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# Nutrición Hospitalaria

*ÓRGANO OFICIAL DE LA SOCIEDAD ESPAÑOLA DE NUTRICIÓN PARENTERAL Y ENTERAL*
*ÓRGANO OFICIAL DE LA SOCIEDAD ESPAÑOLA DE NUTRICIÓN*
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# NORMAS DE PUBLICACIÓN PARA LOS AUTORES DE NUTRICIÓN HOSPITALARIA

Nutrición Hospitalaria

**Nutrición Hospitalaria, es la publicación científica oficial de la Sociedad Española de Nutrición Parenteral y Enteral (SENPE), de la Sociedad Española de Nutrición (SEN), de la Federación Latino Americana de Nutrición Parenteral y Enteral (FELANPE) y de la Federación Española de Sociedades de Nutrición, Alimentación y Dietética (FESNAD).**

**Publica trabajos en castellano e inglés sobre temas relacionados con el vasto campo de la nutrición. El envío de un manuscrito a la revista implica que es original y no ha sido publicado, ni está siendo evaluado para publicación, en otra revista y deben haberse elaborado siguiendo los Requisitos de Uniformidad del Comité Internacional de Directores de Revistas Médicas en su última versión (versión oficial disponible en inglés en http://www.icme.org; correspondiente traducción al castellano en: http://www.metodo.uab.es/ enlaces/Requisitos_de_Uniformidad_2006.pdf).**

**La falta de consideración de estos requisitos e instrucciones producirá, inevitablemente, un retraso en el proceso editorial y en la posible publicación del manuscrito, y también puede ser causa del rechazo del trabajo.**

**IMPORTANTE: A la aceptación y aprobación definitiva de cada artículo deberá abonarse la cantidad más impuestos vigente en el momento de la aceptación del artículo (que será publicada en un anexo en estas normas) en concepto de contribución parcial al coste del proceso editorial de la revista. El autor recibirá un comunicado mediante correo electrónico, desde la empresa editorial, indicándole el procedimiento a seguir.**

## 1. REMISIÓN Y PRESENTACIÓN DE MANUSCRITOS

Los trabajos se remitirán por vía electrónica a través del portal www.nutricionhospitalaria.com. En este portal el autor encontrará directrices y facilidades para la elaboración de su manuscrito. Los archivos correspondientes a texto se deberán de enviar en formato WORD. Los correspondientes a imágenes se podrán enviar en formato JPG.

Cada parte del manuscrito empezará una página, respetando siempre el siguiente orden:

### 1.1 Carta de presentación

- Deberá indicar el Tipo de Artículo que se remite a consideración y contendrá:
- Una breve explicación de cuál es su aportación así como su relevancia dentro del campo de la nutrición.
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### 1.2 Página de título

Se indicarán, en el orden que aquí se cita, los siguientes datos: título del artículo (será obligatorio el envío del Título en castellano e inglés por parte de los autores); se evitarán símbolos y acrónimos que no sean de uso común.

Nombre completo y apellido de todos los autores (es obligatorio el envío por parte de los autores del nombre completo y los dos apellidos, no aceptándose el uso de abreviaturas y/o iniciales), separados entre sí por una coma. Se aconseja que figure un máximo de ocho autores, figurando el resto en un anexo al final del texto.

Mediante números arábigos, en superíndice, se relacionará a cada autor, si procede, con el nombre de la institución a la que pertenecen. Deberá volver a enunciar los datos del autor responsable de la correspondencia que ya se deben haber incluido en la carta de presentación.

En la parte inferior se especificará el número total de palabras del cuerpo del artículo (excluyendo la carta de presentación, el resumen, agradecimientos, referencias bibliográficas, tablas y figuras).

Se incluirá la dirección postal y de correo electrónico del/de el autor/a designado para correspondencia.

### 1.3 Resumen

Será estructurado en el caso de originales, originales breves y revisiones, cumplimentando los apartados de Introducción, Objetivos, Métodos, Resultados y Discusión (Conclusiones, en su caso). Deberá ser comprensible por sí mismo y no contendrá citas bibliográficas.

Se deberá de incluir la versión en castellano e inglés del resumen con idéntica estructuración. Así mismo se incluirán aquí las palabras clave en castellano e inglés. Tanto resumen como palabras claves se deben enviar en los dos idiomas. Debe recordarse que esta información en inglés aparecerá en las bases de datos bibliográficas, y es responsabilidad de los autores/as su corrección ortográfica y gramatical.

### 1.4 Palabras clave

Debe incluirse al final de resumen un máximo de 5 palabras clave que coincidirán con los Descriptores del Medical Subjects Headings (MeSH): http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?db=mesh. Como se ha indicado en 1.3 se deben de enviar las palabras clave en castellano e inglés.

### 1.5 Abreviaturas

Se incluirá un listado de las abreviaturas presentes en el cuerpo del trabajo con su correspondiente explicación. Asimismo, se indicarán la primera vez que aparezcan en el texto del artículo.

### 1.6 Texto

Estructurado en el caso de originales, originales breves y revisiones, cumplimentando los apartados de Introducción, Objetivos, Métodos, Resultados y Discusión (Conclusiones, en su caso).

Se deben citar aquellas referencias bibliográficas estrictamente necesarias teniendo en cuenta criterios de pertinencia y relevancia.

En la metodología, se especificará el diseño, la población a estudio, los métodos estadísticos empleados, los procedimientos y las normas éticas seguidas en caso de ser necesarias.

Cuando el artículo sea enviado en idioma inglés, antes de su envío a la revista, recomendamos a los autores que lo sometan a la revisión de una persona angloparlante para garantizar la calidad del mismo.

### 1.7 Anexos

Material suplementario que sea necesario para el entendimiento del trabajo a publicar.

### 1.8 Agradecimientos

Esta sección debe reconocer las ayudas materiales y económicas, de cualquier índole, recibidas. Se indicará el organismo, institución o empresa que las otorga y, en su caso, el número de proyecto que se le asigna. Se valorará positivamente haber contado con ayudas.

Toda persona física o jurídica mencionada debe conocer y consentir su inclusión en este apartado.

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Para citar las revistas médicas se utilizarán las abreviaturas incluidas en el Journals Database, disponible en: http://www. ncbi.nlm.nih.gov/ entrez/query. fcgi?db=journals. En su defecto en el catálogo de publicaciones periódicas en bibliotecas de ciencias de la salud españolas: http://www.c17.net/c17/.

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### 1.10 Tablas y Figuras

El contenido será autoexplicativo y los datos no deberán ser redundantes con lo escrito. Las leyendas deberán incluir suficiente información para poder interpretarse sin recurrir al texto y deberán estar escritas en el mismo formato que el resto del manuscrito.

Se clasificarán con números arábigos, de acuerdo con su orden de aparición, siendo esta numeración independiente según sea tabla o figura. Llevarán un título informativo en la parte superior y en caso de necesitar alguna explicación se situará en la parte inferior. En ambos casos como parte integrante de la tabla o de la figura.

Se remitirán en fichero aparte, preferiblemente en formato JPEG, GIFF, TIFF o PowerPoint, o bien al final del texto incluyéndose cada tabla o figura en una hoja independiente.

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**2.1 Original:** Trabajo de investigación cuantitativa o cualitativa relacionado con cualquier aspecto de la investigación en el campo de la nutrición.

**2.2 Revisión:** Trabajo de revisión, preferiblemente sistemática, sobre temas relevantes y de actualidad para la nutrición.

**2.3 Notas Clínicas:** Descripción de uno o más casos, de excepcional interés que supongan una aportación al conocimiento clínico.

**2.4 Perspectiva:** Artículo que desarrolla nuevos aspectos, tendencias y opiniones. Sirviendo como enlace entre la investigación y la sociedad.

**2.5 Editorial:** Artículo sobre temas de interés y actualidad. Se escribirán a petición del Comité Editorial.

**2.6 Carta al Director:** Observación científica y de opinión sobre trabajos publicados recientemente en la revista, así como otros temas de relevante actualidad.

**2.7 Carta Científica:** La multiplicación de los trabajos originales que se reciben nos obligan a administrar el espacio físico de la revista. Por ello en ocasiones pediremos que algunos originales se reconviertan en carta científica cuyas características son:

- Título
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- Filiación
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- Texto máximo 400 palabras
- Una figura o una tabla
- Máximo cinco citas

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**EXTENSIÓN ORIENTATIVA DE LOS MANUSCRITOS**

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**Abono en concepto de financiación parcial de la publicación.** En el momento de aceptarse un artículo original o una revisión no solicitada, se facturará la cantidad que se haya estipulado en ese momento + impuestos para financiar en parte la publicación del articulo [vease Culebras JM y A Garcia de Lorenzo. El factor de impacto de Nutrición Hospitalaria incrementado… y los costes de edición también. *Nutr Hosp* 2012; 27(5)].

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NUTRICIÓN HOSPITALARIA ES PROPIEDAD DE SENPE

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Nutrición Hospitalaria

SOCIEDAD ESPAÑOLA DE NUTRICION *PARENTERAL Y ENTERAL*

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La Sociedad Española de Nutrición Parenteral y Enteral, que tiene como objetivos desde su fundación el potenciar el desarrollo y la investigación sobre temas científicos relacionados con el soporte nutricional, agradece su ayuda a todas las entidades participantes en el II International and IV Spanish Hydration Congress (II Congreso Internacional de Hidratación y IV Congreso Español de Hidratación), sin cuya ayuda no hubiera sido posible la realización de este proyecto.

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# SUMMARY

# II INTERNATIONAL AND IV SPANISH HYDRATION CONGRESS

## CLOSING Conference



## ABSTRACTS

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## OPENING ACT

*Chair:* Ascensión Marcos, PhD. President of Spanish Federation of Food, Nutron and Dietetic Societies (FESNAD). Madrid. Spain.

# Hydration and health

Angel Gil, PhD. President of Iberoamerican Nutrition Foundation (FINUT). Granada. Spain.

The majority of biochemical reactions supporting vital processes in humans occur in a water environment in which carbohydrates, proteins, minerals and other molecules are present. However, water is not only a solvent but a substrate for numerous chemical reactions and the final product of oxidative reactions. Indeed, water is a nutrient we must ingest; it is absorbed and has a key role in metabolism. Water is essential in all physiological processes requiring convection transport with net fluid flux, as it occurs with nutrient absorption in the digestive tract and renal excretion. Moreover, circulation system functionality is based on the fact that blood, due to its elevated fluidity because of its high water content, can be easily transported to all organs and tissues. Water is also fundamental in the body temperature homeostasis. Firstly, due to its high specific heat, it is able to capture a great amount of thermal energy as body temperature varies too little. Secondly, water contributes to maintain the body temperature through sweeping and transpiration. The evaporation of I liter of water in the skin surface dissipates about 600 kcal. Likewise, electrolytes maintain the osmotic equilibrium between diverse liquid compartments of the organism. Moreover, concentration ion differences among those compartments are responsible for transmembrane potential influencing cell excitation.

Water is the major component of our organism representing about 60% of the total body weight. i.e. about 40 kg for a subject of 70 kg. However, the water body content varies considerably among tissues, reaching a maximum in muscles and viscera and minimum in bones and other calcified tissues. Likewise, the water content varies among diverse individuals; these variation is related to age, sex and amount of adipose tissue. In fact, water is the only nutrient whose requirements vary as a function of sex, age, physiological situation and environmental conditions.

The European Food Safety Authority (EFSA) Panel on Dietetic Products, Nutrition, and Allergies (NDA) issued in 2010 the dietary reference values for water for specific age. The reference values for total water intake include water from drinking water, beverages of all kind, and from food moisture and only apply to conditions of moderate environmental temperature and moderate physical activity levels (PAL 1.6). Current scientific evidence supports that maintaining an adequate hydration status is not only important for exercise, and particularly for sportsmen, but to support global physical conditions and cognitive function in all subjects.

Dehydration is the process of losing body water and leads eventually to hypohydration (the condition of body water deficit) and eventually to fatal dehydration. Water body content decreases with increasing age and this must be taken into account in early infancy and the elderly. In newborns the water body content is very high (about 80%), thus being very susceptible to dehydration. On the contrary, aged subjects have a reduced content of water (about 45%), close to compatibility with normal functionality; this together with frequent alterations in the mechanisms of urinary concentration and thirst make elderly people very susceptible to hypohydration.

Depending on the ratio of fluid to electrolyte loss, dehydration can be classified as isotonic, hypertonic or hypotonic. Increasing dehydration with fluid losses of more than 1% leads successively to reductions in exercise performance, in thermoregulation, and in appetite; with fluid deficits of 4% and more, severe performance rate decreases are observed as well as difficulties in concentration, headaches, irritability and sleepiness, increases in body temperature and in respiratory rates; when fluid deficits continue to exceed 8% death may ensue. Particularly, hypertonic dehydration in which water loss exceeds salt loss, e.g. through inadequate water intake, excessive sweating, osmotic diuresis and diuretic drugs, can be fatal if water together with appropriate amount of sodium are ingested.

Key words: *fluid restriction, hydration, nutrient recommended intakes, water.*

**DOI:10.3305/nh.2015.32.sup2.10258**

# The importance of hydration and education: challenges and opportunities

Gregorio Varela-Moreiras, PhD. President of Spanish Nutrition Foundation (FEN).
CEU San Pablo University. Madrid. Spain.

The essentiality of water for life is beyond doubt. In spite of being a key element for maintaining a proper health status, until the last years it has not received sufficient research and educational attention. In this context, up to date three national (including one international) hydration congresses have been hold in Spain, and we're at the moment honoring the Opening Act of a fourth one at Toledo. The main conclusions of these previous conferences were that it warrants further scientific attention and concern regarding the diverse aspects that constitute the field of hydration research, and that hydration assessment is an emerging research area which comprises nutritional, exercise, behavioral and biochemical sciences. Both observational and experimental studies are needed to address causality as well as effectiveness.

At this point, I would like to address the importance of involving not only health professionals in the hydration field, recognizing that they are ideally placed to advise and educate on the benefits of proper hydration status and the best ways to achieve this, but also the educators at the different levels. Therefore, at the CEU San Pablo University and through the Spanish Nutrition Foundation we will encourage efforts to include the hydration issues at the school and university curriculum. Nutritional education typically focuses on food intake and physical activity. Both are of critical importance, but incomplete, since the quantity and quality of the fluids we drink every day can have a significant impact on our well-being and long-term health. The process of educating on hydration in primary and secondary schools, and later at the universities may play a key role in different lifestyles acquisition for adult life. It seems clear to me that an hydration education programme, by using a combination of traditional tools and new technologies, should be mandatory and not only a recommendation or conclusion of this Congress.

A good nutritional education promotes health through learning, adaptation and acceptance of healthy eating habits according to one's own food culture and scientific knowledge in nutrition. It can be promoted from different areas by acting at multidisciplinary levels: the family is a good place to practice it, as the individual from birth shares the meals with the rest of the family and a relationship of closeness and affection between the members; Schools, that are a fundamental social environment for children and teenagers, many attempts have been made in schools for promoting healthy behaviors in youth, including eating habits and healthy physical activity. Moreover, since in many cases children do lunch in the cafeteria (most of them eat in the cafeteria five days a week for 9 months a year) the classroom is also a good place to promote knowledge on hydration. Currently in Spain, food and nutrition knowledge are covered by several subjects, such as knowledge of the Rural, Social and Cultural Environment (Primary School), Science and Physical Education (Secondary School) and Applied Anatomy and Physical Education (High School), but as a whole it represents a minimum percentage in school education. Law on Food Security and Nutrition was recently adopted, which set the basis for planning, coordination and development of strategies and actions to promote information, education and health in the field of nutrition. They will help to raise public awareness of healthy hydration and encourage sustainable healthy hydration habits, by sharing scientific research, educational materials and practical tools.

