and also modify fluid requirements. The European Food Safety Agency refers positively to the possibility of expressing water intake recommendations in mL/kcal as a function of energy requirements. The most general pattern recommends 1 mL/kcal and slightly more for nursing mothers and small children (1.3-1.4 ml/kcal). The recommended fluid intake related to body weight is 150 mL/kg/day for healthy nursing babies and about 30 mL/kg for adults.

It is important to note that, although water is quantitatively the most important and essential nutrient (its absence leads to death the fastest), only a few countries include water on their list of recommended nutrients. At present, only the United States and Germany provide AI values for water. The European Food Safety Authority is developing a standard for all of Europe.

Some scientific evidence relates adequate hydration to survival, health promotion, improvement of physical and mental performance, and better safety and productivity at work, and has led the International Life Sciences Institute (ILSI) to establish, at the Hydration and Health Promoting Conference, that water is essential for life but the perception of thirst does not guarantee adequate hydration and therefore taking a variety of drinks (water, milk, tea, coffee, juice, soft drinks, etc.) and eating foods with a high water content (fruit, vegetable, soups, dairies, etc.) may help achieve the requirements and such products can be selected according to the needs and preferences of each individual.

Keeping in mind the high frequency in which insufficient water intake is observed and the ignorance by the population on the recommended intake, it is necessary to have an order and a regulated pattern with regard to the recommended daily intake of fluid, besides the need of a reference in order to evaluate the intake of liquids by different groups.

Key words: hydration, consumer guides, recommended intake, reference intake.

Hydration, physical activities and sports

Chairman: Prof. Dr. Marcela González Gross

Critical aspects of thermoregulation

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Abstract

The ability to exercise when it is hot depends on replacement of lost liquid to prevent dehydration. The rate at which water and substrates can be replaced during exercise is limited by the gastric emptying and intestinal absorption. Even though it is not clear which of them is the limiting process, it is generally assumed that the gastric emptying rate determines the maximum rate of provision of liquids and substrates. Most athletes do not drink enough to counter the loss of sweat during exercise. This is in part because the thirst stimulus appears later, after having already lost about 2% of the body weight. In any case, this level of dehydration is enough to affect performance in sport and thermo regulating ability. It should be considered that excessive consumption of liquids with low sodium content can provoke hyponatremia during long periods of exercise. Also, water consumption in post-exercise recovery can lower the concentration of plasma sodium and plasma osmolarity, reducing therefore the thirst stimulus and increasing urine production, which will delay the process of rehydration.

Among the complications derived from an excessive increase in body temperature are: (1) muscle cramps due to alterations in the Na-K ratio at the muscle membrane, and dehydration; (2) exhaustion due to heat, thought to be caused by a lack of efficiency of the circulatory adjustments during exercise in a hot setting, which entails a significant reduction of extra cellular liquid due to an excess of sweat, the prelude to heat stroke. And (3) heat stroke, basically the failure of the temperature regulating mechanisms, causing elevated body temperature (>40ºC). In absence of immediate treatment, it can lead to death as a result of a circulatory collapse with damage to the central nervous system.

It has also been reported that hypo hydration exacerbates the hormonal catabolic response during aerobic endurance exercise, with more marked increases in plasma concentrations of cortisol and catecholamine, tempering also the response of testosterone.

On the other hand, dehydration seems to encourage muscle micro lesions when carrying out power exercise with a high eccentric component in high temperature settings.

In a different scope such as occupational health, dehydration can adversely affect the worker's productivity and his or her mood. It is recommended that workers replace liquids frequently (250 ml each 20 min.) when the setting is adverse in terms of heat.

During aerobic exercise in a hot setting (for instance, desert racing), some authors recommend adding vitamin supplements (vitamins C, E y β-carotene) and multi minerals in order to minimize the oxidizing stress in athletes who perform exercise in extreme conditions.

Finally, exhaustion and heat stroke pose a problem to soldiers when training and combat operations take place in a hot setting. The prevalence of heat stroke among these individuals is high. Both the recommendations of adequate rehydration and correct clothing for these settings are extremely important elements for debate.

Key words: thermo regulation, liquids, dehydration, muscle damage, heat stroke.

Thermal stress and dehydration in aerobically trained and untrained populations

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Abstract

The objective of this review is to gain an understanding of the factors that may lead to excessive hyperthermia during exercise in the heat, particularly in the healthy but unfit population. Excessive hyperthermia during exercise in the heat induces fatigue and could lead to heat injury. Furthermore, heat exhaustion episodes may deter some individuals from engaging in exercise and thereby prevent them from receiving the associated health benefits. By understanding the factors that can lead to hyperthermia, recommendations can be made to attenuate their impact. Several factors have been shown to alter the thermal response to exercise such as: exercise intensity and mode, environmental conditions (heat, humidity and air flow), hydration status (rehydration or no fluid allowed) and body characteristics (mass, surface and composition). These factors may have a different impact on trained versus untrained individuals during exercise in the heat. This review will focus on situations of submaximal exercise during environmental conditions where heat dissipation is greatly dependent on sweat evaporation (> 33ºC dry-bulb).

During prolonged exercise in the heat, fluid ingestion is recommended to prevent excessive heat accumulation and cardiovascular drift. These recommendations are based on studies conducted in endurance-trained individuals exercising at moderate intensities in a hot environment (> 29ºC). Fluid replacement advices are given to exercisers regardless of their training status. Individuals with low aerobic capacity have reduced sweat rates and skin perfusion during exercise as compared to trained individuals. Therefore, it could be speculated that rehydration in untrained individuals may derived less thermoregulatory benefits than in the trained due to their lower heat dissipatory functionality. However, this remains speculative since there are few studies that document the effects of rehydration in people with low aerobic fitness level, particularly during exercise in the heat.

There are several factor that may differently affect the thermal response to exercise in the aerobically trained vs. untrained population. For instance, exercise mode may be one of these differential factors. Intermittent exercise is common in many sports and is characterized by bouts of high intensity alternated with low intensity recovery bouts. The sudden increase in workload at the onset of the high intensity bouts results in a rapid increase in heat production, yet heat dissipation requires more time to respond. As a consequence, higher rectal temperatures are seen with intermittent exercise compare to the same volume of continuous exercise. Given the lower responsiveness of the heat dissipatory mechanisms in the untrained subjects it is likely that during intermittent exercise they could accumulate more heat than the trained counterparts.

I will present results from our lab suggest that during high intensity exercise in the heat, aerobically trained individuals reach higher core temperatures than their untrained counterparts leaving them more prone to suffer heat related problems. The reduction in sweat sodium observed with heat acclimation has been regarded as a mechanism to maintain osmotic forces and thus plasma volume. However, we have reported that aerobic fitness by itself (without acclimation) does not seem to enhance sodium conservation by reducing its secretion in sweat. Nonetheless, there is data that suggest that aerobic fitness does enhance the effects of fluid ingestion on reducing heat accumulation at least, when exercising at a moderate intensity. Lastly, there are modifying factors (i.e., body composition, movement efficiency) that should be taken into account when comparing thermoregulatory responses of trained and untrained populations.

Key words: hyperthermia, rehydration, aerobic fitness.

Hydration in physical activities and sports

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Abstract

When undertaking exercise, sweat production is common to dissipate the increased heat that is produced. The sweating response is influenced by the environmental conditions, the clothing worn, the duration and intensity of exercise and by the exercisers' individual physiology. Typically, maximum sweat rates are in the order of 2 to 3 litres per hour. Therefore, body mass reductions of up to 2 to 3% and more could feasibly occur in many exercise situations and reductions of this magnitude, and more, are reported in the scientific literature.

For a person undertaking regular exercise, any fluid deficit that is incurred during one exercise session can potentially compromise the next exercise session if adequate fluid replacement does not occur. As such, fluid replacement after exercise can be thought of as hydration prior to the next exercise bout.

The practice of drinking in the hours before exercise is effective at ensuring a situation of euhydration prior to exercise if there is any possibility that slight hypohydration is present. The current American College of Sports Medicine (ACSM) position stand on Exercise and Fluid Replacement suggests that when optimising hydration before exercise the individual should slowly drink a moderate amount (eg 5 to 7 ml/kg body mass) at least 4 h before exercise. If this does not result in urine production or the urine is dark or highly concentrated them more drink should be slowly (eg 3 to 5 ml/kg body mass) about 2 h before exercise. This practice of drinking several hours before exercise gives sufficient time for urine output to return to normal. The guidelines also suggest that consuming beverages that contain some sodium and/or small amounts of salted snacks or sodium-containing foods at meals will help to stimulate thirst and retain the consumed liquids.