Key words: *education, hydration status, curriculum, obesity prevention.*

**DOI:10.3305/nh.2015.32.sup2.10259**

# Gaining awareness of the hydration role in health

Carmen Pérez-Rodrigo, PhD. *President of Spanish Society for Community Nutrition (SENC). Bilbao. Spain.*

Over the last decades nutrition related issues have gained focus in science, epidemiology and social research areas. While in the first half of the 20th century malnutrition, protein and vitamin research deserved most interest, new research areas emerged in the 80s and accumulated evidence brought nutrition and diet related issues to the front line of public and private agendas. Water is essential for life and accounts for 60% of and adult human body composition. However, hydration and water needs have not been subject for abundant research until recent years, except for certain areas such as Pediatrics, specific conditions or athletics performance. In the United States of America (USA), the Institutes of Medicine (IOM) issued Dietary Reference values for water intake in 2004. The European Food Safety Authority (EFSA) published a Scientific Opinion on Dietary Reference Values for water in 2010. Adequate Intakes (AI) in that document were derived from a combination of observed intakes in population groups with desirable osmolality

values of urine and desirable water volumes per energy unit consumed. Those reference values for total water intake included water from drinking water, beverages of all kind, and from food moisture; and they only apply to conditions of moderate environmental temperature and moderate physical activity levels (PAL 1.6). The Spanish Society of Community Nutrition (SENC) published recommendations for a Healthy Hydration in 2008.

This 2nd International-4th Spanish Hydration Congress reflects the increasing interest on water, hydration and beverages as part of the whole diet, the physiological relevance and influence on health and wellbeing. The scientific program includes different presentation formats, such as conferences, round tables and a debate. It also provides ample space for open participation of young researchers in 12 different sessions. Among other themes, the following issues will be discussed: methods for assessment of fluid intake and hydration status; hydration in different physiological contexts; energy balance, hydration, eating habits and dietary patterns; fluid intake and hydration status in different population groups; genetic influence on hydration status; the role of hydration in short and long term health; hydration, the brain and cognition and several topics related to hydration, physical activity, sports medicine and sport performance.

National and international experts will meet and debate in this event contributing to highlight recent advances in research, to debate controversial areas and to seed new ideas to fill in the existing gaps. Furthermore, the valuable contribution of younger researchers will fuel discussions and enhance the exchange of experiences.

Key words: *hydration, diet, health, research, dietary reference values*.

**DOI:10.3305/nh.2015.32.sup2.10380**

# Opening Remarks: The burden of disease attributable to hydration in Europe

Lluis Serra-Majem, PhD. President of Spanish Nutrition and Food Sciences Academy (AEN).
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Dehydration occurs when the body loses more water than it takes. It is often accompanied by disturbances in the body's mineral salt or electrolyte balance, especially in the concentrations of sodium and potassium.

Population at particular risk of hypohydration are on the one hand, the very young who are engaged in professions where fluid homeostasis is regularly challenged and on the other, the elderly. Limited data are available on the prevalence of hypohydration, but there is evidence to suggest that this may be relatively common among the European elderly population. The percentage of population with an inadequate intake of water may vary from 5 to 35% in the different European countries.

While the burden of disease from inadequate water, sanitation and hygiene is well known in developing countries, the consequences of an inadequate water intake in Europe are far from being well understood. Recent researches into the risk of disease (falls and accidents, bowel, metabolic and kidney diseases), disability (cognitive function, physical performance, headache) and death are confirming the importance of poor hydration to overall disease burden and quality of life in Europe.

Moreover, the number of hospitalizations for dehydration has steadily increased in recent decades. In this case, dehydration increases the health care burden in a direct way, as a disease itself. But sometimes, dehydration appears as a comorbidity condition in some diseases. Dehydration has been defined as the second most common comorbidity factor, occurring in 14% of all hospitalizations. In addition to its individual clinical impact, dehydration also represents an important public health issue by imposing a significant economic burden. Depending on the degree or magnitude of the dehydration in hospitalized patients their costs may increase from 7% to 8.5%. Higher costs will be associated with an increase in the hospital mortality, as well as with an increase in the utilization of intense short and long term care facilities, readmission rates and hospital resources, especially among those with moderate to severe hyponatremia. Dehydration represents a potential target for intervention to reduce healthcare expenditures and improve patients' quality of life.

Improving drinking habits during working and leisure time, developing comprehensive hydration guidelines for healthcare professionals and patients would be cost-effective means of addressing the burden of hypohydration in Europe. Given the extent of the problem and its under-acknowledgment, will the Commission engage in a pan-European research and awareness-raising strategy on the burden of hypohydration in Europe? Will the Commission address the burden of dehydration in the elderly as part of its action plan on active ageing to be proposed in the near future?

Key words: *hydration status, public health, Europe*.

**DOI:10.3305/nh.2015.32.sup2.10260**

## SESSION 1

*Chairs:* Lluís Serra-Majem, PhD. Professor of Epidemiology and Public Health and Director. Research Institute of Biomedical and Health Sciences. University of Las Palmas de Gran Canaria. Las Palmas de Gran Canaria. Spain. José González-Alonso, PhD. Professor of Exercise and Cardiovascular Physiology. Brunel University London. Uxbridge. United Kingdom.

# Hydration and the human brain circulation and metabolism

Steven Trangmar, PhD. Lecturer in Exercise Physiology. School of Sport, Health and Applied Science St Mary's University. Twickenham. London. United Kingdom.

*Co-authors:* Scott Chiesa[1,3], Kameljit Kalsi[1,4], Niels Secher[1,5], José González-Alonso[1]

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Dehydration accrued during exercise in the heat challenges systemic and locomotor muscle blood flow, but its impact on brain blood flow and metabolism remains poorly understood. In this talk I will present the findings of two recent studies assessing brain haemodynamics and metabolism during maximal incremental and prolonged sub-maximal exercise in the heat, with and without dehydration. Measurements of cerebral blood flow using Doppler ultrasonography, in addition to arterial and internal jugular venous blood samples for the assessment of cerebral metabolism, were obtained. The pertinent mechanisms regulating brain blood flow in the present studies will be explored. The importance of these disturbances on the metabolism of the brain and the implications for exercise will be discussed.

Key words: *Cerebral blood flow, dehydration, exhaustive exercise*.

**DOI:10.3305/nh.2015.32.sup2.10261**

# Mild hypohydration increases the frequency of driver errors during a prolonged, monotonous driving task

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*Co-authors:* Phil Watson, Andrew Whale, Stephen A. Mears, Louise A. Reyner

*School of Sport, Exercise and Health Sciences. Loughborough University. Leicestershire. United Kingdom.*

*Purpose:* Driver error is the largest cause of road traffic accidents, accounting for around 68 % of all vehicle crashes in the UK. During long and monotonous driving, most individuals display progressive signs of visual fatigue and a loss of vigilance. Since deficits in total body water (TBW) are associated with altered mood and decrements in aspects of cognitive function, it is possible that dehydrated drivers may be more susceptible to errors in judgement and car handling. With this in mind, the aim of the present study was to examine the effects of fluid restriction, on performance during a prolonged, monotonous driving task.

*Methods:* Eleven healthy males (age 22 ± 4 y) completed a familiarisation trial, before two experimental trials were undertaken in a randomised manner. Each experimental trial took place over two days. On day 1 volunteers were instructed to consume a volume of fluid in line with published guidelines (HYD trial) or 25 % of this intake (FR trial). Participants came to the laboratory the following morning after an overnight fast (day 2). One hour following a standard breakfast, a 120 min driving simulation task began. During the HYD trial volunteers were provided with 200 mL of fluid every hour, and on the FR trial only 25 mL was made available each hour. Body mass, serum and urine osmolality, and subjective feelings were recorded during trials. Driver errors, including instances of lane drifting or late breaking, brain activity (EEG) and heart rate were recorded throughout the driving task.

*Results:* Pre-trial body mass (P=0.692), urine osmolality (P=0.838) and serum osmolality (P=0.574) were the same on both trials. FR resulted in a 1.1±0.7 % reduction in body mass, compared to -0.1±0.6 % in the HYD trial (P = 0.002). Urine and serum osmolality were both increased following FR (P<0.05). EEG alpha and theta activity increased throughout both HYD and FR trials (P = 0.038), indicative of reduced vigilance, but no clear difference was apparent between the trials (P=0.062). There was a progressive increase in the total number of driver errors observed during both the HYD and FR trials, but significantly more incidents were recorded throughout the FR trial (HYD 47 ± 44, FR 101 ± 84; ES = 0.81; P = 0.006).

*Conclusions:* The results of the present study suggest that mild hypohydration, resulted in an increase in errors during a prolonged, monotonous drive, compared to that observed while performing the same task in a hydrated condition. The magnitude of decrement reported was similar to that observed following the ingestion of alcohol resulting in a blood alcohol content of approximately 0.08 % (the current UK legal driving limit), or while sleep deprived. There is no question that both drink-driving and driving while tired increases the risk of road traffic accidents, and many countries have instigated national campaigns to educate drivers of the associated risks. Given the present findings, perhaps some attention should also be directed to encouraging appropriate hydration practices among drivers.

Key words: *Dehydration, Cognitive function, Road traffic accident*

**DOI:10.3305/nh.2015.32.sup2.10262**

## SESSION 2

*Chairs:* Marcela González-Gross, PhD. Professor for Sports Physiology and Sports Nutrition. Technical University of Madrid. Madrid. Spain.
Larry Kenney, PhD. Professor of Physiology and Kinesiology. The Pennsylvania State University. Pennsylvania. United States of America.

# Berevage intake methods and hydration status: validation aspects and limitations

Lluís Serra-Majem, PhD. Professor of Epidemiology and Public Health and Director. Research Institute of Biomedical and Health Sciences. University of Las Palmas de Gran Canaria. Las Palmas de Gran Canaria. Spain.

Assessment of beverages and water intake as well as of the hydration status are major challenges in nutrition research despite the large spectrum of research methodologies available. Water intake has been and continues being neglected by most researchers.

Quantification of habitual water exposure by the measurement of food and beverage intake combined with beverages composition is essential to investigate the impact of beverages on health and function.

Difficulties are encountered in the assessment of dietary and water intake. It requires relevant methods to assess the effects of a huge range of diverse foods, beverages and compounds (macro and micronutrients, and non-nutritional bioactive compounds) on individual health. Common methods involve questionnaires such as dietary and beverage questionnaires:

- Beverage frequency
- 24 hour recall
- Diet history over a specific period
- Classical versus photographic beverage record
- Specific beverages items

The validity of these approaches have been often questioned the method could be improved by using dietary recalls more frequently in order to limit the variability and dietary intake markers. Expectations for a better assessment of dietary and beverage intake are focused on new methods such as researches in metabolomics, metagenomics and natural enrichment of stable isotopes which could be helpful in terms of methods validation and useful in addition to standard methods.

The determination of hydration status has received increasing attention over the past 20 years, most of it influenced by the body water losses that can occur in a relatively short period of time related to physical activity or water intake restriction. Bloodborne parameters and urinary markers have been widely studied, and so it is being the use of bioelectrical impedance analysis. In most cases, acute changes in body mass are used to signify the body water losses or gains against which comparisons are made, but body mass changes are not synonymous to body water alterations.

Observational studies derived from large epidemiological surveys are able to raise hypotheses in terms of the association between dietary and beverage patterns and health and functional outcomes. These hypotheses as well as other ones derived from experimental researches should be the basis for randomised clinical trials.

Key words: *beverage intake, hydration status, water balance, validation.*

**DOI:10.3305/nh.2015.32.sup2.10263**

# Development of a hydration index: a randomized trial to assess the potential of different beverages to affect hydration status

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*Background:* The water content of ingested beverages enters the body water pool at a rate dictated by the rates of gastric emptying and intestinal absorption. Water is subsequently lost from the body by various routes, primarily urine in the absence of sweating. The post-ingestion diuretic response following prior hypohydration is influenced by several characteristics of the drink, including primarily volume, energy density, electrolyte content, and the presence of diuretic agents.

*Objective:* This study investigated the effects of 13 different commonly-consumed drinks on urine output and fluid balance when ingested in a euhydrated state, with a view to establishing a Hydration Index (HI; i.e. volume of urine produced after drinking expressed relative to a standard treatment [still water]).

*Design:* Each subject (n = 72, euhydrated and fasted males) ingested 1 L of still water or one of three other commercially-available beverages over a period of 30 minutes. Urine output was then collected for the subsequent 4 h. HI was corrected for water content of drinks and was calculated as the amount of water retained at 2 h after ingestion, relative to that observed following ingestion of still water.

*Results:* Total urine masses (mean (SD)) over 4 h were smaller than the still water control (1337(330) g) after oral rehydration solution (ORS, 1038(333) g, P=0.004), full-fat milk (1052(267) g, P=0.006) and skimmed milk (1049(334) g, P=0.005). Cumulative urine output at 4h after ingestion of cola, diet cola, tea, cold tea, coffee, lager, orange juice, sparkling water and a sports drink were not different from the response to water ingestion. The mean HI at 2 h was 1.53(0.74) for ORS, 1.32(0.51) for full-fat milk, and 1.44(0.54) for skimmed milk.

*Conclusions:* An HI may be a useful measure to identify the short-term hydration potential of different beverages when ingested in a euhydrated state.

Key words: *fluid balance, dehydration, rehydration.*

**DOI:10.3305/nh.2015.32.sup2.10264**

## SESSION 3

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# Dietary Guidelines in the world

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Hydration status, energy balance, dietary pattern, emotional balance and environmental sustainability are nowadays key axes for action in community nutrition and public health. Many countries have included recommendations about water and fluid intake in their Dietary Guidelines (DG). In some cases, DG graphical icons include a water tap, a glass of water or a traditional container, such as Argentina, Germany, Belgium, France, Switzerland or China. In other cases, the recommended amount of water and fluids is represented by a specific number of glasses of water. Such an icon has been more frequently used in designs targeted to older population groups.

The European Food Safety Authority (EFSA) as well as U.S. bodies have issued Dietary Reference Values for water intake for all age and sex population groups. Overall, recommended figures are slightly higher in the American recommendations. In any case and under basal conditions, water intake should be 1 mL per kcal, which means about 2.3 – 2.5 L per day.

Different life stages, certain diseases, participation in sport, pregnancy and lactation can all impact on hydration needs. Environmental conditions and certain characteristics of the diet influence water requirements as well. In certain disease conditions fluid and electrolyte requirements can be increased in variable amounts. e.g. fever, diarrhea, vomiting, kidney stones. Individuals living in hot climates also have higher water requirements as a consequence of water losses due to extra sweating.

Evaluation of beverage intake and adequacy to water requirements has not deserved much attention in most nutritional surveys. Some recently published data suggest that fluid intake is below recommended intake levels in significant proportions of the population. Water intake depends on eating and drinking habits as well as day-to-day variations in dietary choices. These are influenced by the time of day and drinking occasion, seasonality, taste preferences, availability and access to foods and drinks; convenience, attitudes towards foods or ingredients, perceptions about product quality and safety, cultural differences or even weight management concerns.

Food based DG are evidence based recommendations which should consider current population dietary practices and intake levels, as well as social and cultural contexts. The 2013 Australian Dietary Guidelines recommend limiting intake of drinks containing added sugars such as sugar-sweetened soft drinks and cordials, fruit drinks, vitamin waters and energy drinks and encourage consumption of water. The U.S. DG 2015 Committee advice to eat more water and less sugary drinks. The Committee report encourages the food industry to continue reformulating and making changes to certain foods to improve their nutrition profile, such as lowering sodium and added sugars content.