The diversity of physical activity, sport and exercise training and competition including intensity, duration, frequency and environmental conditions mean that providing specific recommendations in terms of drink volumes and compositions and patterns of ingestions is not sensible. The current ACSM position stand on Exercise and Fluid Replacement highlights this and concludes that the goal of drinking during exercise should be to prevent excessive (>2%) body mass loss due to a water deficit and to prevent excessive changes in electrolyte balance. In doing this any compromise in performance should be minimised. They also conclude that because there is considerable variability in sweating rates and sweat electrolyte content between individuals, as highlighted above, customized fluid replacement regimens are recommended to all. This is possible because individual sweat rates can be estimated by measuring body mass before and after exercise.

The primary factors influencing the post-exercise rehydration process are the volume and composition of the fluid consumed and the rate with which it is absorbed into the body. The volume consumed will be influenced by many factors, including the palatability of the drink and its effects on the thirst mechanism, although with conscious effort some people can still drink large quantities of an unpalatable drink when they are not thirsty. The ingestion of solid food, and the composition of that food, are also important factors, but there are many situations where solid food is avoided by some people between exercise sessions or immediately after exercise. Inclusion of sodium in or accompanying the rehydration drink consumed after exercise is essential for retention of the water consumed after exercise.

Key words: hydration, dehydration, rehydration, exercise-induced sweating.

Thirst as a physiological sign

Chairman: Dr. Nieves Palacios

Thirst as a physiological sign

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Abstract

Changes in extracellular fluid (ECF) osmolality cause water exchange across cell membranes to equilibrate the osmolality of the cytoplasm with that of the ECF. The entry of water into cells causes cell swelling. Conversely, loss of cellular water upon dehydration leads to cell shrinkage. Loss or gain of even a small percentage of cellular water may affect profoundly protein function and cellular performance. The osmotic challenge imposed by the environment is faced with different strategies. Osmoconformer animals, adopt ECF osmolalities similar to those of their environment. Osmoregulators, to which humans pertain, face environmental osmotic challenges by maintaining ECF osmolality near a stable fixed osmotic 'set-point'.

Thirst is crucial for the maintenance of fluid balance and ECF osmolality. The sensation of thirst depends on the brain integration of multiple sensory inputs with a predominant role of ECF hyperosmolality. Elevation of plasma osmolality stimulates the sensation of thirst in a linear manner. In addition, ECF hyperosmolality evokes the release of vasopressin (VP, also known as antidiuretic hormone), to enhance water reabsorption in the kidney. The threshold for thirst in healthy individuals is about 285-286 mosmol/kgH2O and that for VP release 288 mosmol/kgH2O. Drinking reduces plasma VP concentrations and thirst ratings before decline or normalization of plasma osmolality. These effects are also observed when hypertonic solutions are ingested, and are supposedly mediated by a swallowing neuroendocrine reflex that specifically reduces plasma VP whatever the osmolality of the fluid consumed and irrespective of subsequent changes in plasma osmolality. In general, thirst sensation parallels plasma VP alterations.

ECF osmolality perturbations are sensed by specialized neurons termed "osmoreceptors". Both cerebral and peripheral osmoreceptors intervene in the osmoregulatory responses, however, central osmoreceptors (particularly in the organum vasculosum laminae terminalis (OVLT) and the magnocellular neurosecretory cells (MNCs) in the supraoptic nucleus (SON)) predominate. Likely, the osmotic set-point is encoded by the resting electrical activity of these neurons, and the magnitude of ECF osmotic changes is signaled to downstream neurons by proportional changes in the action-potential firing rate (or firing pattern). Peripheral osmoreceptors are located in the oropharynge, the gastrointestinal tract, the splanchnic mesentery, the hepatic portal vein and the liver and signal through the vagus and splanchnic nerves. The molecular and cellular structure of peripheral osmoreceptors remains unknown. After the ingestion of hypertonic solutions, peripheral osmoreceptors located on the luminal side of the gastrointestinal system signal to the CNS, inducing VP release and thirst to attenuate the potential impact of ingestion-related osmotic perturbations. This explains why water intake causes satiety in thirsty humans before ECF hyperosmolality is fully corrected. Similarly, gastric water loading blunts osmotically stimulated VP release long before any detectable reduction in ECF osmolality.

MNCs display reversible and sustained changes in volume that are inversely proportional to ECF osmolality. The mechanical effects elicited by these changes in volume are likey sensed by a channel pertaining to the superfamily of transient receptor potential (TRP) channels. The information from peripheral and central osmoreceptors is integrated with other visceral sensory modalities (baroreceptors, ECF Na+ concentration and body temperature) by the brain to coordinate the activation or inhibition of individual osmoregulatory responses to optimize overall homeostasis to compromise between the stability of ECF osmolality, ECF Na+ concentration, blood volume and blood pressure. Both autonomic and endocrine mechanisms target the kidney and the sweat and salivary glands to adjust the rates of sodium and water loss, through the release of VP, angiotensin II and aldosterone. In the kidney, vasopressin enhances water reabsorption while aldosterone and sympathetic activation promotes sodium and water reabsorption. Angiotensin II elevates arterial blood pressure, releases vasopressin, elicits thirst, and increases the ingestion of water and sodium. With aging the thirst and sodium appetite mechanisms are impaired. Another special situation is exercise-induced dehydration, with thirst developing once some degree of dehydration is already present. This is the reason for the disputed questions on: when, how much and what hydromineral mixture should be drank by athletes before, during and after exercise. Is thirst alone enough to achieve optimal fluid balance during and after exercise? What is the optimal hydromineral status during exercise?

Key words: dehydration, thirst, osmolality, exercise.

Hydration and cognitive development

Chairman: Prof. Dr. Arturo Anadón

Diet and lifestyle for the mental performance

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Abstract

Although the deep connection between diet and brain is still unknown, certain nutrients can affect cognitive ability.

State of hydration: Dehydration can diminish mental performance, especially when the body loses more fluid than 2%. It affects the ability of attention, short-term memory or concentration. Dehydration occurs Neurobiochemistry alterations affecting all the mental processes involved in intelligence and perceptual speed. Dehydration induces significant changes in brain cognitive function (attention perception, memory, thought and language). As you move the level of dehydration is detected a further decline of psychomotor skills. Dehydration particularly negative affects brain function in the elderly.

Hyponatremia: It occurs because neuronal overhydration secondary to hypoosmolality the extracellular space. The severity of symptoms resulting from water intoxication is determined by the magnitude of hyponatremia, the rate of onset and age of the patient. Exercise-Associated Hyponatremia (EAH) is produced by the elimination of salt in sweat. However, the most important factor is the duration of the activity, and therefore occurs mainly in marathon runners, cyclists and endurance sports. It has been reported in about 4 to 6% of the athletes, especially in humid climates. 8 deaths have been reported by EAH athletes since 1985. Although the main cause of EAH is a liquid intake above the capacity of free water excretion by the kidneys, it seems that there is also an inability to suppress vasopressin during exercise due to an osmotic stimulus on the secretion of this hormone.

Vitamins: Certain vitamin deficits have historically been associated with neurological disorders and it is known that vitamins are necessary for a normal functioning of the central nervous system (CNS). Deficiencies in B12, B6 and folate involve an accumulation of homocysteine that increases the risk of stroke. Epidemiological evidence relates Alzheimer's disease and vascular dementia to homocysteine. The deficiencies could affect the functioning of the central nervous system.

Antioxidants: The brain is an organ with a high metabolic activity and which generates oxygen free radicals, extremely reactive and toxic for the brain tissue. Given its high metabolic activity, it is especially vulnerable to oxidizing damage. Antioxidant and vitamin E in particular protect the brain against damage caused by oxidizing and inflammatory mechanisms. The Rotterdam study performed on 5,400 adults over 55 years of age in Holland found that vitamin E prevented the development of dementia in 25% over the following decade. Another study in Chicago found a reduced risk of Alzheimer's disease in those with a higher intake of food rich in vitamin E.

Omega 3 fats: Omega 3 poly unsaturated fatty acids are constituents of the cell membranes and essential for brain function, especially docosahexaenoic acid (DHA). DHA deficit has an influence over the flow of the membrane and the metabolic pathways that generate energy, affecting several molecules such as the brain derived neurotrophic factor (BDNF) and insulin-like growth factor 1 (IGF1).

Nucleotides: Inosine (a puric base nucleotide) leads to the expression in neurons in culture of genes associated to the growth of axon, including GAP-43, L1 and 1-tubuline. Apparently, inosine can affect similarly in vivo, enabling cortical pyramidal cells to extend axonal branches.

Gangliosides: Located in the external part of the cell membrane, gangliosides perform several biologic functions, mainly the correct interaction between neurones and glial cells, favouring the growth of axons, the survival in vitro, accelerating regeneration and enabling the neuronal recovery of the central nervous system.