Health authorities issuing recommendations specifically targeted to children agree that water must be the first choice and recommend limited consumption of sugary soft drinks, fruit juices and smoothies containing sugar, as well as flavored dairies with added sugar.

Reports which include specific recommendations for beverage consumption classify beverages according to their energy and nutrient content, particularly, energy, sugar, sodium and fat, but also other constituents. This was the approach considered by the Spanish Society of Community Nutrition (SENC) to develop the Spanish Recommendations for a Healthy Hydration in 2008 along the Healthy Hydration Pyramid symbol. This set of recommendations was the result of a consensus meeting between several scientific societies considering different population groups. The meeting was convened by SENC in Zaragoza during Expo 2008 devoted to water as a unique theme.

The Healthy Hydration Pyramid classifies beverage options into four different levels and advises consumption for each level considering individual and group characteristics. Beverages classified in the first level are advised as the first and prevalent option. This level includes tap water and bottled water with low mineral content. Beverages classified in the second level include non-caloric options, including coffee and tea with no added sugar and non-caloric drinks, as well as water with higher mineral content. The third level includes beverages useful for hydration purpo-

ses which also supply additional energy and nutrients, such as fresh pressed fruit and vegetable juices, milk, soya and cereal based drinks, soups, gazpacho, etc. Finally, the fourth level includes sugar sweetened beverages which are recommended to be occasionally consumed. There is no evidence to support the contribution for hydration purposes of alcoholic beverages, including fermented beverages such as wine, cava and beer and therefore, such drinks are not included in the Healthy Hydration Pyramid.

Recent data from the ANIBES study on food consumption and energy balance in the Spanish population show that water and fluid intake is below recommended levels, especially in adults and elderly population. A Healthy Beverage Index has been recently tested and preliminary results report positive associations between higher HBI scores and more favorable lipid profiles; hypertension risk in adults, although further research is needed. Adequate water and fluid intake contributes to health and wellbeing.

Key words: *dietary guidelines, health, beverages, hydration.*

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# Water intake and hydration indices in healthy adults; the European Hydration Research Study (EHRS)

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Hydration status is linked to health, wellness and performance. Consequently, it is of public health interest to evaluate hydration status of population groups and to relate it with water intake from foods and beverages.

In this study, our objective was to evaluate hydration status, water intake and the output of 7 consecutive days in healthy adults in summer and winter. It was studied in three European countries (Spain, Germany and Greece).

The volunteers living in Spain, Germany or Greece (n=577, 40±12 y, (50.2 % males)), 25.06±4.62 kg/m2 BMI have participated in an 8-day study protocol during summer and winter. Total water intake was evaluated from food and drink records gathered in 7 day diaries. Hydration status was measured in 24h urine samples collected for 7 days and in blood samples collected on days 1 and 8 of the protocol. Hydration indices in urine (24h volume, specific gravity, colour, sodium and potassium concentration) and blood (haemoglobin, haematocrit and osmolality) were associated with water intake.

Total water intake was 2.63±0.98L/day, water from beverages 2.09±0.94L/day, water from foods 0.63±0.31 L/day, 24h urine volume 1.65±0.88 L/day, 24h urine osmolality 628±219 mOsmol/kg$H_2O$, 24h specific gravity 1.020±0.07, 24h sodium concentration 117±5 mEq/L, 24h potassium concentration 50±18 mEq/L, colour 4.2±1.4, haemoglobin 14.7±1.7 g/dL, haematocrit 43±4% and serum osmolality 294±9 mOsmol/kg$H_2O$. Water intake was higher in summer than in winter ($p<0.001$). Water intake was associated negatively with urine specific gravity, urine colour, urine sodium and potassium concentration ($p<0.01$). Applying urine osmolality cut-offs for hydration status, 21% of participants were hyperhydrated, 60% euhydrated and 19% dehydrated. Predictors for urine osmolality were age, country, gender and BMI but not season or physical activity.

Hydration indices on a large number of free-living individuals are provided. Most participants were euhydrated but a substantial number showed evidence of over- or under-hydration. Seasonal differences on total water intake were observed.

Key words: *Hydration status, water intake, urine hydration indices, blood hydration indices, seasonality.*

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# Adverse functional outcomes associated with body water deficits

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Humans have intricate regulatory mechanisms to sustain hydration, however, body water deficits can occur. Acute body water deficits are common due to high rates of fluid losses and insufficient intake. Chronic water deficits are rare and often associated with pathologies and/or medications. This lecture examines the adverse functional outcomes possibly associated with body water deficits. Functional outcomes are measurable changes in physiological strain, health/wellness and performance. Hydration physiology and evidence regarding five possible adverse functional outcomes will be reviewed: 1) cardiovascular strain, 2) thermoregulation, 3) aerobic performance, 4) mood/cognition, and 5) diseases.

*Hydration Fundamentals:* Total Body Water (~76 % of Lean Body) is tightly regulated with normal daily variation of <1 % of body mass. Body water deficits >2 % of body mass are defined as hypohydration and can be either hyperosmotic (from under-drinking and high sweat loss) or iso-osmotic (diuresis from cold, hypoxia or loop diuretics). Hyperosmotic hypovolemia elicits a plasma volume reduction proportionate to the water deficit; whereas, iso-osmotic hypovolemia results in greater plasma loss for a given water deficit due to reduced osmotic gradient to draw water from the intra-cellular to extra-cellular space. Both plasma hyperosmolality and plasma volume reduction stimulate arginine vasopressin (AVP) release that acts on the kidneys to reabsorb water. Plasma hyperosmolality, plasma volume reduction and elevated AVP have all been postulated to contribute to adverse functional outcomes from acute and chronic body water deficits. In addition, since daily water losses vary greatly between persons due to physical activity, environmental exposure, health and genetics there is no one fluid consumption rate that ensures full hydration for all.

*Cardiovascular Strain:* Body water deficits reduce plasma volume and thus cardiac filling and stroke volume, making it more difficult to maintain blood pressure during exposure to orthostatic, environmental and exercise stressors. Hypohydration reduces cerebral blood flow during orthostatic stress causing fainting. During rest and aerobic exercise, hypohydration will increase heart rate in proportion to the magnitude of water deficit. During aerobic exercise with moderate heat stress, hypohydration decreases cardiac output (compared to performing the exercise task when euhydrated). During aerobic exercise with severe heat stress, hypohydration can reduce skeletal muscle blood flow. Likewise, the cardiovascular strain imposed by hypohydration increases the risk of heat exhaustion.

*Thermoregulation:* Body water deficits increase core temperature during exercise at a given metabolic rate in temperate and warm-hot conditions. As the magnitude of water deficit increases, there is a concomitant graded elevation of core temperature, which is accentuated in warm-hot conditions. The elevated core temperature results from a decrease in heat loss from both sweating and skin blood flow responses (elevated threshold temperatures and decreased sensitivity) for a given core temperature. Both plasma hyperosmolality and hypovolemia contribute (with plasma hyperosmolality contributing more consistently) to the regulated increase in core temperature. In addition, body water deficits enhance the fever response that is likely due to increased production of pyrogenic cytokines.

*Aerobic Performance:* Aerobic performance can be quantified as maximal intensity (e.g., maximal aerobic power) or submaximal intensity (time-trial or time-to exhaustion). Maximal intensity studies are relatively few, but demonstrate that hypohydration generally impairs VO2max. The earliest studies of hypohydration and submaximal intensity exercise capacity in the 1940's found a reduced work capacity when fluid replacement was restricted in warm-hot environments. Subsequently, many laboratory studies have examined hypohydration and submaximal intensity aerobic performance. Those studies demonstrate that hypohydration does not alter aerobic performance in cold conditions; often impairs aerobic performance in temperate conditions, but consistently impairs aerobic performance in warm-to-hot conditions. Hypohydration begins to consistently impair submaximal aerobic performance when skin temperatures exceed 27ºC, and even warmer skin exacerbated the impaired aerobic performance (additional -1.5 % impairment or each 1ºC skin temperature elevation above 27ºC). Elevated skin temperatures are associated with increased skin blood flow / volume and cardiovascular strain.

*Mood/Cognition:* Mood degrades with hypohydration in proportion to the body water deficit. Early investigators reported strong associations between hypohydration level and impaired cognitive performance; however, many subsequent studies have not replicated those initial findings and suggest a more complex scenario. Recently, studies have demonstrated that body water deficits can alter brain structure and function (increased neural activity and recruitment) as well as impair cognitive-motor tasks. Thus, body water deficits are more likely to impair cognitive performance during or shortly after stressful psychological-motor tasks or in compromised (e.g., elderly, dementia) populations.

*Diseases:* Possible relationships between hydration and disease morbidities are difficult to establish due to an absence of a single valid "gold standard" biomarker of body water deficits. As a result studies of possible chronic dehydration and disease morbidities must rely on imprecise hydration biomarkers. Recently, copeptin a biomarker for arginine vasopressin (AVP) has been suggested as a hydration biomarker; however, several other factors (besides hydration status) can elevate these hormones. Regardless, interesting data are suggesting possible associations between elevated copeptin (thus AVP) and/or osmotic stress with diabetes/metabolic syndrome, renal and heart diseases in vulnerable populations.

*Conclusion:* The following hypohydration-mediated adverse functional outcomes are currently supported by the scientific literature: 1) increased cardiovascular strain and reduced orthostatic tolerance; 2) increased core temperature during physical exercise and fever; 3) impaired aerobic performance in warm-hot conditions with an increased risk of heat exhaustion; 4) degraded mood, with likely impairments of cognitive-motor performance.

Key words: *aerobic performance, body water deficits, cognition, dehydration, health, hypohydration, mood, orthostatic tolerance*.

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# Hydration and skeletal muscle

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Water is required for multiple processes related to muscle contraction from ATP hydrolysis at the myosin head to Krebs cycle reactions. In addition, water forms in muscle during the process of glycolysis and at the final step of mitochondria electron transport chain. Despite the utmost relevance of water for muscle energetics, it is largely unknown if humans incur into muscle water deficit to the extent to compromise contractile function or muscle energetics. It is however relevant to define the role of muscle water on fatigability and exercise tolerance since those are the main barriers for achieving health benefits from exercise.

Costill and associates studied muscle water changes during and after prolonged dehydrating exercise. They found that if muscle tissue is collected after 15 min of exercise, muscle does not decrease but rather increases its water content. Sjøgaard and Saltin also reported increases in active muscle water when sampling muscle right after three bouts of supramaximal cycling exercise. Likely, the increase in blood perfusion pressure and capillary recruitment with exercise results in a transient rise in muscle fluid content. However, Costill and co-workers were able to measure reductions in muscle water content when body weight decreased 5.8% by dehydration. After exercise, hydrostatic pressure rapidly declines to resting values allowing muscle water to shift to other fluid spaces and replenish their fluid losses. We have recently shown that whole body dehydration (4.2%) reduces muscle water content when 1 h of recovery is allowed to balance between body fluids. In fact, the reduction in muscle water content coincided with the recovery of plasma fluid suggesting the predominance of regaining cardiovascular stability after marked dehydration.

Skeletal muscle participation in whole body dehydration could have undesirable metabolic consequences. Haussinger and co-workers have found in the liver of rats that water deficit in this tissue causes reduced glucose transport and increased glycogenolysis. Based on this animal data it could be hypothesized that muscle water deficit by itself could increase glycogen use. Experiments in humans also point in that direction, since rehydration during exercise reduces glycogen use in comparison to a similar trial where participants are not allowed to replace fluids (i.e., dehydrated). However, recent data from our laboratory suggest otherwise. We separated the effects of reduction in muscle water content, by whole body dehydration, from the associated hyperthermia produced by dehydration. We found that hyperthermia rather than muscle water deficit is the main stimulator of glycogenolysis when exercising in a hot environment. However, the effects of muscle water deficit on glycogen use in other exercise types (intervallic, high intensity) and climates (thermoneutral) are open to investigation.

Back in 1930's, experiments in the liver of rabbits led to suggest that there was a relationship between water and glycogen storage in this tissue. Confirming this relationship in rat myotubes, glycogen synthesis is reduced when cell water is reduced by exposure to a hyperosmotic media. Furthermore, glycogen synthesis is increased after swelling induced by exposure to hyposmotic media. In horses, fluid ingestion after exercise affects glycogen restoration. Waller and co-workers found that glycogen recovery is accelerated in Standardbred horses after depleting-dehydrating exercise when an amount of water and electrolytes similar to the volume and composition of sweat lost during exercise was administered. In contrast in humans, Neufer and co-workers were first to find that water deprivation does not prevent normal muscle glycogen resynthesis. We partially corroborate their findings, although we found a nearly significant reduction for glycogen stored when subjects remained dehydrated ($P = 0.15$). One important difference between our studies is that Neufers' recovery period was 15 hours while we studied the 4 hours after exercise. We studied the 4 h post-exercise period because it is the period with the higher glycogen resynthesis. It is possible that muscle dehydration affects glycogen resynthesis in the short but not in the long term.

Finally, the effect of training in muscle water content is another area of interest. Aerobic training expands intravascular water after a few sessions purportedly to allow better cardiac function and sweat gland fluid supply. It is unclear if muscle water is also expanded with aerobic training. Data in old women supports a water expansion effect after 3 months of aerobic training. However, this effect has not been confirmed in a subsequent study with

young and old men. Furthermore, competitive runners display lower muscle water content when compared with recreational runners. However, it is unclear if the repeated deficits in body water incurred during training may be behind these responses. In summary, researchers are currently unveiling the consequences of muscle dehydration on metabolism and muscle function.

intensity aerobic performance. Those studies demonstrate that hypohydration does not alter aerobic performance in cold conditions; often impairs aerobic performance in temperate conditions, but consistently impairs aerobic performance in warm-to-hot conditions. Hypohydration begins to consistently impair submaximal aerobic performance when skin temperatures exceed 27ºC, and even warmer skin exacerbated the impaired aerobic performance (additional -1.5 % impairment or each 1ºC skin temperature elevation above 27ºC). Elevated skin temperatures are associated with increased skin blood flow / volume and cardiovascular strain.

Key words: *muscle energetics, water content, hydration.*

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# "Hydration. Fundamentals at different stages of life" handbook

*Speaker:* Frania Pfeffer, PhD. Scientific Manager. Coca-Cola Beverage Institute for Health & Wellness (BIHW). México.

Water is an essential element for life, it is the single largest nutrient in the human body, it is involved in most of the body reactions, nearly all the major systems of the body depend on water to work properly; nevertheless, the recommendations regarding its intake are based on assumptions and vary from country to country.

Being well hydrated is related to an adequate health and wellbeing; however, it is easier to find information in the literature on issues related to dehydration, than to find information on hydration.

This book consists of 11 chapters divided into two sections; the first one is about general information of water and hydration, and the second is about the basics of hydration at the different stages of life.

Chapter 1 is an overview of the characteristics of the water molecule and its functions in the body, which are countless. It also refers to some of the mechanisms to maintain water homeostasis in the body.

Chapter 2 deals with the sources of hydration which include different kinds of beverages, foods and also macronutrient oxidation. It is important to have knowledge of all sources of hydration and their characteristics to generate specific intake recommendations.

On Chapter 3 the recommendations for a healthy nutrition and hydration are addressed. Although there are daily suggested intakes and guidelines for water and food consumption, the requirements present a wide variability and depend on each individual's own characteristics. In fact, there is no consensus about the suggested water intakes which are based more on assumptions than on scientific evidence and are variable between countries.