Caffeine: It is widely known and accepted that caffeine has positive effects on the degree of attention and mental concentration. Caffeine acts as an adenosine receptors antagonist, mainly A1 and A2A and causes on the central nervous system: motor activation, arousal and reinforcement effects. There is evidence that (a moderate) consumption of caffeine prevents Alzheimer's disease since caffeine and/or other xanthines reduce production of beta-amyloid Ab peptide and diminish the phosphorylation of tau.

Physical activity: In many epidemiological studies published since the 90's, has been found that the practice of regular physical activity, including walking, is associated with better cognitive function and less cognitive impairment. Moreover, in a systematic review of available published scientific studies concluded that regular physical activity, more than 2-3 times per week of moderate or 1 hour per week of vigorous exercise reduces the risk of dementia. In addition, physical inactivity increases twice the risk of Alzheimer's disease and dementia.

Key words: hydration, diet, mental performance.

Hydration and cognitive performance

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Abstract

No matter how mild, dehydration is not an innocuous condition as there is an imbalance in the homeostatic function of the internal environment. This can adversely affect cognitive performance, not only in groups more vulnerable to dehydration, such as children and the elderly, but also in young adults. Healthy young adults are also at risk of a decrease in their cognitive performance when hydration is not adequate. However, few studies have examined the impact of mild or moderate dehydration on cognitive performance.

This work reviews the principal findings from studies published to date examining the impact of dehydration on cognitive skills. Changes in the amount of electrolytes in the body that occur when dehydrated can alter brain activity and the functioning of the monoaminergic and cholinergic neurotransmitter systems involved in cognitive processing. It has also been found that dehydration is associated with changes in blood-brain barrier permeability and decreases in the blood flow in some areas of the brain. A state of dehydration leads to the activation of the hypothalamic-pituitary-adrenocortical axis and to the subsequent production of stress hormones such as cortisol an underlying factor in the negative effects on perception, spatial ability and memory.

Being dehydrated by just 2% impairs performance in tasks that require attention, psychomotor and immediate memory skills. A level of dehydration of more than 2% also resulted in marked decreases in alertness and concentration ability and increased fatigue, tiredness and drowsiness, as well as headaches in young subjects. In contrast, the performance of long-term and working memory tasks and executive functions is more preserved, especially if the cause of dehydration is moderate physical exercise.

The lack of consistency in the evidence published to date is largely due to the different methodology applied and an attempt should be made to standardise methods for future studies. These differences relate to the assessment of cognitive performance (type of task, measures of response, time of day), the method used to cause dehydration and the type of drink used to rehydrate, and the characteristics of the participants. Gender has been found to be a determining factor in relation to differences in levels of dehydration and their correlates with cognitive performance. The impact of mild-to-moderate states of dehydration on cognitive performance is greater on women than on men. However, most studies include either men only in their samples or participants of both genders, without studying them separately. Moreover, the menstrual cycle influences the state of hydration and cognitive task performance. Circadian typology (morning-, neither, and evening-type) has been found to be the most important individual difference in the way people function, it is very important to say that there is not any scientific study about hydration on cognitive performance which including that last aspect. Although most studies check for the consumption of psychoactive substances (alcohol, nicotine, caffeine, etc.) for a few hours before and during the experiments, the participants' usual consumption is rarely taken into account and that could affect the results of performance and subjective state.

Relationship between hydration and cognitive performance is an emerging area of study, which requires a solid base of new evidence from the study of large samples of participants of both genders, with suitable control of factors that are known to lead to biased results. In relation with this, it is necessary that the food companies, health experts and the health authorities develop campaigns to educate and promote awareness among the general population about the importance of looking after their hydration levels on a daily basis.

Key words: cognitive performance, dehydration, attention, psychomotor skills, memory.

The influence of chronic dehydration on cognitive decline

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Abstract

Alzheimer's disease (AD) develops over the years and enters a phase of mild cognitive impairment before causing the characteristic symptoms of dementia. Its treatment requires early identification to be efficient.

The CITA Alzheimer Foundation's project will look for diagnostic markers and study the natural progress of preclinical and prodromal Alzheimer's disease. AD's markers will be researched in a sample of 500 50-70 year-olds without dementia, enhanced with high risk individuals (half of them having a direct family history of AD). About 20% of them will have a mild cognitive impairment/prodromal AD. Together with the neuropsychological, neuroimage and cerebrospinal fluid markers, the project will examine the role of changes related to brain activation patterns in functional resonance, the state of activity networks by defect and the alteration of brain connectivity, spectroscopy parameters, axonal integrity, brain metabolism (PET-FDG) and other biological parameters in the blood. Also, the risk/protection factors will be studied, such as those related to functional reserve, the role of stress, vascular risk factors and diet and nutrition patterns as possible risk factors for the appearance of disease symptoms after a 2-year follow-up. Finally, the epigenetic influence and in the distribution of the tau and amyloid protein in the cerebrospinal fluid of the state of nutrition (including hydration) will be determined. The data collected from the 150 people analysed to date will be included.

A first transversal multivariate analysis on the effect of markers and risk factors on cognitive performance will allow study of the researched markers in a more detailed and focused analytic study. Also, the study aims to standardize and validate, if possible, the scales and measurements of the parameters studied. One of them is the state of hydration, whose value as a predisposing factor for AD is completely unknown. In any case, it is reasonable to think that there might be an influence, since a state of chronic dehydration is associated to cognitive dysfunction (psychomotor slowness, attention disorder, memory reduction, etc.). The mechanism/s implied can be varied (hipovolemia, hypernatraemia, neurotransmitter disorder, cerebral blood flow disorder, etc.).

Key words: alzheimer, dehydration, hypernatremia.

Hydration under specific circumstances

Chairman: Prof. Dr. Manuel Díaz Rubio

Carbonated beverages effects on gastrointestinal system

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Abstract

In examining the carbonated beverages effect on gastrointestinal system the presence of carbon dioxide in these beverages appears intriguing. The gas ingested can influence the alimentary tract by direct mechanical and chemical means.

A common belief among practicing physicians is that carbonated beverages cause or exacerbate gastroesophageal reflux disease (GERD). Consequently, many recommend cessation of carbonated beverages consumption in GERD patients as part of lifestyle modifications. In several large population-based studies, there was no apparent association between soda consumption and GERD (Feldman, 1995; Johnson, 2010). Cessation of soda consumption has not been shown to improve clinical or physiological abnormalities related to GERD. Moreover, in a study in which subjects consumed still water, Sprite with and without carbon dioxide, there were no differences across beverages in the number of reflux events (acidic or non-acidic) after a meal (Cuomo, 2008). Thus, current data do not support recommendations for eliminating carbonated beverages from the diet in GERD.

Regarding the possibility of carbonated beverages being involved in determining alimentary tract cancer, several surveys have shown that there are no associations between carbonated soft drinks and any of the alimentary tract cancers (oral cavity cancer, esophageal carcinoma, gastric cancer, colon cancer, pancreatic cancer) (Mayne ST, 2006; Ren JS, 2010; Zhang X, 2010).

One the most interesting points of the interaction between carbonated beverages and alimentary tract is the influence of these beverages on satiation and satiety. Satiation is the complex of processes which cause meal termination whereas the events which arise from food consumption and which serve to suppress hunger are defined as satiety (Blundell JE, 1999; Cuomo R, 2004). If the carbonated fluid is taken while or after eating it tends to settle in the upper part of the stomach and it may produce a feeling of fullness. However, no difference in gastric emptying or in the feeling of fullness emerged from a study carried out on healthy volunteers where 300 ml of sweetened beverages with or without carbon dioxide did not influence the gastric emptying and satiation during 480 kcal standard meal (Cuomo R, 2008). In the same research, the authors did not show any effect of increasing beverage carbonation on meal size intake. On the other hand with a 400 ml beverage, the increased beverage carbonation affects fullness and desire to eat immediately after beverage consumption and 10 minutes thereafter (Moorhead SA, 2008). The primal ingestion of a 300 ml non-caloric carbonated beverage significantly increases the gastric volume evaluated by magnetic resonance, but it does not influence the size of a liquid or solid meal intake (Cuomo R, 2011). Another study also confirms that regardless of carbonation, when a 360 g caloric beverage is consumed with a meal it adds to the energy taken from the food, without significantly affecting satiety ratings (Della Valle DM, 2005). Five hundred ninety ml of regular cola and sparkling water consumed at breakfast time are associated with a higher fullness and reduced hunger rating as well as the desire to eat throughout the 2 hours and 15 minutes following the beverage intake (Almiron-Roig E, 2003). In another research, changing the volume of an isocaloric preload by incorporating air (330, 450 and 600 ml) affected satiation limiting energy intake (Rolls BJ, 2000). Therefore, both beverage volume and carbonation levels could work together in triggering satiation and satiety in healthy subjects.

In conclusion, although there is not strong evidence for any advantage on gastrointestinal system, there is no indication that beverage carbonation per se is dangerous. The intriguing effect on satiation and satiety needs further researches.

Key words: hydration, beverages, carbonatation.

Hydration in hospital routine

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Abstract

Proper body functioning depends very much on the water available, its main role being the transport of molecules and other organic substances in physiologic processes from ingestion, digestion to absorption and excretion of substances. It is the body's main solvent and enables the development of chemical reactions. It is also indispensable for body thermo regulation. Also, water contributes micronutrients, some of which help with ionic balance.

The body's fluid balance defines the state of hydration of an individual and it must receive a sufficient amount of fluid to replace physiological (urine, stools, sweat, skin, lungs) or pathological losses (vomit, diarrhoea) and prevent dehydration. Its worsening, defined as mild, moderate or severe, varies according to the ethiology and duration of the factor causing the clinical picture. Symptoms range from dry mucus membranes, orthostatic hypotension and reduction of skin turgidity, to oliguria or anuria, confusion, hypotension while idle and even pre-shock and shock.

The volume of water present in the body is also influenced by the amount of electrolytes. The sodium concentration in the blood is a good indicator and allows us to classify this type of dehydration in: hypertonic, isotonic and hypotonic. Defining the cause and type of dehydration is essential to proceed with the best treatment. In many cases, the patient can't or mustn't take liquids during their hospital stay and therefore many experts in nutrition and other consultants prescribe different rehydration therapies from a simple change in the diet and type of liquids to serotherapy or enteral or parenteral artificial feeding.

Compared to adults and especially in case of illness, babies, children and the elderly are more prone to dehydration due to the percentage of liquids in their body composition and the fact that they request less water and older people have a diminished perception of thirst as opposed to adults.

In general, the onset of diarrhoea and vomits are frequent causes of a negative fluid balance such as liquid dysphagia due to neuromuscular or tumoral diseases and in general any clinical condition that diminishes the level of consciousness and during the peri-surgical period in which the patient can't or mustn't take liquids or food. We will analyse the routine in a hospital like La Paz with some 1,500 beds and determine the clinical practice.

Nevertheless, the importance of water in a hospital goes far beyond that and its drinkability and the presence and content of certain chemical elements is crucial. Many hospital factors can be associated with the onset of nosocomial diseases but perhaps water is the most important and controllable of them. Water quality control from the source is especially important to reduce the risk and susceptibility of patients, especially when immuno depressed. Finally, it should be reiterated that extreme caution must be given to water used in dialysis process for patients with kidney failure.

Key words: dehydration, liquid balance, quality of hospital water.

Hydration in extreme situations

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Abstract

Humans are homeothermic; we are able to regulate our body temperature although within very narrow margins, (34ºC-45ºC). Homeostasis systems are intensely altered in extreme thermal conditions. When the heat is generated by physical activity, we are able to maintain homeothermy by activating the heat loss mechanisms. However, from 37°C of dry temperature or 29°C of wet one, the subject has difficulties and maintaining a physiological and prolonged physical activity results in a decreased performance and occasionally this endangers the health of the athlete.

Factors influencing thermoregulation during physical exercise in extreme situations.

State of acclimatization, fitness and hydration of the person.

- Acclimation to physical exercise in extreme situations: Heat: Acclimation is the set of adaptations that allow a person to tolerate greater stress due to environmental heat. Cold: The adaptation to cold is less complex.
- State of fitness: The physical fitness (VO2max) is not a decisive marker for heat tolerance but it is an additional factor of thermal tolerance, if the athlete becomes acclimated by training at high temperatures.
- State of hydration.

Heat: The negative effects of the dehydration are observed both when subjects are dehydrated during prolonged exercise, as they begin the exercise under hypo hydration conditions.

Cold: It induces diuresis. Inappropriate clothes induce fluids loss due to sweat of up to 2 L/h.

Hydration in extreme situations

Training to hydration: During prolonged exercise in heat stress, athletes incur in dehydration mainly by sweating losts. The ideal fluid replacement during exercise in heat is the one in which it is fully replaced the water loss caused by sweating (and in long events, diuresis). However, from a competitive point of view, the intake of large volumes of fluid forces to reduce the running speed of the race and causes gastrointestinal disorders. To avoid this, athletes should train their ability of hydration, by drinking during their trainings, especially in the season of acclimatization.

Digestive –emptying and hydration: The water balance during exercise is not always possible because the maximal sweat rates exceed the maximal gastric emptying rates, which limits the absorption of fluid. However, fluid intake during exercise can be done in small quantities that can be emptied from the stomach and absorbed in the intestine. Liquids containing 4-8% carbohydrate (CHO) can be emptied within 1L/hour rates when gastric volume is maintained above 600 ml. Hypo hydration combined with hyperthermia and intense exercise slows gastric emptying and increases the risk of gastrointestinal discomfort, therefore, it is important to begin the fluid intake in the early stages of the exercise to minimize the hypo hydration and to improve the bioavailability of liquids.

Composition of the drink: The formula of the drink must avoid the limitations imposed by the voluntary intake, gastric emptying and intestinal absorption. It has to provide fluid, carbohydrate and electrolytes in sufficient quantity and speed to cause positive physiological responses which will improve as well the performance. The exercise carried out under extreme temperatures increases the demands of CHO up to 76%. The balance between CHO and electrolyte keeps low the heart rate. It is imperative to constantly replace them during the hydration process. The effectiveness of the drink in heat stress situations is largely determined by the amount and type of CHO. In addition to conferring the sweetness that enhances the palatability, the correct amount of CHO, promote gastric emptying and stimulates water and electrolyte absorption in the small intestine. They should have a mixture of CHO at a concentration of 60-70 g/L (6-7%). In the thermal stress, the lost of electrolytes (sweat and urine) is higher by almost 30% to less extreme situations, even in individuals acclimatized (having less concentration of electrolytes in sweat). Electrolytes play a key role in maintaining fluid intake and promote hydration. This intake is made with a small amount of salt. Salt absorption into the bloodstream prevents early fall of plasma osmolality below the thirst threshold, and helps keep the desire to drink. Drinks should be 110-125 ml sodium/250 mg. Occasionally environmental conditions are not known until the day of the competition, therefore, the athlete should carry a variety of products to make drinks with higher and lower concentration of solutes and to administrate himself the liquids according to his needs. Finally, it is important to take into account that there are extreme environmental conditions in which it is not possible, even for well trained and acclimatized to heat athletes, to maintain a constant level of body functions despite being well hydrated. In such conditions a rapid increase of the body temperature is produced –hyperthermia-, and the only option to safeguard the health of the athletes consists on lowering the heat production by decreasing the intensity of exercise.

Key words: heat exhaustion, physical performance, liquids, euhydration.

Hydration: 20 years of scientific knowledge development

Chairman: Prof. Dr. Lluis Serra Majem

Hydration: 20 years of scientific knowledge development

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Abstract

Hydration affects every aspect of human health and performance. Deprivation of water for more than a few days inevitably leads to death, though there are occasional reports of much longer survival without access to water in exceptional situations, highlighting the individual susceptibility to the effects of absence of water intake. Such extreme conditions are seldom encountered in the activities of daily living for most of the population, but it is normal for small fluctuations in body water content to occur throughout the day with no perceptible effect on health or performance. Losses incurred due to sweating, respiratory loss, through vomiting and in urine and stools, are replaced through the intake of liguids and foods at more or less regular intervals throughout the day.

The consequences of an inadequate fluid intake for health and for physical and mental performance are now accepted, and drinking behaviours are beginning to change to recognise this increased awareness.

In the last 20 years, our understanding of the consequences of an inadequate intake has increased, and there are now well-recognised associations between a low habitual fluid intake and some chronic diseases, including urolithiasis, constipation, asthma, cardiovascular disease, diabetic hyperglycemia, and some cancers. Acute hypohydration also is recognised by many clinicians as a precipitating factor in a number of acute medical conditions in the elderly.

Hydration guidelines in the area of sports nutrition have changed dramatically in recent years, with the recognition that prescriptions for fluid replacement must take account of individual needs rather than relying on generic advice. The formulation of sports drinks is also changing to take account of individual needs: drinks with a wide range of carbohydrate and electrolyte content are now available. There is also a growing recognition that increasing levels of physical activity are necessary to counter the growth in morbidity and mortality that can be attributed to non-communicable diseases. The sensation of effort during exercise is increased by dehydration, and this is a major disincentive to continued participation, and communicating messages about the link between hydration and effort will be vital in encouraging the necessary behaviour changes.

The links between hydration status, mood, wellness and cognitive function have also begun to receive more attention, with evidence that this may be important for learning and behaviour in children. This area, however, remains under-developed, perhaps in large part due to methodological difficulties.