Chapter 4 is about the consequences of an inadequate hydration, both dehydration and over hydration. Children and elderly, pregnant and lactating women, patients admitted to the Emergency Room and people who perform physical activity (amateur, professional and elite athletes) are most at risk of hydration disorders.

In Chapter 5, some of the methods for assessing hydration status are reviewed. It is very important to know how to evaluate patients clinically and through laboratory test, to know how to interpret the findings and generate effective and correct therapeutic actions.

Regarding the different stages of life, Chapter 6 is about the importance of hydration in childhood and adolescence. Children are often more vulnerable to fluid and electrolyte imbalances as between 60 and 80 % of their body weight is water, which explains their high needs per day. Children have different thermoregulation systems and their sweating rates are lower than those of adults so they are more vulnerable to dehydration.

Chapter 7, deals with hydration in adulthood. Under normal conditions, the restoration of fluid and electrolyte balance in adults is easily achieved due to the neural, endocrine and renal mechanisms. However, certain situations like extremes in climate and humidity can increase fluid losses. So it's important to understand hydration needs and always maintain proper fluid and electrolyte intakes.

In Chapter 8 the importance of hydration in pregnancy and lactation is mentioned. During pregnancy, the accretion of body water is essential for foetal development; during lactation the volume of milk produced by the woman provides the new born with the amount of energy, nutrients and water required for proper growth and development. So these two physiological states are associated with the increase in water requirements.

In Chapter 9 the hydration of the elderly and how aging is associated with several changes that affect the water balance is addressed, these changes include the decline of lean body mass (sarcopenia), the decline of the feeling of thirst and a decreased renal ability to concentrate urine, among others; this makes dehydration one of the most common disorders in the elderly.

Chapter 10 is about the importance of adequate hydration status in athletes and people who perform physical activity. Special sport drinks and strategies to maintain a good hydration status in individuals who exercise to avoid water losses which are related to a decline in physical performance are described.

The last chapter of the book is about myths in relation to water and hydration, here a group of preconceived ideas about this issues are enlisted and discussed

Thus, in a clear, accurate and entertaining manner, the most important aspects of hydration are covered from the physiological standpoint. The intention of this book is to be useful in the daily health care practice as well as becoming a reference text on this subject.

Key words: *water, hydration, population groups*.

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## SESSION 5

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# Hydration guidelines for fractionation of liquid intake in hot environments: report of Latin America

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*Introduction:* Total water intake is the sum of the liquid provided by water and all types of fluids, beverages and foods that contain it. It is assumed to represent around 80 % of total intake by humans, including 20 % from foods (EFSA). Water intake is mostly achieved though fluids like water, juices, energetic drinks, caffeinated drinks, soft drinks or soups. The needs of water intake vary depending on characteristics such as gender, life span, physical activity, geography, weather conditions, and others. Considering the life cycle, our first fluid intake, as suggested by the World Health Organization, should be breast milk. If the healthy newborn is well hydrated it can self-regulate the human milk intake. After the first six months of age and until 2 years old, others liquids and foods different from breast milk are responsible of the hydration and nutrition of the infant. Then, breastfeeding is displaced by others fluids, that may change across life cycle.

In hot weather a thirsty infant may want to breastfeed more frequently but for shorter periods. Extra fluids are normally not required if the child is breastfed whenever he needs and this may be more often than usual. In this way he is getting more low-fat breast milk and so is satisfying his thirst. In hot conditions, mothers should assure their own water intake is adequate (Australian Breastfeeding Association). With growth, self-regulation of fluids becomes more complex and is not necessarily satisfied optimally.

South America climate is variable, including wet and hot areas. In the Amazon basic temperatures vary from 21.1 ºC - 32.2 ºC while in the Andes it is cold during the whole year. According to the U.S. Environmental Science Services Administration the highest temperature registered in South America was from Argentina of 48.9 °C. These hot temperatures affect the temperature regulation of the body, increasing the amount of water and fluids needed to satisfy the requirements of the population. Children and older people are most at risk of being dehydrated.

*Methods:* A systematic review from the official web pages of the Ministries of Health, Institutes of Nutrition, Institutes of Public Health of each country, and pages like those from FAO from 20 Latin American countries, ranging from Mexico to Chile, were visited. The languages used for the search were Spanish, Portuguese and English. The key words were: hydration guidelines + the name of the country, reference values of water and fluids, nutritional needs of water and fluids and food guidelines. We selected the official guideline of each country, and searched for differences across life cycle, gender and characteristics of the weather.

*Results:* Although 15 of the 20 Latin American countries had food guidelines for their populations, only 9 countries (Bolivia, Brazil, Chile, Costa Rica, El Salvador, Honduras, Mexico, Nicaragua, and Paraguay) suggested as a general recommendation drinking 6 to 8 glasses of water a day. Venezuela recommended drinking liquids, without indications as to the quantity and frequency of intake, while Ecuador and Peru had no detailed food guideline. In the icons used to promote in the consumers to think, select and eat a healthy and varied meal, the presence of water and liquids is scarce. The most frequent liquid present in these icons were the milk and yogurt. A reference to water is present in a few icons such as in Argentina. Only Colombia recommended increasing the intake of fluids in hot environments, without any advice regarding to quantity or fractioning of consumption. Each country had their own references values for water and other liquids adapted to their cultural characteristics, geographic and weather conditions. Mexico and Venezuela supported their water and fluids references intakes as recommended by the Institute of Medicine of United States of America.

*Conclusions:* To our knowledge in Latin American countries, hydration guidelines for fractionation of liquid intake in hot environments do not exist. These countries have no official recommendations for water and fluids intakes. This may be due to different climates ranging from tropical areas with few variations of temperatures, to dramatic changes in climate across a year in the south. The food guidelines usually include a message related with water

consumption, but this message was not clear or specific to age, gender, quantity and/or frequency. Latin America and the Caribbean will face a challenge that will affect their optimal fluid intake. Estimates predict a rise of 4 °C in temperature for the next years, according to the study "Turning down the Heat" from World Bank. Another challenge is the need of surveying populations in the Latin American region to assess the intake patterns of different types of fluids (water and all other beverages) across gender and the life cycle. This requires developing the water and fluids intake references for the Latin American population for different climatic conditions.

Key words: *water, hydration, food, latinan american countries*

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# Evidence behind daily water and beverage intake recommendations

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Water requirements to meet hydration needs can be met by plain water, by water from caloric and non-caloric beverages, and by moisture from foods. The Dietary Reference Intake (DRI) values for water, established by the Institute of Medicine (IOM) in the US and the European Food Safety Authority (EFSA) in Europe, are based in part on observed population intakes of plain drinking water (tap and bottled); water from other caloric and non-caloric beverages, and on moisture from foods. For children, the US IOM recommendations for adequate intakes (AI) for water are 1,700 mL/d for boys and girls aged 4-8y and 2,100 mL/d for girls and 2,400 mL/d for boys aged 9-13.

Being mostly water, beverages contribute more to hydration than they do to energy intakes. Based on the national food consumption data for the US, plain drinking water and beverages accounted for up to 75% of total water intakes, with the remaining 25% provided by moisture in foods. By contrast, solid foods provided as much as 81.3% of daily calories for people aged >4y, whereas caloric beverages provided only 18.7%. Among the key beverages consumed in the US are plain drinking water, milk, juices, sodas and fruit drinks, coffee and tea.

Most data on beverage consumption patterns and consumption trends in the US come from federal agencies. The ongoing National Health and Nutrition Examination Survey (NHANES) conducted by the National Center for Health Statistics is the prime source of beverage consumption data, based on one or 2-day food recalls. The NHANES data are based on a representative sample of the US population, spanning different demographics and age groups. The US Department of Agriculture maintains national food availability data, useful for tracking long-term time trends by beverage category.

Consumption patterns of different beverages vary sharply by age. Young children are more likely to drink milk, whereas older adults are more likely to drink coffee. The consumption of citrus juices and sodas reaches a peak in adolescence but declines in adult life. Consumption patterns can also vary by socioeconomic status (SES). In the US, the consumption of plain tap water, bottled water, skim milk, and diet soft drinks has been linked to higher education and to higher incomes. By contrast, the consumption of regular soda and whole milk was linked to lower SES.

Nutrient density of beverages has been expressed in nutrients per calorie and nutrients per serving. While drinking water, tap and bottled, contains no calories and no nutrients, other beverages are important dietary sources of vitamin C, potassium, calcium and other vitamins and minerals. Although sweetened beverages are the biggest source of added sugars, they are not the biggest source of dietary calories. Added sugars account for about 13-18% of total daily calories in the American diet, depending on age. Sugar sweetened beverages (SSBs) account for about 40% of added sugars, on the average. Thus, the mean contribution of SSBs to total daily calories in the US has been estimated at 6-7%. Recent national data for the US point to a sharp decline in energy intakes from sugar sweetened beverages. The consumption of added sugars has also declined.

In summary, relying on food moisture does not come close to satisfying daily hydration needs. Water and beverages supplied 75% of daily water intakes, depending on age. Importantly non caloric plain water, both tap and bottled, contributed between 30% and 37% of total water intakes. Drinking plain drinking water and beverages is the key to satisfying hydration needs.

Key words: *drinking water, beverages, hydration, calories, trends*

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# Basic concepts of Mediterranean lifestyle and their impacts in the genomic aspects

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The Mediterranean lifestyle has traditionally been associated with a healthier life pattern, less prone to chronic illnesses, especially cardiovascular diseases. Among the different lifestyle variables, the concept of the Mediterranean diet (MedDiet) stands out as the healthiest aspect of the Mediterranean lifestyle. Moreover, although big differences in diet can be observed between the various countries on the Mediterranean coast, the Mediterranean lifestyle is also characterized by greater physical activity, mainly consisting of frequent walks encouraged by the warm and pleasant climate in comparison to central and northern Europe. So-called social support is also greater in the Mediterranean lifestyle with a closer and stronger family network and friends proving to be beneficial for health. However, there is great controversy about the Mediterranean siesta, mealtimes and sleep patterns. With regard to the MedDiet and despite the heterogeneity in the MedDiet definition, there is a commonly recognized pattern of consumption characterized by: a) high consumption of vegetables, fruits, cereals, legumes, nuts, and olive oil; b) moderate to high fish consumption; c) low consumption of red meats, and meat products; d) poultry and dairy products in moderate to small amounts and. There also seems to be a pattern of alcoholic and alcohol-free beverage consumption that varies depending on age. Environmental factors mainly contribute to this Mediterranean lifestyle, although genetic influences also interact. It is known that there are genetic variants that are associated with the intake of certain foodstuffs and among them the most relevant gene is the lactase gene (LCT) and its association with milk consumption. Thus, single nucleotide polymorphisms (SNPs) in the minichromosome maintenance complex component 6 (MCM6) gene are associated with differential transcriptional activation of the promoter of the neighboring lactase (LCT) gene and, thereby, influence lactase persistence (LP) in adulthood. The rs4988235 SNP, located at -13910 bp upstream from the LCT gene (-13910C>T) within intron 13 of the MCM6, has been the most studied SNP in relation to LP, milk intake and obesity-related diseases. Curiously, there is a north/south gradient in the prevalence of this gene variant, LP being less prevalent in the Mediterranean countries. Fruit, vegetable, sweets, sugared drinks, bitter drinks, etc. have been associated with variations in the different genes related to taste perception. There is increasingly detailed knowledge on the genes associated with the perception of sweet, bitter, sour, umami and salty tastes and their association with both food consumption, and the different health/disease phenotypes are being investigated. We have found associations between the perception of different tastes and the degree of adherence to the MedDiet. Moreover, diet itself may explain why certain gene variants are more prevalent in some countries than in others, as in the case of mutations in the MTHFR gene, which are more prevalent in Mediterranean countries than in northern Europe. In contrast, mutations in the APOE (E4 allele) are more frequent in northern Europe than in Mediterranean countries. To better understand these gene-diet interactions and their impact on the intermediate and final phenotypes of cardiovascular disease, we shall review several results from the PREDIMED (PREvención con DIeta MEDiterránea) study. We have detected interesting gene-diet interactions in which greater adherence to the MedDiet, or to some of its typical foods, is able to reverse the adverse effects that the risk alleles have on the specific phenotypes.Although in nutrigenetics, the interactions of SNP candidates with total liquid intake in the diet are less well known and difficult to study, there are classic examples in monogenic diseases that point to their importance. Outstanding among these examples is that of cystinuria, an autosomic recessive genetic disorder characterized by an impairment in the transport of cystine, ornithine, lysine, and arginine. Of these, only cystine is insoluble enough to cause stone formation. It can lead to significant morbidity in affected patients due to the often large and recurrent resulting kidney stones. Incidence of cystinuria in the Spanish Mediterranean population is high and has a specific genetic pattern. Mutations in the amino acid exchanger System b(0,+), the two subunits of which are encoded by SLC3A1 and SLC7A9, predominantly underlie this disease. Our group showed a low prevalence of mutations in the SLC3A1 gene and a higher prevalence of mutations in the SLC7A9 gene, in contrast to that found in other countries. However, the wide variation of phenotypical traits suggests that further investigation into other genetic and/

or environmental factors should be carried out. Among the environmental factors, increased fluid intake and urine alkalinization are the most successful preventive recommendations. Cystinuria is not very frequent, but there are other genetic alterations that may result in stone formation and consequently nephrolithiasis, both of which can be improved with greater hydration. Likewise, some interactions between genes associated with vasopressin and liquid intake on blood pressure and other phenotypes of cardiovascular risk are becoming known.

Key words: *Mediterranean, lifestyle, genetics, gene-diet interactions, cardiovascular.*

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# Water is life: an evolutionary perspective of hydration-related gene-environment interactions

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Since the time that archaic species left the water to live on land, the essential evolutionary demand was to provide the organism's cells with an aqueous environment similar to the one that was left behind in the oceans. The importance of proper hydration continues to be manifested in modern humans that can survive weeks without food but only a few days without water. It was in 2004 when the Food and Nutrition Board at the Institute of Medicine of the National Academies released the Dietary Reference Intakes for Water, Potassium, Sodium, Chloride, and Sulfate Report. In this report, we find a brief but comprehensive description about the importance of appropriate hydration to maintain health: "The largest single constituent of the human body, water, is essential for cellular homeostasis and life. It provides the solvent for biochemical reactions, is the medium for material transport, and has unique physical properties (high specific heat) to absorb metabolic heat. Water is essential to maintain vascular volume, to support the supply of nutrients to tissues, and to remove waste via the cardiovascular system and renal and hepatic clearance. Body water deficits challenge the ability of the body to maintain homeostasis during perturbations (e.g., sickness, physical exercise, or climatic stress) and can impact functions and health. Total water intake includes drinking water, water in other beverages, and water in food." However, despite the paramount role of hydration we don't have well -defined and soundly supported figures regarding daily water requirements for the general population. This is partially due to the many factors involved in defining the individual's needs (i.e., age, sex, dietary habits, physical activity, climate, seasonality and geographical and cultural environment) and related mechanisms (i.e., thirst, genetic background).

Apart from the hydration-related functions outlined above, a major driver through human evolution has been the correct maintenance of osmolality and vascular volume in changing environments. This is prior to the out-of-Africa dispersion (included the initial hot and humid forest, followed by the hot and dry savannah) where members of the homo genus survived and thrived thanks to a highly efficient heat dissipation mechanism, achieved through evaporative heat loss (sweat). However, sweating leads to loss of water and salt, which triggers thirst, salt appetite and renal sodium conservation, essential for survival in that ancestral environment. The downside of this evolutionary adaptation is the current prevalence of hypertension and other common diseases, characteristic of the modern society exposed to such different environmental and behavioral conditions.

Despite the relevance of hydration in relation to human evolution, metabolic homeostasis and its potential involvement in most common chronic diseases, the field of gene-environment interactions and more specifically, the area of nutrigenetics, has focused exclusively on gene-(solid)nutrient interactions, with a blatant absence of gene-hydration interactions. Withstanding the fuzziness involved in collecting drinking information and the lack of practical biomarkers of hydration status, there is enough evidence to support that individuals in the general population can maintain homeostasis, and apparently good health, with reported water intakes that differ as much as one order of magnitude (i.e., between 400 and 4000 ml/day). This suggests different individual needs and susceptibilities (i.e., perspiration, urination or thirst) that could have a significant genetic component. For example, it is known that subjects in northern latitudes sweat more under similar environmental conditions than people in the tropics. Moreover, it is also known that the susceptibility to hypertension in blacks leaving in the US is higher than in US whites. Whereas no genome wide association studies have been reported related to hydration factors (i.e., thirst, water intake and water loss), there are a number of alleles at candidate genes related to blood pressure, renal function and arterial and cardiac contractility that were potentially advantageous in our ancestral African habitat

but deleterious in today's world. This may be the case of the A-6G (rs5051) genetic variant in the proximal promoter region of the angiotensinogen (AGT) gene in the renin-angiotensin-aldosterone system (RAAS) pathway. The ancestral allele, shared with non-human primates, has been associated with elevated AGT gene transcription and plasma AGT levels and with essential hypertension. Other alleles related to hypertension are present only in humans and increased in frequency, most probably due to the positive selection, during the adaptation to the hot and dry environment characteristic of the African savannah. Some of the best characterized include: AGT G-217A (rs5049); G protein β3 subunit (GNB3) C825T (rs5433); β2 adrenergic receptor (ADRB2) G47A and G79C; and Sodium Channel, Non Voltage Gated 1 Alpha Subunit (SCNN1A) A-946G.

We need to keep in mind the evidence from most other dietary components studied so far, showing that the relation between intake and disease risk follows a J or U shape curve, and that the optimal intake may vary from one individual to another depending on genetic factors. Therefore, much more research is needed to elucidate individual hydration levels in order to achieve optimal homeostasis through life. This is especially important at a time in which hedonic, cultural and social factors contribute substantially to our current habits, overriding the ancestral endogenous thirst mechanism and potentially driving us outside of our specific "genomic" comfort zone.

Key words: *hydration, nutrigenetics, positive selection, hypertension, evolution.*

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### Intracellular water is related to half-marathon race time

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*Introduction:* Endurance training and competition can induce chronic dehydration, which in turn influences performance. Hydration levels have been classically associated with aerobic performance. However less is known about the relationship between aerobic performance and race time in half marathoners. Bioelectrical impedance analysis (BIA) equations can predict total body water (TBW) and extracellular water (ECW) in athletic healthy populations.

*Objective:* The aim of this study was to show the relationship between hydration status and performance in half-marathon race time.

*Method:* Thirty male long distance runners participated in the study and completed fasting body composition assessment by bioelectrical impedance analysis. TBW, and ECW were estimated and ICW was calculated. Pearson correlation coefficients were calculated and stepwise multiple regression were performed. The level of significance was set at $P<0.05$.

*Results:* Associations with extracellular water and total body water were not significant (r=-0.24; P=0.28 and r=-0.36; P=0.09). Intracellular water was related to half-marathon race time (r=0.46; P=0.03). Stepwise multiple regression shown that ICW explain a 21% of variance of race time (R2= 0.21, residual standard deviation: 6.9 min, P=0.03). Performance is not related to total body water and extracellular water.

*Conclusions:* Our findings suggest the importance of hydration status, particularly with ICW, in relation to endurance sports.

Key words: *performance, BIA, intracellular water, half-marathon.*

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### Water intake and urine osmolarity in Spanish school children aged 7-11 years

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*Background:* Dehydration is acutely associated with a wide variety of adverse outcomes in healthy adults and children.

*Objective:* To analyze the hydration status assessed by water intake and urine osmolarity in a group of Spanish school children.

*Method:* This is a cross-sectional study including 278 schoolchildren aged 7-11 years selected from various Spanish provinces. All children completed a 3-day "food and drink record" and 262 provided a 24-h urine sample. Total intake and dietary sources of water were calculated using DIAL software and osmolarity was calculated using urine sodium, potassium and urea.

*Results:* Mean total water intake was 1,405±437.9 mL/day and 86.3% of the children did not meet adequate intakes of water (IoM, 2005). No differences in total intake and dietary sources of water were observed by sex. Elevated urine osmolarity (>800 mOsm/L) was observed in 50.6% of participants. Boys presented higher urine osmolarity than girls (827.9±208.5 mOsm/L vs. 765.6±198.1 mOsm/L; $p<0.05$). A linear correlation was found between urine osmolarity and food moisture (excluding beverages) ($r=0.147$; $p<0.05$) and soft drinks moisture ($r=0.264$; $p<0.05$). In an analysis by sex group, the association between urine osmolarity and food moisture remained only in boys ($r=0.237$; $p<0.01$).

*Conclusion:* The present study reports a high prevalence of elevated urine osmolarity in children, especially in boys. Elevated urine osmolarity was associated with food moisture (excluding beverages) and water from soft drinks.

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Key words: *hydration, schoolchildren, urine osmolarity, water.*

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### Impact of physical activity and sedentary lifestyle on hydration status and liquid intake in Spanish older adults

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*Introduction:* Data on hydration status in older adults are scarce and there are very few studies focused on the impact of physical activity on drinking behaviour.

*Objective:* To determine the impact of physical activity and sedentary lifestyle on fluid intake in Spanish older adults.

*Method:* 430 non-institutionalized Spanish older adults (58% females), aged 55-80 years were divided into four groups: ILS (inactive and low sedentary), HIS (inactive and high sedentary), ALS (active and low sedentary) and AHS (active and high sedentary). Experimental data were collected by questionnaires, physical fitness tests, and osmolality was measured in serum. Data was analyzed using one-way ANOVA.

*Results:* Serum osmolality values were within references values in all subjects, independently of the physical activity and sedentary level. Liquid intake increased in parallel with physical activity. There were significant differences between ILS/ALS ($p=0.002$) and IHS/ALS ($p=0.001$), and no differences were found between AHS/IHS ($p=0.066$).

*Conclusions:* Spanish elderly seem to be well hydrated independently of the physical activity and sedentary level. Physical activity has a higher impact on fluid intake than sendentary lifestyle.

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Key words: *beverages, physical activity, elderly, sedentary.*

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## Dehydration in the hospitalized elderly

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*Introduction:* Mild dehydration is common and it is usually caused by an insufficient fluid intake throughout the day. People are continuously losing liquids through sweating, breathing and urine. Others causes that lead to a loss of body water are diarrhea, vomiting, physical activity, fever or burns.

Inadequate fluid intake during hot weather or when performing physical exercise can deplete body water levels. On the other hand, people suffering from a chronic disease or undergoing drug treatments are more susceptible.

*Method:* We developed a care plan to maintain hydration, prevent dehydration and also to explore the prevalence of dehydration, evaluated by objective parameters, on a medical ward at Virgen de la Arrixaca University Hospital and its association with indicative dehydration parameters in hospitalized elderly people.

The target population were people between 75 and 88 years old, prescribed with a lot of medication due to chronic underlying diseases.

*Results:* The observed symptoms were: dry mouth, oliguria or anuria, high heart rate, dry skin and very low blood pressure in severe cases.

*Conclusions:* Besides the physical and anthropometric assessment scales we used Barthel and Yesavage to assess the emotional state and MNA to assess nutritional status.

Key words: *dehydration, elderly, water balance, liquids.*

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## Water consumption and hydration status affects fine motor skills in schoolchildren

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*Introduction:* Previous studies have shown that hydration status and water consumption affects cognitive performance but, to date, little research has looked at the effects on fine motor skills.

*Objective:* To investigate whether water consumption improved performance on tasks that require predominately fine motor skills.

*Method:* In Study 1, 57 children (mean age 10.11 years) were tested individually. In one occasion children were given a drink of water (500 millilitres) and on the other occasion they were not. They completed a selection of cognitive tasks and a finger-tapping task pre and post-intervention; a urine sample was collected and urine osmolality (Uosm) analysed. In Study 2, 86 children (mean age 10.1 years) were tested pre and post-intervention in a drink or no drink condition on a bead threading, finger tapping, handwriting and Figure-Ground task.

*Results:* In Study 1, the number of finger taps were significantly higher on the occasion that children had a drink compared to when they did not ($p<0.05$). Exploratory analysis suggests that this effect was moderated by Uosm. In Study 2, having a drink of water increased handwriting speed ($p<0.05$) and there was a trend for finger-tapping speed to increase but handwriting quality and Figure-Ground performance was not affected.

*Conclusions:* Fine motor speed increased when children had a drink of water. This finding is important because children spend a large proportion of the school day using fine motor skills and handwriting skill can predict future academic performance.

Key words: *children, hydration, motor skills, cognition*.

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## Consumption of different types of fluids in Hungarian adults

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*Introduction:* Water is involved in practically all functions of the human body and plays an important role in life and health. The type of fluid intake has an impact on daily calorie intake.

*Objective:* The aim of this study was to assess the frequency of consumption of different types of fluids in adults.

*Method:* A total of 1,058 adults (496 men and 562 women) aged 18-85 were recruited from South Hungary. The information on the quality of fluid intake was collected using food and fluid frequency questionnaire.

*Results:* The main part of daily fluid consumption was water in 76.9% of the study population. A total of almost 50% never drink milk or any other fluid dairy products. Consumption of sweet regular beverages and alcoholic drinks (beer, wine and hard liquor) was significantly higher in men than in women ($p<0.05$). 63% of women choose yogurt several times a week or more often than men ($p<0.05$). 74% of subjects consumed coffee.

*Conclusions:* The biggest part of total fluid intake is water. Differences in the pattern of fluid consumption were observed between genders. Men were at a greater risk than women of unnecessary energy intake from sugar and alcohol.

Key words: *fluid intake, types of beverages*.

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## Hydration needs during breast-feeding

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*Introduction:* Many women stop breastfeeding their newborns because of their subjective perception of a low and insufficient milk supply. Sometimes mothers increase fluid intake hoping that this could improve milk production, based on the popular belief that recommends without any evidence that increasing fluid intake increases milk production.

*Objective:* To determine if fluid intake in lactating mother increases milk production.

*Method:* A descriptive study of the available evidence, using as tools for data collection the literature reviews from Cuiden database, Medline, Cochrane and Science.

*Results:* only a small controlled (210 women) study was found. The trial was of poor quality and did not report significant results. The study showed that extra fluid intake did not lead to increased milk production.

*Conclusions:* The effect of extra fluid intake in breastfeeding mothers is unknown due to the lack of well-conducted trials. The physiological basis for any improvement is not yet clear. There is insufficient evidence to support that an increase in fluid intake in breastfeeding mothers may be required to meet their physiological needs and satisfy their thirst.

Key words: *hydration, breastfeeding*.

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## Hydration for prevention of premature births

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*Introduction:* Preterm births are one of the risk factors that increase infant morbidity and mortality worldwide. Primary prevention and treatment tools are known. Theoretically, hydration may reduce uterine contractility by increasing uterine blood flow and decrease the pituitary secretion of ADH and oxytocin.

*Objective:* Find out if hydration in cases of risk of preterm labor is an effective measure.

*Method:* A descriptive study of the available evidence, using as tools for data collection in the literature reviews available in the Cuiden database, Medline, Cochrane and Science.

*Results:* Two studies involving 228 women with risk of preterm labor and intact membranes, compared intravenous hydration with bed rest alone. Both studies concluded that the risk was similar in both groups, except one which showed a lower risk if hydration occurred from week 35.

*Conclusions:* The data are too few to support hydration as a specific treatment in patients presenting a risk for preterm labor. There is no proof of important advan-

tages of hydration compared to the bed rest alone. In woman with risk for preterm labor, intravenous hydration does not seem to have beneficial effects, however, patients with evidence of dehydration may benefit from the intervention.

Key words: *preterm birth hydration*.

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## Conditions of fluid intake in the elderly

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*Introduction:* Aging process is associated with several physiologic changes that may affect the water balance, influencing the water input (thirst) and water output (urine, stool, sweat, and insensible respiration and perspiration). Some studies claim that 1% of hospitalized elderly suffer dehydration. This diagnosis is associated with increased morbidity-mortality (40-70%).

*Objective:* To describe the determinants of fluid intake in the elderly. Urine osmolality will also be measured.

*Method:* Descriptive, transversal and observational study. Sample: people aged ≥ 65 years from Toledo. Exclusion criteria: enteral-parenteral nutrition, pathology with water restriction, current acute process, terminal illness and severe dementia. Sampling: recruitment of convenience. Variables (Ad hoc questionnaire): sociodemographic, clinical (drugs, water intake volume, nutritional habits, symptoms and related factors), density and urine pH. Statistical analysis: SPSS 22. Pilot study was conducted to verify the relevance of the questionnaire.

*Results:* Pilot study: Sixteen adults. 43.8% women, aged 77±7.46. Urine density=1,029.38±6.80, pH=6.03±0.53. Drugs: 12.5% don't take, 25% take 1-3, 62.5% take ≥4.75% take IECAS and 31.25% take diuretics. Water intake: 12.5%: 6-8 glasses, 37.5%: 8-12 glasses and 50%: ≥12 glasses. Intake of fruits and vegetables: 50% ≥3 times daily and 12.5% don't take daily. Causes of decreased fluid intake: 44.44% decrease in thirst, 22.22% quickly sated and 11.11% doesn't like water. Consequences: 28.95% xerostomia, 13.16% dizziness/hypotension-weakness, 13.16% constipation, 15.79% less urine and 10.53% urinary infection.

*Conclusions:* Elderly don't have a good habit of hydration. It's important to prevent dehydration to minimize the effects on their health. More measures should be included in Health Programs.

Key words: *water, hydration, thirst, elderly, fluid-intake*.

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## Dehydration, cognitive and skill performance in sport. Systematic review

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*Introduction:* Currently, there is a lack of information about the effect of dehydration on cognitive performance in athletes. Moreover, this information could be an incentive for athletes to improve their liquid intake and, consequently, obtain performance and health benefits.

*Objective:* To check the effect of dehydration on cognitive and skill performance in sport.

*Method:* Systematic review following the Campbell Collaboration guidelines. A bibliographic search was performed in Web of Science using the following topic search strategy: (dehydration OR hydration OR liquid* OR fluid*) AND (cognitive performance OR cognitive function OR decision making) AND (sport* OR athlete*); by two independent reviewers. Inclusion criteria were: original research that test the effect of dehydration on cognitive performance with similar conditions for experimental and control groups, not including food-intake restriction. From a total of 56 articles, 12 articles met the inclusion criteria.

*Results:* Most of the studies (n=8) showed an impairment of cognitive capacities or skills in sport by dehydration. However, 4 articles did not find significant effects. In general, laboratory tasks are more sensitive to find negative effects of dehydration than a more real context (e.g., basketball shooting).

*Conclusions:* Cofound variables could affect results due to dehydration induction mechanisms and lack of control studies. Notwithstanding, dehydration seems to impair the cognitive performance and it can be used as an incentive for athletes to prevent dehydration and health problems.

Key words: *cognitive performance, making decision, athletes*.

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## Relation of liquid-intake habits and nutritional status, dependency and quality of life in malnourished patients

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*Introduction:* Malnutrition and dehydration are common problems among older people that can be aggravated during hospitalization. Thus, assessing the nutritional status according to liquid-intake habits in malnourished patients after hospital discharge, and its impact on quality of life and dependency, could be interesting factors for the health clinic practice and follow-up.