There remain many challenges in attempts to fully understand the role of hydration in both health and performance. Not least of these is distinguishing between fluid intake and hydration status. Although much has been learned, there remains much that we do not know.

Key words: hydration, health, performance, water.

Abstracts

01/25. Hydration habits in Venezuelan contact and team sports delegation teams

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Abstract

Introduction: Hydration is closely related to sports performance and also to training in hot weather.

Objective: The main objective of this research is to know the hydration habits of athletes.

Methods/Design: The sample consisted of 156 nutrition records from the athletes' medical services at the National Sports Institute. These records belonged to members of team sports (DE): football, basketball, volleyball, baseball and softball (n=87) and contact sports (DC): boxing, karate, taekwondo, judo and wrestling (n=69). This is a descriptive type of study. The moment of fluid intake was monitored (before, during and after training) and the volume of liquids taken was estimated (from the approximate measure in glasses). Differences were established between the times of hydration and the volumes were established and comparisons were made between the groups.

Results: In the DE group, the moment of highest hydration was after training ($p>0.05$) and in the DC group, a lower frequency of fluid intake was evidenced during training ($p>0.05$). When the volume of fluid intake was calculated, there was a lower intake before training in both groups and a higher intake by the DE group after training.

Conclusions: Hydration habits varied among each group and did not follow the guidelines of the American College of Sports Medicine.

Key words: hydration, intake, habits, training.

02/25. Analysis of the water intake of elderly people who receive social assistance in their home

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Abstract

Introduction: Dehydration is the most frequent abnormality of water balance in the elderly and a morbidity and mortality threat in this group. If the nutrition-related disorders are major geriatric syndromes, we must not forget water as an additive in the diet and basic requirement from a nutritional standpoint.

Objectives: To evaluate the daily fluid intake of old people who are recipients of social care in their own homes and give dietary advice to their carers on the quantity of fluid they should consume to avoid health problems associated with insufficient hydration.

Methods/Design: Study carried out by 5 dieticians/nutritionists in two rural locations in Extremadura through questionnaires of dietary history, evaluation of hydration and evaluation of the nutritional status, Mini Nutritional Assessment (MNA), water intake record, physical examination and anthropometric parameters. Statistical analysis with SPSS v.15.0.

Results: Of the 163 people studied, 25 were men and 132 women aged between 39 and 94 years with a mean age of 78. 54% consumed between 0.5 and 1 litre of fluid daily and 46% between 1 and 2 litres. They tended to drink water with meals and medication.

Conclusions: There are pockets of the population especially vulnerable to dehydration, such as older people. In our study, more than 50% did not reach the recommended water intake. It is advisable to provide fluids at meals (75%) as well as at other times throughout the day (25%). It is important to prevent dehydration by detecting patients at risk and encouraging a higher fluid intake of water, tea, fruit juice and soup.

Key words: elderly, nutrition, dehydration.

03/25. Selected for oral communication

Sodium intake in athletes

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Abstract

Introduction: The European Union Authorities have approved a daily amount allowed of salt intake for the general population of 6 g. There are no specific recommendations for people that do intense physical activity, with profuse sweating.

Objectives: To quantify the intake and excretion of sodium in athletes.

Methods/Design: There has been a quantitative analysis of total caloric intake with sodium for 48 hours, measuring the excretion of sodium in urine for 24 hours, in 51 healthy athletes with an average age of 19 years, a body mass index average of 21.7 and who train 5 hours a day.

Results: Female athletes exceed the recommended intake of salt by 6.3% and male athletes by 66.6%.This significant difference between genders is due to a higher caloric intake in men. The average value of 24-hour urine sodium excretion was 134.0 mmol/l with an average of 1327.6 ml diuresis / 24 h. The values are lower than in the general population (sodium excretion: 154.0 mmol/L, diuresis average 1500 ml / 24 h). Sport athletes studied loose an average of 1.3 L of sweat in an hour.

Conclusions: The intake of salt in this sample exceeded the recommendations allowed of European Union Authorities although the sweat levels were very high, which increase the loss of sodium and its requirements. For people who do intense physical exercise and sweat heavily, an increased intake of sodium during and after the activity helps decrease the level of dehydration.

Key words: sodium, intake, sport, diuresis, athletes.

04/25. Assessment of the state of hydration in nursing homes

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Abstract

Introduction: Attention to fluid intake is especially important for those living in nursing homes. Kidney function can be reduced by infection, diabetes, kidney stones and urinary tract obstruction. Medication can also adversely affect the control mechanisms of hydration and cognitive impairment causes failure of response to the stimulation of thirst, so monitoring systems that provide support to hydration are needed.

Objectives: To assess patients' hydration status and their risk of dehydration.

Methods/Design: On arrival, the patient is evaluated with a questionnaire about his or her characteristics and needs. Direct observation during meals and throughout the day will provide additional information about the resident's drinking and clearance patterns.

Results: Of all people surveyed (69 residents) 46 were women (66.67%) and 23 men (33.3%) aged between 65 and 101 years old. Generic risk factors included the gender (women), age over 85 years, more than 4 simultaneous diseases, more than 4 medications, prostration, use of laxatives and chronic infections. Specific risk factors included fluid loss associated with kidney failure or diabetes. Diuretic medication to control heart failure and hypertension causes a stable fluid loss.

Conclusion: Dehydration in the elderly is easily identified by its signs such as the skin, concentration of urine, mental confusion, etc. It is important to try to prevent the consequences of dehydration by detecting patients at risk and stimulating increased fluid intake.

Key words: assessment, hydration, dehydration.

05/25. Dehydration and muscle force production in badminton players during a national championship

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Abstract

Introduction: The negative effects of dehydration on endurance activities are well established. However, what is unknown is the dehydration reached during indoor intermittent sports activities and its relationship with power production.

Objectives: To describe the sweat rate and dehydration attained by elite badminton players and its relationship with upper- and lower-body muscle performance.

Methods/Design: We recruited 70 participants (46 men and 24 women) during the Spanish Badminton Championship. We measured their body mass and power production (countermovement jump and hand-grip) just before and after an official game, and we collected urine samples. The fluid ingested during the game was individually assessed by weighing rehydration bottles.

Results: 90.91% of the players arrived at the championship with a urine specific gravity under 1.020. Sweat rate was 1.16±0.70 l/h and rehydration rate was 0.48±0.23 l. Since the mean duration of the game was 40.11±11.94 min, dehydration attained during a badminton game was only 0.35±0.62%. There were no differences in jump power production (pre=30.06±7.77 W/kg; post=31.06±7.40 W/kg) or dominant handgrip force after the game (pre=424.95±101.59 N; post=425.94±96.70 N). However, the prevalence of proteinuria, leukocyturia and erythrocyturia increased after the game.

Conclusions: The low level of dehydration attained during a badminton game did not affect muscle performance. However, the high intensity experienced produced urine abnormalities mostly related to a reduced flux to the kidney.

Key words: badminton, dehydration, countermovement jump, manual dynamometry, power production.

06/25. Acclimatisation to physical exercise in extreme situations

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Factors influencing thermoregulation during physical exercise in extreme situations. State of acclimatisation, fitness and hydration of the person.

- Acclimatisation: Set of adaptations that allow a person to tolerate greater stressdue to environmental conditions. Heat: The body induces changes in the quantity and quality of sweating and blood flow, adapting the body to work in hot weather generating less internal heat. Cardiovascular and thermoregulatory adaptations occur during the first days of heat exposure. It requires a repeated exposure to heat, training at an exercise intensity of at least 50% of maximal oxygen consumption (VO2max). Cold: Adaptation to cold is less complex. Adequate clothing, training and a high-calorie balanced diet are required.

- State of fitness. The physical fitness (VO2max) is not a decisive marker for heat tolerance but it is an additional factor of thermal tolerance, if the athlete becomes acclimatised by training at extreme temperatures.
- State of hydration. Heat: The negative effects of dehydration are observed both when subjects are dehydrated during prolonged exercise and when they begin to exercise under hypo hydration conditions.

Cold: It induces diuresis through an increased central blood volume. Inappropriate clothes induce fluid loss due to a sweat rate of up to 2 L / h.

Conclusions: Although it is true that people can adapt to physical activity and heat stress by acclimatisation "there is no evidence to show that it is possible to adapt to hypo hydration". In fact, hypo hydration limits the benefits of acclimatisation.

Key words: acclimation, acclimatisation, physical performance, euhydration.

07/25. Physical exercise fluid replacement and dehydration in athletes: mechanisms and consequences

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Abstract

Introduction: Scientific evidence suggests that the fluid lost through sweat during exercise can lead to dehydration of the body by interfering negatively with physiological parameters such as plasma volume, blood flow, osmolality, sodium concentration, and also thermoregulation. These factors, when added to environmental factors, for example, prolonged exposure to extreme temperatures and aggressive weight loss in the pre-competitive stages can compromise the performance of athletes.