*Objective:* To assess differences in Body Mass Index (BMI), weight, malnutrition status, dependency and quality of life according to liquid-intake habits of malnourished patients after hospital discharge during a 2-month home follow-up.

*Method:* Cross-sectional descriptive study in 88 patients (44 males) who presented malnutrition at their hospital discharge. Patients presented 72.28±11.84 years of age and were grouped according to their liquid intake: from 3 to 5 glasses (n=42), and over 5 glasses of liquid (n=46); estimated through the Mini Nutritional Assessment questionnaire. The BMI, weight, Malnutrition Universal Screening Tool (MUST), dependency (Barthel questionnaire), and quality of life (Short Form 12 Health Survey (SF-12)) were assessed 2-months after discharge.

*Results:* Significant differences (t test) were reported for BMI (p=0.001), weight (p<0.001), MUST (p=0.020), Barthel (p=0.037), and SF-12 index (p=0.013); showing improved values in the group with a liquid intake >5 glasses compared with the 3-5 glasses intake.

*Conclusions:* A higher liquid-intake habit could be associated with better nutritional status, dependency and quality of life, in malnourished patients after hospital discharge during their home follow-up.

Key words: *malnutrition, hydration, body mass index.*

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## Influence of adequate hydration in the management of patients with Metabolic Syndrome

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*Introduction:* The prevalence of Metabolic Syndrome (MS) in our population has increased considerably in recent years. It also increases the need to maximize Dietary Advice in Primary Care consultation, emphasizing on hydration, even more relevant in climatic areas like Andalusia, holding high temperatures most of the year.

*Objective:* Study hydration degree in patients attending the Health Center, analyze age groups, gender, MS pathologies and good control criteria.

*Method:* Descriptive study of a random sample of patients between 18 May-19 June 2015. Those without MS (according to WHO criteria) are discarded. Sample n=102 (64 female, 38 male). Assessed variables: 1) Hydration (per day): a. <1liter; b. 1-1.5liters; c. 1'5-2liters; d. >2liters. 2) Age group: a. <65years; b. 65-80years; c. >80years. 3) Gender: a. Male; b. Female. 4) Compliance with good control criteria (last 3 months): a. Type 2 Diabetes. HbA1c <7 if age <75, HbA1c<8 if age >75; b. Obesity. Lower abdominal perimeter or BMI; c. Dyslipemia. Triglycerides>150 or HDL cholesterol >40 if male, >50 if female; d. Hypertension. Average on 80% of measurements <130/85.

*Results:* The study shows that the hydration level is below recommended in 56.9% of the sample. By age groups, the best hydrated are those between 65-80 years. By gender, women are more hydrated than men, though only 46.8% get to drink more than 1.5 liter per day. Regarding the last variable, we found a correlation between higher consumption of water and good control of HbA1c glycated, HDL and blood pressure values.

*Conclusions:* We may affirm that a proper degree of hydration contributes to a better management of metabolic syndrome. Dietary Advice in Primary Care should include recommendations on hydration by health professionals.

Key words: *hydration influence metabolic syndrome management.*

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## Is hydration enough in a healthy group of the elderly in a Valladolid neighbourhood?

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*Introduction:* Health education is the best tool to promote changes in the behaviour in the elderly to increase liquid consumption as a habit.

*Objective:* a) General: Improve the hydration in the elderly of a Valladolid neighbourhood; b) Specific: Determine water consumption and other liquids in an elderly group. Design an Education programme for health (EpS) to improve hydration.

*Method:* A sample of 60 people between 65 and 88 years old was evaluated. It was composed of 50% males and 50% females, in an aged neighbourhood in Valladolid. All were regular users of the Senior Center. A questionnaire with ten items to evaluate hydration was filled by each participant. The results were used to design an EpS programme.

*Results:* Evaluation of liquid intake: 53% females reach an intake of 1.8 l while 50% males only reach 1.3 l. Design of an EpS programme. Educational goals, which consist in three activities for 60 minutes, once a week, during two months: Feel and taste; Pyramid of healthy hydration; Trivial of water; Active methodology; Human and material resources; Evaluation.

*Conclusions:* An EpS programme is a useful tool to achieve the increase of water consumption and that of other drinks with a consequent decrease of the dehydration risk in a specially vulnerable population group. Females have lower risk of dehydration than males due to consumption of other drinks apart from water.

Key words: *elderly, hydration, health education.*

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## Development solution for water stress situations in military activities

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*Introduction:* The effects of dehydration in sports have been studied in depth but not in other areas such as military or rescue and security, where a number of factors can cause water stress: prolonged exercise, extreme environments or carry personal gear. Dehydration can negatively influence the effectiveness of the mission, equipment, vehicles or weapon handling, monitoring and warning statements or decisions.

*Objective:* To design a moisturizing solution prepared for use in different areas of health, in which water stress is generated. Establish a model to assess the ability of rehydration, based on the development of an activity and subsequent measurement of the physical and cognitive recovery.

*Method:* A literature review was performed to determine the composition of the beverage, define the activities that reproduce the conditions that can lead to dehydration in these groups and identify possible benchmarks for rehydration profile prepared in accordance with physical and cognitive obtained state. This method supports these assessments. The possible design of a prepared rehydration solution is set. A model that reproduces the collective activity is designed. Indicators of physical and cognitive status of the population tested is justified.

*Conclusions:* The need for a rehydration drink for application to the military field is established and similar. A possible design of the drink and a program to evaluate its rehydration effectiveness is determined.

Key words: *water stress, military activity, rehydration.*

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## Total water intake in 7-11 year-old Spanish children according to their physical activity level

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*Introduction:* Recommendation about Total Water Intake (TWI) varies according to the level of physical activity in adults, but these recommendations are not commonly extended to children.

*Objective:* To evaluate the TWI and hydration status by 24-h urinary osmolarity (UO) in children according to their physical activity level

*Method:* 262 out of 278 children (7-11 years old) (those with valid urine samples) were studied. Dietary data were collected by a 3-day food dietary record, and TWI and the amount of different beverages and food were calculated using the DIAL Software. 24-h urine samples were analyzed, calculating their UO. A physical activity questionnaire was filled to establish the physical activity factor and to divide the sample into tertiles (T1=low, T2= medium and T3=high activity level).

*Results:* TWI was 1,351.5±382.8 mL/day in girls and 1,443.5±470.0 mL/day in boys (3.1% and 6.8% respectively above EFSA (2008) recommendations). UO was 764.8±200.1 and 827.1±207.1 mOsm/L in girls and boys respectively. There were no significant differences in TWI and UO regarding sex. According to activity level groups, there were no differences in girls, but UO in T1 boys was significantly lower than those of T3 (743.46±217.13 vs. 861.9±191.5 mOsm/L) and incidence of UO>800 mOsm/L was 46.2% and 63.6% respectively.

*Conclusion:* The most active children, especially boys, are not properly hydrated. Level of physical activity should be taken into account to establish an adequate intake in children.

Key words: *hydration, children, physical activity.*

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## Health education: an analysis of wine and carbonated beverage consumption in college students in Extremadura

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*Introduction:* In our society, Mediterranean Diet (MD) eating habits are currently being lost. Promoting them and learning them is a competency that has to be developed in groups of young people, such as college students, especially correct hydration intake, whose benefits are not only physiological but cognitive as well. Furthermore, worthy of note is the importance of instruction, through Health Education (HE), of healthy eating habits in college students who will be teachers in the future, given their potential as public health agents.

*Objective:* To analyse the intake of benchmark MD drinks in college students.

*Method:* A cross-sector and descriptive survey in the healthy university population, with an average age of: 22.01 years and a BMI: 21.93 kg/m$^2$, on the Badajoz campus of the UEX (n=160). The analysis was based on the Predimed Survey, which records the consumption of carbonated and/or sweetened beverages (soft drinks, colas, tonic waters, bitter-flavoured drinks) per day and the consumption of wine per week.

*Results:* The most significant results showed that the daily consumption of carbonated and/or sweetened beverages stood at 58.8% in college students in general and at 67.5% for college students who will be teachers in the future. With respect to wine consumption, worthy of explanation is the fact that it was only quantified at 1.25% in college students who will be teachers in the future.

*Conclusions:* The moderate residual consumption of wine in the university population analysed and the high consumption of carbonated and/or sweetened beverages stands out. Hence, the promotion of healthy hydration through Health Education is recommendable.

Key words: *HE, hydration, MD, college students, cognitive.*

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## Hydration and cognitive performance in elderly people

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*Introduction:* The importance of a suitable hydration has been widely studied and is considered an indispensable factor in the maintenance of a good health. In older adults, there is a predisposition to dehydration due to several physiological factors of age and other social factors. Dehydration makes them more vulnerable to various diseases, being even a cause of death.

*Method:* The current work gathers information of a succinct bibliographical review on the hydration level of the Spanish elderly population as well as diverse studies that indicate a relation between hydration and cognitive health in the older person.

*Results:* In Spain, some studies and sociological surveys show an inadequate hydration in older persons, which increases the risk of dehydration and therefore the suffering of disease, hospital admittance and death.

*Conclusion:* A suitable hydration might improve the condition and cognitive performance of this population and prevent or delay dementia or Alzheimer's. Most studies indicate a theoretical benefit in cognitive performance associated with the maintenance of a suitable hydration in this population, but there is no proven scientific evidence that shows this benefit. Further research that allows to link the above mentioned association as well as a greater intervention of the agents involved in the maintenance and care of the health of this population to prevent dehydration is necessary.

Key words: *hydration, dehydration, cognitive performance, elderly.*

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## Liquid intake habits during competition in paddle players

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*Introduction:* Athletes must maintain a good level of hydration during competition by taking an appropriate amount of water or sport drinks before, after and during exercise. Dehydration reduces performance capability and abilities.

*Objective:* Given the rise in the practice of paddle, we consider of great interest to study hydration habits of paddle players.

*Method:* The study involved 416 non-professional (amateur) paddle players (128 women, 288 men) aged from 9 to 66, from Almeria (Spain), with an average of 14.6 years of sports practice and 4.4 years playing paddle. Prior informed consent was assessed by a validated survey liquid intake. SPSS 20.0 was used.

*Results:* 63% of the studied players drink before, during and after the competition, whereas other 32% don not do it regularly. However, the amount of liquid ingested by 48% of subjects, does not exceed 800 ml, being an insufficient intake to reach the water needs of an athlete. According to this, in 46% of the players on a match lasting two hours, only 5.8% of players have the habit to always consume sport drinks to counter and delay the onset of fatigue, while the 44% remaining never do it. The most consumed beverage was Aquarius.

*Conclusion:* The study shows risky habits between population tested and therefore the need for adequate hydration habits.

Key words: *paddle, drinking habits*.

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## Evolution of drinks availability in households from Spain in the last 50 years

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*Introduction:* There is a continuous need of updating the food and beverage consumption and dietary patterns and trends in Spain.

*Objective:* to describe the evolution of Spanish household drinks availability from the 60`s to nowadays.

*Method:* This study is based on household food purchases evaluated by the National Statistics Institute (1964-1991) and Spanish Ministry of Agriculture, Food and Environment (2000-2014) in collaboration with the Spanish Nutrition Foundation (FEN).

*Results:* Many differences are observed regarding the consumption of beverages in Spain, between the 60`s and 2014. Consumption of alcoholic beverages has decreased (50% -1964: 145 g/person/day; 1991: 113 g/person/day; 2000: 78.4 g/person/day and 2014: 72.6 g/person/day-) and consumption of non-alcoholic has increased (721 % -1964: 46 g/person/day; 1991: 96 g/person/day; 2000: 240 g/person/day and 2014: 332 g/person/day).

In 2014, the most consumed alcoholic beverage was beer (41.3 g/day), followed by wine (23.0 g/day). Regarding non-alcoholic beverages the most consumed was water (144 g/day), followed by cola (ordinary: 30.7 g/day and diet: 20.5 g/day).

In 2014, alcoholic beverages contributed 2% of the available energy and sugars and non-alcoholic 3% of energy and 16% of sugars while in 2000 alcoholic beverages contributed 2% energy and 1% sugars and non-alcoholic 4% energy and 23 sugars.

*Conclusion:* In the last decades, there were significant changes in the patterns of intake of drinks, with a dramatic increase in non-alcoholic drinks consumption especially in some Spanish regions whereas a decline in alcoholic beverages consumption was observed.

Key words: *non-alcoholic drinks, alcoholic drinks*.

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## Consumption trends of enriched/fortified beverages in Spain by the food consumption survey

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*Introduction:* There is a wide availability of enriched/fortified products in our stores, and a need to know the patterns and trends of consumption in Spain.

*Objective:* To study the evolution of the availability of enriched/fortified drinks in Spanish households in the last 15 years.

*Method:* This study is based on household food purchases evaluated by Spanish Ministry of Agriculture, Food and Environment (2000-2014) in collaboration with the Spanish Nutrition Foundation (FEN).

*Results:* in a general way, an increase is observed in the availability of enriched beverages (2000 vs. 2014: 328%). More important in the group of juice drinks with milk (2000 vs. 2014: 535%). The availability of enriched juices showed an increase between 2000 and 2010, but in 2010 (9.6 g/person/day) began a decline in consumption, nevertheless consumption in 2014 (4.7 g/person/day) was higher than in 2000 (2.7 g/person/day). Enriched with vitamins juices are the most commonly purchased in all years studied (2000: 2.0 g/person/day; 2005: 5.0 g/person/day; 2010: 9.1 g/person/day; 2014: 4,3 g/person/day).The evolution in the consumption of juices drinks with milk showed a continuous increase (2000: 2.0 g/person/day; 2005: 6.5 g/person/day; 2010: 7.9 g/person/day and 2014: 10.7 g/person/day).

*Conclusion:* An increase in the availability of enriched beverages in households is observed, so it is important to continue studying consumption, because food fortification with vitamins and minerals is currently considered as one of the main approaches to improve vitamin and mineral intake in populations.

Key words: *enriched/fortified beverages*.

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## Educative actions to promote hydration and rational use of herbal teas in pregnancy and lactation

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*Introduction:* During pregnancy the body of women undergoes a transformation and develops complex physiological situations, especially in the first trimester. Pregnant women may be at greater risk of dehydration by not drinking water due to nausea and vomiting. Hydration plays a crucial role for the renewal of amniotic fluid, which is the living environment of the fetus. Having said that, educative actions are required to promote maternal and child health.

*Objective:* Promotion of meetings with pregnant women about healthy habits especially regarding hydration.

*Method:* The meetings were organized weekly during 2013-2014 in the NGO "Baby on Board", Araraquara, SP, Brazil.

*Results:* It was observed that the women began to have a better understanding of the fact that good hydration is fundamental for the growth and development of the placenta and fetal amniotic fluid and that the liquid intake is crucial for the production of milk, being breastfeeding the best form of nutrition for their baby. It was also observed that many women consume herbal teas (as senna, chamomile, lemon grass), replacing the water consumption. However, plants have pharmacological activity and many are contraindicated during pregnancy and lactation, such as senna, that can lead to contractions, abortion, cramps and diarrhoea in infants.

*Conclusions:* The consumption of teas can be a form of hydration. However, it is extremely important that pregnant and lactating women are informed about the adverse effects of the consumption of herbal teas during pregnancy and lactation. Educational actions are well accepted by women and have positive effects.

Key words: *pregnancy, lactation, hydration, tea, herbs.*

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## Dose response effects of water on cognition in children and adults

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*Introduction:* Water supplementation has been found to facilitate visual attention and short-term memory, but the dose required to improve performance is not yet known.

*Objective:* We assessed the dose response effect of water on thirst, mood and cognitive performance in both adults and children.