Objectives: To outline what the main physiological consequences of dehydration are. It is an approach to the mechanisms of hydration and suggests strategies to minimize the misfits of dehydration to the physiological system.

Methods/Design: A quick systematic review of the literature.

Conclusions: The review sought to address in a generic way aspects of dehydration and point strategies to minimize the misfits of dehydration for the physiological system. The study designed the policies necessary to minimize the negative effects of dehydration and score strategies to maximize the performance of athletes. Importantly, although there is ample evidence about the process of hydration and rehydration it is strongly recommended that the hydration strategies are always customised for each athlete, taking into account the weather and sport practiced.

Key words: exercise, hydration, dehydration.

08/25. Effects of a handball match on the hydration status of athletes

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Abstract

Introduction: Scientific evidence suggests the need to establish guidelines that ensure an optimal state of hydration in high-performance athletes.

Objectives: The purpose of this study was to evaluate the effects of a handball match on the hydration status of 14 athletes (23 ± 4 years old).

Methods/Design: The analyses were led by application of t-Student test for dependent samples before and after the match, through measurement of the corporal composition [total corporal water (At) and total corporal mass (Mc)], relationship: Sweating-Water ingestion (r: TS-IA) and urinary [urinary volume (Vu) and specific gravity (Du)].

Results: After the handball match, reductions were verified on At (-0.44%), Mc (-0.90%). The r: TS-IA, revealed that on average hydration during the match compensated for 88.08% of the water lost through sweating (IA: 8.72 ml/min versus TS: 9.90 ml/min). Moreover, a positive relationship was observed between total sweating and water consumption ($r = 0.9572$; p).

Conclusions: The results of this study indicate that the requirements of a game of handball altered hydration levels. Therefore, it is recommended to have hydration strategies for each individual athlete and the sport that consider the environmental and physiological variables.

Key words: hydration, handball, dehydration.

09/25. Effects of a soccer match on the hydration status of junior athletes

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Abstract

Introduction: It is known that there has been an increase in energy demand of different sports teams over recent years. Therefore, researchers are trying to define the most effective strategies for athletes to maintain an optimal hydration state. Objectives: The purpose of this study was to evaluate the effects of a soccer match on the state of hydration of 15 athletes from the junior soccer category (18 ± 4 years). The tests occurred with application of t-Student test for paired samples, in a pre-and post-match.

Methods/Design: Through measurements of body composition: total body mass (MCT), urinary: [urine volume (Vu) and specific gravity (Du)] and relative rate of water intake, sweating (r: TS-IA).

Results: After the soccer match reductions were found in MCT (-0.96%), Vu (ml) (pre: 233.3 ± 87.4 versus post: 106 ± 60.4, p.

Conclusions: We conclude that physical activity promoted by a soccer game had a negative impact on the state of hydration of athletes from the junior category. Water intake must be raised especially for athletes who are the most required during the match.

Key words: state of hydration, soccer, dehydration.

10/25. Selected for oral communication

The effects of additional carbohydrate supplementation on metabolism and hydration indices

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Abstract

Introduction: It is widely accepted that carbohydrate ingestion can improve exercise performance during endurance and team sport activities. However, the influence of carbohydrate load on hydration status during exercise is not well understood.

Objectives: The aim of the study was to determine the effects of exogenous carbohydrate availability on metabolism and hydration status during a soccer-specific protocol.

Methods/Design: A group of recreational soccer players (n=14) completed the soccer match simulation (SMS) on three separate days while ingesting a 6% carbohydrate fluid and carbohydrate gels (CHO6), a 10% caffeinated-carbohydrate fluid and carbohydrate gels (CHO6), or a placebo fluid and placebo gels (PLA). Metabolic responses (blood glucose concentrations) and hydration status (plasma osmolality and blood sodium concentration) were measured.

Results: Ingesting carbohydrates increased blood glucose concentrations duringthe first half of the SMS. Blood glucose concentrations decreased during all treatments after the half-time (CHO10: 40%; CHO6: 38%; PLA: 16%). Plasma osmolality increased with the ingestion of the CHO10 drink at the end of the SMS protocol (pre-SMS: 292±3 mOsm/kg; post-SMS: 298±3 mOsm/kg, $P<0.05$). Blood sodium concentrations were elevated in CHO6 and CHO10 during the SMS (CHO6: 141±0.8 mmol/L; CHO10: 143±0.7 mmol/L; PLA: 140±0.8 mmol/L; $P<0.05$).

Conclusions: High carbohydrate loading (CHO10) was effective in increasing blood glucose concentrations when compared with PLA. However, an acute drop in blood glucose was observed after the half-time period in all trials. Although CHO10 increased plasma osmolality and blood sodium concentration, hydration status did not reach critical values in temperate conditions. Therefore, players.

Key words: hydration, carbohydrate, glucose, caffeine.

11/25. Water balance and electrolyte loss in young soccer players during competition in warm weather

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Abstract

Introduction: Dehydration is one of the main causes of lower performance in competitive practice. Over the last decade, there have been several studies about hydration and electrolyte loss in athletes. Despite this, only a few studies have focused on young soccer players.

Objectives: The aim of this study was to quantify the level of dehydration, liquid intake and electrolyte loss during the contest of a competitive match.

Methods/Design: Fluid balance and sweat electrolyte losses were measured in 16 soccer players belonging to the Spanish Cadets Honour Division (15.9±0.2 years; 1.72±0.05 m; 68.87±6.4 kg) over the course of a competitive match played at an ambient temperature of 18.7°C (relative humidity 47.3%). Pre-match urine specific gravity (1016.82±9.8 g/mL) suggests that players started the sport activity euhydrated. Body mass was recorded before and after the game, obtaining the dehydration level (1.24±0.85%). The total liquid intake of sports drinks was recorded (0.61±0.34 L) and sweat composition was estimated from absorbent swabs applied to 4 skin sites during the game (1.32±0.52 L). The sodium concentration was 21.44±10.1mmol/L.

Results: The results show that soccer players dehydrated within tolerable limits during the competition. Despite this, the variability that exists in sports drinks intake, hydration status and electrolyte losses should be taken into account.

Conclusions: Given that we are talking about young players, we must make an individualised assessment of the hydration status to optimize fluid-replacement strategies.

Key words: football, dehydration, young athletes.

12/25. Comparison of beverage intake between Palestinian and Spanish populations

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Abstract

Introduction: As with the diet, the pattern of beverage consumption varies among populations. Because of their high water content, juices, soft drinks, herb teas and dilute alcoholic beverages (e.g. beer) can contribute, besides water, to achieving the recommended daily liquid intake.

Objectives: To compare beverage intakes between two different Mediterranean populations, in Palestine and Spain.

Methods/Design: Subjects. Palestinian households from Hebron (n=150 families) and Spanish households from Granada (n=328 families). Dietary questionnaire. Semi-quantitative food frequency questionnaire administered to the female representatives of each household. Statistical analysis. Student's t-test ($p \leq 0.05$ was considered significant). Software. DIAL 1.0 (© 2008 Alce Ingenierías) and SPSS 15.0 (SPSS Inc., Chicago, IL, USA).

Results: The mean (SD) daily liquid intake was 1517.31(408.83) mL in the Palestinian population and 1567.74(453.89) mL in the Spanish population. The greatest contribution to this intake was water ($p > 0.05$) in both populations, followed by juice and soft drinks for the Palestinians and by beer and juice for the Spaniards. The main difference was that alcoholic beverages, which formed 7.5% of the total liquid intake of the Spaniards, were not consumed by the Palestinians.

Conclusions: Both populations showed a similar liquid intake although with significant differences in the type of beverage consumed.

Key words: water, hydration, beverages, household.

13/25. Assessment of young population's liquid intake at breakfast and late-breakfast in Southern Spain

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Abstract

Introduction: Water is the main constituent of the human body, representing around 60% of body weight in adult males and 50-55% in adult females (lower due to their higher proportion of body fat) and up to 75% in newborn infants. Water is involved in practically all functions of the human body and is particularly important for thermoregulation.

Objectives: To assess the fluid intake at breakfast and late-breakfast of school children and adolescents in Granada.

Methods/Design: Subjects. The analysis is based on 3,190 school children and adolescents aged 8-17 years in Granada. Dietary questionnaire. Specific semi-quantitative food frequency questionnaire for breakfast and late-breakfast. Statistical analysis. Student's t-test and stepwise regression. $P \leq 0.05$ was considered significant. Software. DIAL 1.0 (© 2008 Alce Ingenierías) and SPSS 15.0 (SPSS Inc., Chicago, IL, USA).