*Method:* Participants were offered either no water, 25 ml or 300 ml water to drink. Study 1 assessed 32 adults and Study 2 assessed 79 7-9 year old children. In both studies, performance was assessed at baseline, and 20 minutes after drinking (or no drink), on thirst and mood scales, letter cancellation and digit span.

*Results:* For both children and adults, a large drink (300 ml) was necessary to reduce thirst, while a small drink (25 ml) was sufficient to improve visual attention (letter cancellation). In adults, a large drink improved digit span, but there was no such effect in children. In children, but not adults, a small drink resulted in increased thirst ratings.

*Conclusions:* Both children and adults show dose-response effects of drinking on visual attention and memory. Visual attention is enhanced by small amounts of fluid and appears not to be contingent on thirst reduction. Memory performance may be related to thirst, but differently for children and adults. These contrasting dose-response characteristics could imply cognitive enhancement by different mechanisms for these two domains.

Key words: *drinking, water, cognition, children, adults.*

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## Survey among elderly people related to their fluid intake

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*Introduction:* Appropriate hydration is a requirement for health. The aim of this study is to evaluate total fluid intake provided by different types of beverages and food in a sample of elderly people living in nursing homes.

*Method:* Interviews with a questionnaire. The study was carried out between April and June, 2014.

*Results:* A total of 140 interviews were completed. The people surveyed mostly consider themselves as active as their contemporaries (39%). More than half of seniors never do any sports. More than two-thirds of those surveyed have some kind of illness. Mean total water intake was 1,8 L for men and 1,7 L for women, far away from the "adequate Intake" set by the EFSA, 2.5 L (for adults

men) and 2 L (for adult women), respectively. Water and other beverages contributed 75% of total fluid intake, with 25% provided by water in food. Older adults consumed less water and beverages than younger adults.

*Conclusions:* Our study points out that water intake by the institutionalized elderly people remains well below the recommended daily amount of water intake. Interventions involving family members and HCP's to promote fluid consumption seem to be necessary.

Key words: *hydration, elderly, fluid intake*.

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## The importance of smoothies in hydration

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*Introduction:* Dehydration occurs when the body loses more water than you take in that is when the water balance is negative, it is shifted to water loss. It is often accompanied by changes in the balance of mineral salts or electrolytes in the body, especially sodium and potassium. It is aggravated by heat and swallowing problems. Today green smoothies are increasingly present in the diet of people interested in pursuing a healthy diet. Also, there is a major direct input of water and mineral salts contained in vegetables and fruits used to constitute an effective element of hydration.

*Objective:* Knowing the contribution of water and salts present in green smoothies.

*Method:* Observational analytical study of the composition of water and salts commonly used in green smoothies.

*Results:* From a total of seven green smoothy recipes comprised of 22 different plant nutrients, it has been found that these shakes have more than 92% water, an average sodium concentration of 0.15% and 1.16% potassium.

*Conclusions:* Green smoothies provide a high concentration of water and mineral salts in a prompt and pleasant way, avoiding dehydration.

Key words: *smoothies, fruits, vegetables, water, minerals*.

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## Dehydration in the elderly treated in the emergency room of the regional hospital

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*Introduction:* At this time, there is no absolute definition of dehydration that can be useful in clinical practice. The term dehydration refers to several conditions associated with loss of total body fluids. The terms commonly known in clinical practice to describe this situation are fluid deficit, volume depletion, and dehydration. The actual incidence of dehydration is unknown and probably underestimated. There is an important limitation of its diagnosis due to the lack of standardized methods to measure the quantity of liquids in the body. The variation in weight is the process most commonly used to measure the total loss of liquids in the body to determinate dehydration. This is not feasible in patients seen in the emergency department, a fact that has favored the use of other indicators in daily clinical practice. Dehydration underlies many clinical symptoms. Therefore, dehydration diagnosis should be present as a probable cause in the presence the above mentioned risk factors. Among these risk factors are extreme ages of life. The elderly have a higher risk of dehydration compared to the general population.

*Objective:* This study aims to determine the prevalence of dehydration in elderly patients received at the emergency department of EH, and its correlated risk factors associated with their age.

*Method:* An observational and retrospective study from 01/08/2015–31/08/2015 at the EH Emergency Department. The records of every person older than 65 that received medical services will be analyzed. A multivariate analysis of the factors that could influence in the outcome was conducted.

Key words: *dehydration*.

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## Water and beverage consumption among a Mediterranean sample

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*Introduction:* Appropriate hydration is essential for health. Water and other beverages are generally available to the population without limitations, but consumption patterns show variability across Europe.

*Objective:* To evaluate the liquid intake habits of a Mediterranean population (Spain-Portugal) and if they support the current EFSA policies and recommendations related to hydration.

*Method:* A record of fluid intake was obtained from 826 participants from both countries and compared with current hydration consensus.

*Results:* The average fluid intake was within the recommended: 1,600–2,000 mL/day (mean of 1800 mL/day). Portugal, in particular, had a lower intake (mean of 1365 mL/day), while Spain had a mean of 2,236 mL/day. Though water had a large contribution to total fluid intake (mean of 1,500 mL/day in Spain and 1,000 mL/day in Portugal), tap water consumption was higher than bottled water (23.3% vs. 6.1%, Spain). Milk and milk products (72.9%) and hot beverages (61.3%), in Spain, and hot beverages (5.9%) and milk (3%), in Portugal, follow water regarding the highest consumption. Only 8.5% of Spaniards and 2.5% of Portuguese knew hydration recommendations, and 7.5% and 9.6%, respectively, followed them.

*Conclusions:* The population studied does not ingest enough amount of liquid. The inconsistency and heterogeneity of data could be the result of a lack of a standard method for assessment of hydration status and insufficient knowledge regarding fluid intake recommendations.

Key words: *hydration, water, fluid-intake, health-policy, Mediterranean*.

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**Prevention of constipation during pregnancy with the hydration**

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*Introduction:* Constipation is a functional bowel disorder characterized by pain and discomfort, straining, hard stools and feeling of incomplete bowel movement. Pregnancy predisposes to constipation, about a third of pregnant women report suffering from constipation. It is more common in multiparous than primiparous.

*Objective:* Knowing how hydration affects the prevention of constipation during pregnancy.

*Method:* A literature search was performed in the following databases: Cochrane, IME, Pubmed, Cuiden and the website of the Spanish Society of Obstetrics and Gynecology.

*Results:* Constipation in pregnancy is probably due to reduced gastrointestinal motility by an increase in the concentration of circulating progesterone during pregnancy, resulting in a slowing of gastric emptying and intestinal transit for its relaxing effect on the smooth muscle. Conduct an adequate fluid intake helps prevent constipation. This should include about 8 glasses of water a day and a glass of fruit juice, especially plums.

*Conclusions:* In pregnancy is important to have a balanced diet and drink adequate amount of fluids within an active lifestyle and healthy life. Proper hydration during pregnancy benefits the fetus and the mother.

Key words: *pregnancy, constipation, hydration*.

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**Hydration campaigns: five years of experience**

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*Introduction:* For the last 5 years the General Pharmaceutical Council of Spain has conducted a series of campaigns

*Objective:* to get information out to the general public about the importance of hydration and the body's daily need for liquids, adapted to the individual and his physiological condition.

*Method:* The pharmacists provided personalized counselling on hydration to users at community pharmacies. For this task pharmacists used a technical/training document, alongside with a leaflet designed for users with a series of tips on dehydration prevention. These materials were distributed to community pharmacies through the Spanish Provincial Pharmaceutical Chambers. Pharmacist members were also able to consult and download materials at www.portalfarma.com.

*Results:* These healthcare campaigns have count on the participation of more than 16,000 community pharmacies per year and distributed more than 3,250,000 leaflet to citizens.

*Conclusions:* a) Community pharmacists play an essential role by informing and counselling the public about healthy lifestyle habits. b) The extensive participation in these educational campaigns has led to preventive and awareness-raising efforts as the cores of an essential educational drive carried out by Spanish pharmacists.

Key words: *hydration, mineral salts, water, pharmacists*.

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**Liquid intake in elderly people**

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*Introduction:* The adequate intake of liquid has been established to prevent several disorders.

Elderly people are a vulnerable group. The recommended intake should not be less than 1600 ml/day.

*Objective:* To identify the amount of liquid that elderly people require, in our basic health area; To evaluate their knowledge about recommended liquid intake and its benefits.

*Method:* Descriptive observational study conducted at Health Center (Torrijos). 121 subjects aged 65 years and older were selected by accidental non-probabilistic sampling between June-August 2015. The data was obtained by personal interview. We analyzed variables such as age, sex, weight, Barthel dependency score, daily liquid intake, knowledge about recommended liquid intake and its benefits.

*Results:* The mean age was 75.8; 53.7% were women. 57.1% of men had an adequate liquid intake. 66.1% of women had a liquid intake of less than 1,600 ml/day. No statistic relation between the Barthel dependency score and liquid intake. Significant relation between a higher level of knowledge of recommended liquid intake and an adequate liquid consumption in men (p=0.0004).

*Conclusions:* This study shows that there is a significant percentage of our elderly people with inadequate liquid intake. Increasing knowledge of people has a positive impact on achieving an adequate intake.

Nursing consultations should pay attention to liquid intake of older people as a fundamental part to accomplish proper nutrition.

Key words: *liquid intake, elderly people, nursing outcome criteria, knowledge, therapeutic regimen.*

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## Hydration status using free water reserve in Portuguese adolescents

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*Introduction:* Few data is available about the hydration status of active adolescents in free living conditions. Cell dehydration may be prevalent in healthy, free-living children at school and they could be in a state of chronic voluntary dehydration.

*Objective:* This study aims to describe hydration status assessed by Free Water Reserve (FWR) in adolescents.

*Method:* Two hundred participants (118 girls), aged 13-18 years completed the study. Urinary volume (ml/d) and urinary osmolality (mosm/kg) were measured by one 24h urinary collection, and coefficient of creatinine was used to validate completeness of urine collections. FWR (measured urine volume minus the obligatory urine volume) was used for characterization of hydration status. Positive values of FWR indicate euhydration, negative values the risk of hypo-hydration.

*Results:* Median urinary volume excretion was 1100.0 ml/d for boys and 1025.0 ml/d for girls (p=0.923). Mean urinary osmolality was 715.7±172.3 mosm/kg for boys and 597.42±193.1 mosm/kg for girls (p=0.247). Median FWR (ml/24h) was positive in both sex groups (173.2 ml/d in boys and 373.2 ml/d in girls); however, 40.2% of boys and 31.4% of girls (p=0.195) were at risk of hypo-hydration status.

*Conclusions:* In this sample of adolescents approximately one third was classified as at risk of hypo-hydration status. Preventive measures to increase the level of total water intake should be considered.

Key words: *adolescents, hydration, free water reserve.*

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## Beverages intake and hydration status in adolescents

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*Introduction:* Type and quantity of beverages intake among adolescents may influence their hydration status.

*Objective:* To evaluate the association between hydration status assessed by Free Water Reserve (FWR) and consumption of 5 types of beverages (water, milk, soft drinks, fruit juices and hot beverages).

*Method:* Cross-sectional study including 200 participants (118 girls), aged 13-18 years. Urine collections were validated by 24-hour urinary creatinine excretion in relation to body weight according to age group. FWR was assessed for characterization of hydration status (negative values represent risk of hypo-hydration). A 24-hour dietary recall was also collected and data on beverages (g/d) were analyzed from the following groups: water (tap water, natural mineral water, water from a fountain); hot beverages (coffee, tea, beverages made from cereals); milk; juices (home-made juice, bottled juice, nectar without added sugar, other 100%

fruit drinks); soft drinks (carbonated and non-carbonated soft-drinks). Mann–Whitney U test was performed to compare ingestion of beverages with FWR status.

*Results:* Median FWR was positive in both sexes (173 ml/d for boys and 373 ml/d for girls); however, 40% of boys and 31% of girls were at risk of hypo-hydration. Mean ingestion of beverages was: water 656±459g/d (n=159), hot beverages 168±200g/d (n=44), milk 489±290g/d (n=165), soft drinks 467±248g/d (n=107) and fruit juices 249±89g/d (n=10). Euhydrated participants reported to drink more water (p=0.009) and hot beverages (p=0.023) than participants at risk of hypo-hydration.

*Conclusions:* In this sample of participants, euhydrated adolescents ingest more water and hot beverages than those at risk of hypo-hydration.

Key words: *adolescents, hydration, beverages, urinary collection.*

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## Hydration status and water sources in free-living physically active elderly

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*Introduction:* Age-related changes contribute to increased susceptibility to dehydration in the elderly.

*Objective:* To evaluate the hydration status and the contribution of food and beverages to the total water intake in a sample of free-living physically active elderly.

*Method:* A sample of 74 individuals (28 men), between 60 and 83 years old, were included in this study. To assess hydration status, a 24h urine sample was collected; urinary markers were quantified in order to estimate the Free Water Reserve (FWR) and the hydration status. Additionally, a 24h food recall corresponding to the day of urine collection was obtained. Food and beverage groups were created to estimate the contribution of food groups to total water intake and its association with the hydration status.

*Results:* Most of the participants were classified as being euhydrated (91.9%). Water from food was about half of the total water intake (47% in females and 48% in males, p=0.757). "Water" (22%) and "Foods with reduced water content" (19%), were the groups that contributed most to the total water intake in women and men, respectively. In men, the contribution of "Alcoholic beverages" was significantly higher than that of women (10.5% vs. 1.7%, p <0.001).

*Conclusions:* Although most of the study participants were classified as euhydrated, the contribution of water-rich and nutritionally dense food, and non-alcoholic beverages, particularly in men, should be promoted.

Key words: *free water reserve, elderly.*

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## Fluid needs of aging cerebral palsy patients

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*Introduction:* Aging people with cerebral palsy have raised present dehydration that can cause serious physical and psychological damage risk.

*Objective:* This study analyzes the water needs of aging people with cerebral palsy.

*Method:* A descriptive-interpretative study on water necessities is performed. In Cerebral Palsy Association of Burgos, 26 adults (8 females, 18 males) with an average age of 40 years were selected to answer the questions; the oldest participant was 65 years old. All persons were classified with the Gross Motor Function Classification System (GMFCS), the Ability Classification System Manual (MACS), the Communication Function Classification System (CFCS) and the interviews on water needs. A statistical frequency analysis was conducted.

*Results:* The participants had 88% GMFCS level V and IV, 53% MACS level V and 38% CFCS level III. The factors that determine the fluid needs are their ability to move, swallowing disorders, medication and fear of incontinence.

*Conclusions:* It was confirmed that the people with a severe degree of disability presented a higher average of liquid needs. The adequate intake of water has been established to prevent the effects of dehydration. The degree of hydration can influence the health and welfare of people with cerebral palsy.

Key words: *primary prevention, health, drinking, disability.*

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## Isotonic sports drinks vs water in the hydration recovery after an immediate postpartum period

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*Introduction:* During pregnancy, hormonal changes cause a change in the thirst threshold. This is recovered in the postpartum period by a demand of drink to get back hydration homeostasis due to liquid loss after labour. Thus, an increase of necessity of drinking liquids is produced to generate milk.

*Objects:* To demonstrate whether there are any differences of glucose and ions in the immediate recovery of postpartum. To compare the administration of isotonic drinks vs water during the post-labour period after a low-risk pregnancy, as well as the degree of satisfaction.

*Method:* Comparison of the levels of glucose and ions in the pre-labour stage, post-labour stage and 24 hours after drinking isotonic drinks in a group of 50 women (experimental group) and another group of 50 women (control group) after drinking water. All participants completed a satisfaction survey.