Results: Mean (SD) fluid intake was 317.46 (114.65) mL at breakfast and latebreakfast. The intake was significantly higher in females and in the 8-13 yr age group. This intake represents 17% of the daily intake and 62% of the breakfast intake recommended by the European Food Safety Authority (EFSA). Stepwise regression analysis showed that juice, milk shakes, milk, fruit, and yoghurt explained 99% ($R2=0.99$) of the fluid intake at breakfast and late-breakfast in this population.

Conclusions: It is necessary to promote fluid intake by children and adolescents through their families and schools, in order to ensure adequate hydration at this stage of life.

Key words: water, hydration, breakfast, children.

14/25. Liquid intake in long distance runners

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Abstract

Introduction: Proper hydration plays a very important role in the performance of athletes. There are a few specific needs that depend on various factors, such as individual physiological conditions, the timing of the season, training, and the length of each match.

Objectives: This paper is intended to meet the guidelines of hydration to still long distance runners.

Methods/Design: The study subjects are 50 long-distance runners (40 men and 10 women). The criterion for inclusion was a speed above 42.195 km, to practice mainly athletics and be of 18 to 50 years old. The study was conducted between March and November 2011. Each individual was provided with a form to collect the water intake and with guidelines emphasizing the intake of beverages in athletes.

Results: All the subjects claimed to drink about 2 L of water a day and 42.86% of athletes also ingested isotonic drinks. 24.49% ingested water before training or races, 57.14% drank water or isotonic drinks at the same periods and 97.96% drank water at the end of the exercise.

Conclusions: Even though the intake may be sufficient, the population group studied (long distance runners) showed a lack of knowledge

with regard to the most suitable patterns for the development of their sports activity.

Key words: hydration, sport, athletes.

15/25. Selected for oral communication.

Exercise and hydration: effects on homocysteine levels

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Abstract

Introduction: Serum Homocysteine (Hcy) levels in relation to physical exercise have been scarcely analysed and results are contradictory.

Objectives: The aim of this study was to determine the influence of acute maximal and submaximal intensity exercise on Hcy levels and recovery after exercise by conducting two rehydration protocols.

Methods/Design: We studied 10 physically active male subjects (23.51±1.84 years) who performed one maximal and two stable submaximal tests at 65% VO2 max of intensity on a tread mill over 40 minutes. Temperature (30ºC) and humidity (60%) were controlled. Subjects were rehydrated with water (SA) or a sport drink (SP) for 2 hours. Blood samples were collected before, after, at hour 1 and hour 2 after the tests and analysed for Hcy, Folate, Vitamin B12, and Creatinkinase (CK).

Results: Hcy levels increased significantly immediately after all tests ($p<0.05$) and decreased after rehydration (NS). Levels of Folate and B12 also increased significantly after tests ($p<0.05$). A tendency of better recovery of Hcy was found with SP, but it did not reach baseline levels in any case. Significant differences of CK levels were found in baseline levels during rehydration in the SA ($p<0.05$), while no significant differences in the SP were found ($p>0.05$). Rehydration with SP after 2 hours was more effective to restore basal levels of CK after exercise; by contrast, the recovery process with water was transient.

Conclusions: Both high intensity and moderate aerobic exercise increased serum Hcy levels immediately after exercise. The effectiveness of rehydration on the recovery process needs further research.

Key words: exercise, hydration, homocysteine, cardiovascular risk.

16/25. Water intake in the old dependent population

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Abstract

Introduction: The importance of dehydration in geriatrics lies in its high prevalence and the increase of mortality (higher than the rest of patients). The reduction in the sensation of thirst in this age group is one of the reasons why liquid intake control is so important.

Objectives: To evaluate water in dependent population user of the different services of social assistance.

Methods/Design: Customised surveys were conducted at home, assessing the contribution of drinks contained in the Mediterranean diet: water, dairy products, juice, soups and broths, tea, wine, beer and soft drinks, taking into account the weekly consumption and the usual measures for each liquid according to CESNID. Results: Users showed a tendency to consume liquids below the minimum recommended by the Spanish Society of Community Nutrition (1500ml/day). An increase in liquids with higher nutritional content (dairy products, juice, soups and broths) was observed after 70 years in both sexes, to the detriment of alcoholic beverages and soft drinks, although male consumption increased in that age range. However, the liquid intake in women (65 and 70 years) is close to the recommendation.

Conclusions: Water intake in both sexes and age groups barely reached the recommended minimum. Emphasis should be placed on this aspect in this population group.

Key words: old dependent population, liquid intake.

17/25. Consumer perceptions and preferences regarding water intake from various sources

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Abstract

Introduction: Little is known on consumer perceptions and preferences regarding water intake.

Objectives: We evaluated consumer habits and beliefs in relation to water intake from various sources.

Methods/Design: A questionnaire was administered in summer and in winter on a stratified sample of the general population in Athens (n=892, 41.3±20.7 yrs, 48.4% males).

Results: In winter, water intake was 2892±987 ml/day and came approximately 24% from solid foods, 50% from drinking water and 26% from beverages. In summer, water intake was 3875±1373 ml/day, and came approximately 15% from solid foods, 61% from drinking water and 24% from beverages (fruit juice, soft drinks, milk/chocolate milk, tea/herbal infusions, coffee, isotonic/energy drinks, alcoholic drinks). Approximately 60% drank water for taste/pleasure. Some carried water when out of the home (44% in summer, 37.3% in winter) but when at home fewer drank bottled water (29.8% in summer and 34.9% in winter). During exercise participants drank water and isotonic drinks, in summer 70% and 7.4 % and in winter 62.5% and 7.9%, respectively. Approximately 50% drank liquids before feeling thirsty, but when thirsty

few preferred other beverages instead of water (17.2% in summer and 26.2% in winter). Consumption of liquids did not cause a feeling of saturation to approximately 60% of the participants.

Conclusions: The study recorded consumer perceptions and preferences of liquid intake in summer and in winter.

Key words: consumer preference, choices, winter, summer.

18/25. The Consumption of sugary drinks in altitude

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Abstract

Introduction: In Spain, high mountain is considered from the 2.500 meters high and where environment returns hard, isolated and hostile. The physical conditions (among them feeding, hydration and physical preparation) and psychology conditions are absolutely necessary for the life.

Objectives: To establish the sugar drink habits of mountaineers on high mountains.

Methods/Design: A transversal descriptive study conducted on a sample of 389 mountaineers situated at an altitude of 1989.5 metres in the highland shelters of the Posets-Maladeta Natural Park (Huesca, Spain) over the period of July and August 2010.

Results: The juices are the type of sugar drink more consumed before and during, and the cola drinks after the realization of the PAE in HM, being their percentages 62.0%, 39.3% and 47.6% respectively.

Conclusions: In spite of the fact of good hydration based on water, sugary drinks contribute to hydration, calorie intake and glycemic in the practice of PAN in HM.

Key words: hydration, high mountain.

19/25. Selected for oral communication.

Updated information on beverage consumption in Spain: a nutritional overview

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Abstract

Introduction: The drinks market in Spain has expanded and changed mainly for nonalcoholic beverages. Dietary patterns, lifestyle and also consumer perceptions have shifted in recent years. However, there is a lack of information on drinking patterns and other related issues. The Spanish Nutrition Foundation has led this new survey of critical **importance for nutrition, health and hydration.**

Objectives: To evaluate beverage consumption habits, with stratification by age, gender, type and time of the meal as well as the potential benefits and perception attributed to the different beverages by the Spanish population.

Methods/Design: The representative sample included 2,119 men and women (15-55 years) from different Spanish regions. A market research company (TNS) made an online questionnaire that included: food and drink consumption habits, and potential functional benefits associated with drinks.

Results: The average drink consumption was 9.1 servings/day; 96.5% of those interviewed took the main meal of the day with a drink (nearly two glasses).The most consumed drinks were: water (92.3%), cola drinks (83.8%) and coffee with or without milk (72.1%). 36.3% of the sample attributed spontaneous "functional benefits" to coffee and 32.2% to cola drinks. The sample attributed benefits to cola drinks such as that they "wake you up" (23%) and are "refreshing" (19.6%) and to coffee such as that it "wakes you up" (47.8%) and gives you "energy/ vitality" (13.9%).

Conclusions: Average drink consumption by the Spanish population is quite satisfactory. Potential attributes are clearly associated by the population according to the perceived health as well as taste preferences and others. The updated information from the present study will allow in the near future the establishment of a guidance system on beverage consumption for the Spanish population.

Key words: beverages, nutrition, dietary patterns, hydration status, preferences.

20/25. Non-alcoholic beverages consumption: Madrid Nutrition Survey (ENUCAM)

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Abstract

Introduction: The previous nutrition survey in Madrid was completed in 1994. Fifteen years later, the Regional Health Ministry of Madrid and the Spanish Nutrition Foundation (FEN) have implemented a new nutrition survey to update the data and observe the changes in food and drink patterns as well as on healthy habits.

Objectives: To evaluate the non-alcoholic beverage intake in adults from the region of Madrid.

Methods/Design: The sample used was the ENUCAM study, representative of Madrid and stratified for sex, age and residence (1,553 subjects: 697 men, 856 women; age>18 years). Food and drink intake was calculated using a validated food frequency questionnaire, with 161 foods (11 non-alcoholic beverages).

Results: The average intake of non-alcoholic beverages was 1.681±831 g/person/day (1.382±795 water and 300±263 others). Consumption was lower in women (1.561±728) than in men (1.829±922) and in older age groups (18-44 years: 1.859±881; 45-64 years: 1.593±778; ≥65 years: 1.347±633), for both sexes. The energy intake of this food group represents 3.1% of total energy consumption per day. Water came from non-alcoholic beverage (51.4%), dairy products (12.6%), vegetables (11.5%) and fruit (10.8%). After water, the most consumed non-alcoholic beverage was (g/person/day): 64.1±65.8 coffee/herb tea, 62.7±144.9 soft drinks, 47,4±114,3 packaged juice, 46.9±90.9 fresh juice and 38.8±144.8 diet soft drinks.

Conclusions: Non-alcoholic beverage intake was below the recommendations for all groups studied, although higher than that found by the former nutrition survey of Madrid in 1994. Therefore, strategies that encourage proper hydration should be a priority for future nutritional policies.

Key words: beverages, nutrition survey, dietary patterns, hydration status.

21/25. Selected for oral communication

Dehydration after prolonged exercise combined with severe caloricrestriction despite ad libitum drinking

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Abstract

Introduction: The effects of prolonged exercise (PE) combined with severe caloricrestriction (SCR) on hydromineral balance and related neuro-endocrine responses inmen drinking ad libitum remain unknown.

Objectives: To determine the influence of protein versus carbohydrate supplementation on the hydromineral balance after PE combined with SCR.

Methods/Design: 15 overweight men (27-54 years old) were randomly assigned to a Protein (n=8) or Sucrose group (n=7), each receiving a hypotonic solution containing 0.8 g/kg of body weight/day of whey protein or sucrose, and Na+, Cl-,and K+. Each day of PE, subjects performed 45 min of one-arm cranking and walked8 hours (30-35 km/day). The next three days they rested and started to eat (80% of their daily energy requirements). The last assessment was carried out four week slater.

Results: Body mass was reduced by 5.2 kg after PE, from which 1.8 and 1.3 L corresponded to intra and extracellular water, respectively. Plasma osmolality was reduced from 289±2 to 283±2 (P<0.05), and recovered to 285±2 and 286±2 mOsm/kg after three days and four weeks, respectively. Plasma [Na+] and [K+] remained unchanged, while [Cl-] was reduced by 7 mEq/L after PE (P<0.05). Plasma aldosterone concentration and renin activity increased (3-8-folds), significantly more in the Protein than in the Sucrose group (P<0.05). After the control diet the body water was recovered (2.3 L) and aldosterone and renin levels normalized.

Conclusions: Drinking ad libitum a hypotonic solution does not prevent dehydration during prolonged exercise with caloric restriction. Protein solutions elicit stronger renin-angiotensin-aldosterone axis activation than sucrose solutions.

Key words: caloric restriction, prolonged exercise, dehydration.

22/25. Hydration status and body water composition in elderly patients at admission in a big hospital: analysis of routine clinical practices

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Abstract

Introduction: Elderly patients (>65 years) have an increased risk of dehydration.

Objectives: To assess the usual clinical practices around hydration status of elderly patients and their hydration status at general hospital admission, excluding critical and nefrological patients.

Methods/Design: A standardized questionnaire containing clinical history parameters and a checklist with substantial items for clinical evaluation was used. Electric bioimpedancy was used to evaluate body water composition. In addition, anthropometric parameters were measured in all patients. The randomisation order was decided according to admission time: the first three hospitalizations until 72 hours in each general hospital department.

Results: At this time 21 patients (76 ± 6 years) were included from several medical specialties: 57% internal medicine and 43% surgical area. Five patients (24%) presented BMI < 23 kg/m2 and 10 (48%) BMI > 25 kg/m². According to total body water (TBW) composition 66.6% (n=14) presented dehydration (TBW < 55%). In relation with clinical practices in clinical history were recorded body temperature, blood pressure, heart rate and general condition of the elderly patients in the study. However a complete water balance was performed only in 2 patients (9.5%). None had a register of food and water intake, including oral supplements, urinary analyses and subjective signal of dehydration.

Biochemical parameters were found in 15 (71.4%) clinical histories. Weight, height and BMI were only measured in 4 patients (19%).

Conclusions: Prevalence of dehydration among elderly patients was high at admission. Hydration status assessment in these patients was not a routine in this hospital. Therefore, the usual clinical practices should be reviewed.

Key words: dehydration, fluid balance, total body water.

23/25. Levels of breast milk and plasma osmolarity in healthy lactating women of the Canary Islands

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Abstract

Introduction: During pregnancy and breastfeeding, hydration plays an essential role since an adequate supply of water is essential for meeting the water needs of your body and of the baby. Proper hydration during breastfeeding ensures milk supply.

Objectives: The aim of this study was to estimate the correlation between plasma and breast milk osmolarity.

Methods/Design: Cross-sectional study based on 104 women aged 18-40 years who gave birth at the Gran Canaria Child University Hospital. Peripheral blood samples were obtained at 3 d postpartum. 104 samples of colostrum, 99 of early milk and 91 of mature milk were obtained.

Results: The average age for women in the study was 29±4.4 years (mean±SD), and the average week of gestation 40±1.3. The average osmolarity was 311mOsm/L, 358 mOsm/L, 302 mOsm/L and 324 mOsm/L for plasma, colostrum, early milk and mature milk, respectively. The Pearson correlation coefficient for the cross-sectional relation between plasma and colostrum osmolarity was -0.006 (p=0.951).

Conclusions: Breast milk osmolarity varies over the course of lactation. No correlation was observed between plasma and colostrum osmolarity. Future research involving larger populations is required to analyze the relationship between maternal diet and changes in milk osmolarity, and whether there is any disturbance of the normal process of breast milk synthesis.

Key words: lactating women, breast milk, hydration, osmolarity, breastfeeding.

24/25. Body water changes in amateur cyclists and their relationship with rehydration

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Abstract

Introduction: When ambient temperature is higher than the temperature of the skin the only way to dissipate heat is by sweating. But sweating causes dehydration. Rehydration favours lower plasma concentration and reduces stress and the perception of effort.

Objectives: To describe the total body water (TBW) of cyclists, its alterations at the end of a cycle race and its relationship with age and performance. To establish a relationship between TBW and fluid intake.

Methods/Design: We analysed 100 cyclists (age: 40.9±8.73). Body composition was analysed before and after the test by bioelectrical impedance (BIA). During the race, cyclists measured their heart rate (HR). The amount of fluid ingested and the type of beverages were also recorded.

Results: The cyclists lost 2.1 L of TBW. Their intake was 4.4 L (0.54 L/hour). No relationship was found between pre-test TBW and fluid intake. We observed no relationship either between fluid intake, age and performance, although it seems that those who consumed more than 0.6 L/hour achieved an outstanding performance.

Conclusions: Optimal rehydration may be between 0.6-0.8 L/hour. Acclimatisation improves pre-test TBW and enhances the feeling of thirst. Increased fluid intake tends to lower HR during the test.

Key words: dehydration, rehydration, total body water (TBW).

25/25. Alterations in blood tests related to dehydration in endurance tests

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Abstract

Introduction: When ambient temperature is higher than the temperature of the skin the only way to dissipate heat is by sweating. But sweating causes dehydration. Dehydration causes electrolyte, biochemical and haematological changes.

Objectives: To study the association between changes in total body water (TBW) and physiological, haematological, biochemical and physiologic electrolyte changes.

Methods/Design: We analysed 100 cyclists (age: 40.9±8.73). Body composition was analysed by bioelectrical impedance (BIA) and a blood test was performed before and after the test.

Results: TBW disturbances were associated to a greater or lesser extent with leukocytosis, increased haematocrit, erythrocytes, hemoglobin, platelet count, hypernatremia, hyperphosphatemia, hypomagnesemia, hypoglycemia and increases in urea and creatinine.

Conclusions: Significant changes in body weight (W) and TBW during cycling events may cause most of the haematological, immunological, electrolyte and biochemical changes.

Key words: dehydration, biochemistry, electrolytes, hematological parameters.

Authors