*Results:* The analytical control either of administration of isotonic drinks or of water doesn't make clear a meaningful difference. However, there is a great satisfaction when drinking isotonic drinks and there is a feeling of quicker recovery.

*Conclusions:* Although isotonic drinks may not be essential in the analytical recovery at post-partum, woman's satisfaction is higher due to her feeling of taking part in her own recovery by drinking, the increase in blood glucose is also important, instead of just drinking water.

Key words: *hydration, ions, isotonic drinks, postpartum.*

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## Spanish "Bilbilis" Foundation for research and innovation in medical hydrology and hydrotherapy

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*Introduction:* Bilbilis Foundation (BF) created in December, 2007 is the first Spanish Foundation on Medical Hydrology (MH) and Balneotherapy providing the largest funding to research projects in Medical Hydrology, Rehabilitation and Geriatrics. The consultant team includes a wide range of specialists in different bio-areas, interested in medicinal waters, hydration and ageing.

*Objective:* To link basic research with daily clinical practice in Medical Hydrology, promoting National & International research projects with the objective of new diagnostic and therapeutic approaches, promoting quality in the clinical setting, concern about economic impact and medical results of Hydration and Hydrothermal therapies. Including these working fields: Rehabilitation, Nutrition, Geriatrics and Cosmetic Medicine. Lecturing and training program activities, teaching other medical professionals through organization of seminars and conferences.

*Method:* Financial support and scholarship on Medical Hydrology and Pelotherapy. Biannual Research Awards and Grants. Promotion and scientific support to young researchers. Publications: "Pelotherapy: medical and cosmetics applications of thermal muds". Patents.

*Results:* Presentation of main research pelotherapy projects developed during the last 5 years. Website presentation and development. Access to Bibliographic Database: about 9,500 Medical hydrology references (Evidence Based Medicine). Collaborative agreements. Development of research methods on Medical Hydrology, Pelotherapy and ageing.

*Conclusion:* BILBILIS FOUNDATION would like to establish new collaborative agreements with other scientific organizations and researchers in Medical Hydrology & Hydration. Study of ageing process and therapeutic approaches to prevent it.

Key words: *medical hydrology, thermalism, hydration-hydrotherapy, pelotherapy-mud-therapy.*

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## Beneficial effects of hydrotherapy on immunity and longevity in a mouse model of social isolation

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*Introduction:* Hydration and Hydrotherapy is a new type of environmental enrichment strategy, reverting the age-related decline of the homeostatic systems (nervous, endocrine and immune systems), enhancing the neuroendocrine-immune communication and, consequently, improving health and life span. In social species (humans, rodents), loneliness and social isolation are psychological stressors which impair the neuroendocrine-immune communication, increasing morbidity and mortality. Since aging especially affects homeostatic systems and older adults are more vulnerable to feeling lonely or socially isolated, suffering these stressors may aggravate health state in the later stages of life.

*Objective:* The aim of this work was to study the effects of hydration-hydrotherapy on immunity and life span in socially isolated old mice.

*Method:* ICR-CD1 old female mice were maintained in group (n=8) or isolated (n=10) during one month. Then, a group of isolated mice (n=5) was submitted to a 4-weeks hydrotherapy treatment. Peritoneal leukocytes were obtained and macrophages and lymphocytes chemotaxis, and lymphoproliferation in absence (basal) or presence of the mitogens Lipopolyssaccharide and Concanavalin A were analyzed. Mortality was also monitored.

*Results:* Hydration and Hydrotherapy improves lymphocytes chemotaxis and lymphoproliferative response to mitogens (functions reduced with aging), decreases basal lymphoproliferation (which increases with age) and increases life span in socially isolated mice.

*Conclusions:* Hydration-Hydrotherapy seems to be an effective strategy to reverse the immune decline induced by social isolation in elderly as well as to increase longevity.

Key words: *aging, hydration-hydrotherapy, social-isolation, immunity, longevity.*

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## Parents body mass index as modulator of fluid intake habits among their children

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*Introduction:* Overweight and obesity is a growing health problem nowadays. Its relationship with inadequate life habits (including low fluid intake) is an added problem.

*Objective:* To evaluate fluid intake by school children of the Community of Madrid according to body mass index (BMI) of their parents.

*Method:* 564 schoolchildren (258 boys and 306 girls) aged 9-12 years, were studied. Data on fluid intake was obtained by applying a food intake record (3 days). BMI of children was calculated by measured weight and height. BMI of parents was calculated by weight and height self-reported by parents and it was classified according to WHO criteria (2000). Statistical data was obtained using SPSS (v 19.0).

*Results:* 23.4% children had mothers with overweight/obesity (BMI ≥25 kg/m2). Fluid intake of these children was lower (1,465.52±390.3 mL/day) than those whose mother's BMI below 25 kg/m$^2$ (1,532.13±384.45 mL/day). BMI of children increased according to parents BMI, even more in the case of father BMI (r=0.243) vs mother BMI (r=0.199) ($p<0.05$). There were no differences in water intake of children considering BMI of fathers.

*Conclusions:* Most of the studied children had an inadequate water intake. Higher BMI of mothers is linked with lower fluid intake in their descendants, and higher BMI of parents is associated to higher BMI in children. This group needs special counseling to improve their patterns of hydration.

*Acknowledgements:* This study was performed with financial help from the FISS (project number PI060318).

Key words: *children, fluids, parents, body mass.*

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## Fluid intake habits among school children in Madrid depend on the educational level of their parents

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*Introduction:* Several studies show the influence of educational level of parents in their children's habits, including their fluid intake.

*Objective:* To evaluate fluid intake by of school children of the Community of Madrid, differing according to educational level of their parents.

*Method:* 564 schoolchildren (258 boys and 306 girls) aged 9-12 years, were studied. Data on fluid intake was obtained by applying a food intake record (3 days). Educational level of parents was self-declared, and it was classified depending on the type of studies completed (low, medium or high). Statistical data was obtained using SPSS (v 19.0) and it was set as statistical significance at $p<0.05$.

*Results:* Children with mothers with higher educational level (medium or high) take more liquid (1,562.4±406.9 and 1,565.7±371.9 mL/day, respectively) than those whose mother's educational level is lower (1395.04±367.5 mL/day) ($p<0.001$). It occurs similarly in the case of children whose fathers have higher educational level (fluid intake in children whose parents educated middle and upper: 1,538.7±411.4 and 1,606.8±380.5 mL/day, respectively), compared to those whose fathers have low

educational level (1,404.7±350.7 mL/day) (p<0.001). Although in all cases fluid intake is below the adequate intakes (IOM, 2005).

*Conclusions:* The water supply is below the appropriate in most of children studied. A lower educational level of parents is associated to lower fluid intake in their descendants, so these children need greater care in their patterns of hydration.

*Acknowledgements:* This study was performed with financial help from the FISS (project number PI060318).

Key words: *children, fluids, parents, educational level.*

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**Questionnaire design to evaluate water balance**

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*Introduction:* Body water balance is determined by the difference between the sum of water intake and endogenous water production and the sum of losses. Several questionnaires have been developed to evaluate water intake through food and drinks. However, assessing water losses through different routes of elimination is more complicated. Thus, few questionnaires evaluate intake and loss of water at the same time.

*Objective:* This study aims to develop a hydration questionnaire which can accurately determine the hydration status in the university population.

*Method:* The questionnaire development process included 3 steps: (1) identifying all foods and beverages from Spanish food composition tables which have water content higher than 80% (w/w); (2) recognizing the drugs and pathologies that may compromise hydration status as well as important hydration habits such as daily fluid consumption; (3) compiling all items and developing the hydration questionnaire.

*Results:* The final version of the hydration questionnaire comprises 24 items about hydration habits, relevant pathologies and questions related to regular fluid elimination (urination/defecation). In addition, it includes a brief food frequency questionnaire of the main water diet contributors.

*Conclusions:* We have designed a comprehensive, short and simple screening tool to assess the population's hydration status.

Key words: *hydration, water balance, questionnaire.*

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**Relationship between hydration status and psychological tests in Spanish schoolchildren aged 7-11 years**

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*Background:* Data about hydration status in children and psychological aspects are scarce.

*Objective:* To analyze the relationship between diuresis and urine osmolarity and indicators of stress, mood, and attention in a group of Spanish schoolchildren.

*Method:* 278 children (aged 7-11 years) from different Spanish provinces participated in a cross-sectional study. Single 24-h urine samples were collected and urine osmolarity was calculated. IECI, CDI and "d2" tests were applied in order to assess stress, mood and attention, respectively. Sample was divided regarding urine osmolarity in children with high urine osmolarity (HO) (>800 mOsm/L) and with low urine osmolarity (LO). Statistical analyses were performed with SPSS v.20.

*Results:* Finally 129 boys and 120 girls provided complete urinary and psychological data. In boys there were no differences in psychological scores between HO and LO but significant positive correlations were found between diuresis and attention (r=0.2262, p<0.01) and concentration scores (r=0.2512, p<0.01).

In females, stress scores in health domain (IECI-Health scores) and Global stress were significantly higher in HO than in LO. Also osmolarity positively correlated with IECI-Health scores (rho-Spearman=0.2236, p<0.05) and Global stress scores (rho-Spearman =0.2015, p<0.05), while inverse correlations were found between diuresis and IECI-School (rho-Spearman =-0.2130, p<0.05), Global stress (rho-Spearman =-0.2215, p<0.05) and CDI-Depression scores (rho-Spearman =-0.1879, p<0.05).

*Conclusion:* In this study, a better hydration status is related to better selective attention and mental concentration scores in boys, and lower stress and better mood in girls.

Study supported by a UCM Research Project (PR6/13-18866) and the Grant UCM-Santander Research Group Program (Ref. GR3/14).

Key words: *hydration, stress, mood, attention, schoolchildren.*

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## Design of a beverage visual guide to facilitate data collection in research studies

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*Introduction:* Quantification of water and beverage intake is an emerging topic in nutritional sciences. Different sizes in glasses, cups, bottles and cans have been observed, which contributes to the difficulty in data collection.

*Objective:* To design a visual beverage guide in order to facilitate data collection in nutritional studies.

*Method:* Pictures were taken with a Nikon Coolpix S2800 Digital Camera from 20MP at one of the largest food retailers in Spain, in different cafeterias in the city of Madrid and our laboratory. Different types, brands and sizes of drinks, like water, coffee, beer and wine were photographed, allowing the identification and recognition of that amount in different glasses and cups, to estimate any amount of ingested fluid.

*Results:* A total of 43 photographs were taken. The guide was divided into two parts. In the first part, volumes of liquids are presented in different glasses and cups available. In the second part, different sizes of bottles, cans, etc., are presented. Most of bottles and cans have the amount of fluid in the back of the pack, which makes fluid amount identification more difficult.

*Conclusions:* A specific beverage visual guide has been developed to facilitate data collection, in order to avoid under and over-reporting in nutrition surveys.

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Key words: *beverages, nutrition, visual guide, hydration.*

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## Does seasonality affect fluid intake?

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*Introduction:* The proportion of elderly population is increasing globally; however, there are few studies on fluid intake in older adults and specifically on beverage intake throughout the seasons.

*Objective:* To evaluate the effects of changes on fluid intake according to the four seasons in Spanish elderly people.

*Method:* Twenty-eight Spanish subjects aged over 55 years (60.7% females) performed a longitudinal study during one year. Subjects completed in each season a 24-hour dietary recall. Fluid intake was calculated using the DIALfood composition computer program (AlceIngeniería, S.L.). Also, physical fitness status was evaluated performing two strength tests and subjects were divided into 2 fitness groups (fit and unfit). Data was analyzed using one-way repeated measures.

*Results:* Beverage intake was higher in summer than in winter ($p=0.001$), spring ($p=0.008$) and autumn ($p=0.005$). Water was the fluid most consumed in all seasons. Seasonal variation was highest for soft, diet drinks and beer. An interaction effect of sex, age, and fitness status was not observed ($p>0.05$).

*Conclusions:* Seasonality has an influence on fluid intake and should be considered when analyzing drinking behavior and water and beverage intake in research studies.

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Key words: *hydration, fluid, seasonality, physical fitness, elderly.*

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## Questionnaire design to facilitate water and beverage intake data collection in research studies

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*Introduction:* The difficulty to quantify water and beverage intakes well established in the literature, and consequently, under and over-reporting exists in nutrition surveys.

*Objective:* To design a specific questionnaire in order to obtain reliable data on water and beverage intake and drinking patterns in adults.

*Method:* A hydration questionnaire was created by the Research Group based on food-frequency and eating habits questionnaires published in the literature, taking into account the modern beverage market.

*Results:* The questionnaire consists of three different parts. The first part includes questions about the different type of fluids consumed one day before the questionnaire is carried out. The second part records the fluid intake during a normal week of each beverage type. The beverages included are: water, juices, soft drinks, diet drinks, milk, milk drinks, coffee, tea or infusions, sport drinks, beer, wine and distilled drinks. The third part includes 20 questions about current drinking habits and changes occurred in the last 30 years, especially in regard to drinking habits before, during and after doing sport.

*Conclusions:* A specific questionnaire has been developed both paper-based and online to facilitate data collection on water and beverage intake to improve scientific accurateness.

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Key words: *beverages, nutrition, questionnaires, fluid, drinking*.

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## Evaluation of the Corporal Composition of Professional Acrobatic Parachutists with Bioelectrical Impedance and Anthropometry

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*Introduction:* The Parachute Acrobatic Patrol of the Air Force (PAPEA) is an international elite team in this sport. The environmental conditions in which they do his work; 3-4 daily jumps from 2300-11000 feet, the speed of their bodies during the free fall, the abrupt changes of altitude, and also temperature and atmospheric pressure can produce modifications in their bodily composition and level of hydration.

*Objective:* To assess the body fat measurement by anthropometric equations and bioelectrical impedance methods of PAPEA.

*Method:* Cross sectional study where 9 members of the masculine team of the PAPEA have participated: men aged 34.4±4.36 years; experience 3,944.4±2,780.8 jumps and 8.6±5.6 years in the team. Device OMRON BF 306 has been used to quantify fat mass. Body fat percentage have been calculated anthropometrically from the formula of Yuhasz, after the measurement of skinfold of biceps, triceps, subscapular and suprailiac regions.

*Results:* The average values of weight, height and BMI are 77.18±7,45Kg, 173.56±6.73cm and 25.61±1.92Kg/$m^2$ respectively. The percentage of body fat average with bioelectrical impedance is 20.49±3.93%. Anthropometrically, the percentage of fat is 12.49±2.88% .The average of the relation between both percentages is 0.61±0.1. Its coefficient of correlation is r=0.7325.

*Conclusions:* The values of both measurements are different but with a relation among them. The differences could be due to the non-evaluation of the muscular mass or because of t the level of hydration.

Key words: *parachuting, body composition, electrical bioimpedance, anthropometry, body fat*.

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## Importance of dairy consumption on the total water intake in young Mexicans

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*Introduction:* Total dietary water intake includes plain water and other beverages such as juices, milk and moisture in food, and it was established to ensure an adequate hydration. The type and amounts of water and beverages varied by age, gender, race/ethnicity, physical activity, health and socioeconomic status as well as environmental factors such as temperature and humidity.

*Objective:* To analyze the dairy intake as a source of water among young Mexicans according to weight status.

*Method:* A cross-sectional study including adolescents was conducted in Mexico City; anthropometric measurements were assessed. A 24 h recall was obtained and analyzed with the Food Processor Software. Body mass index (BMI) and was calculated and subjects were classified as overweight /obese (OW-O) according to CDC percentiles.

*Results:* 242 adolescents were evaluated; the average age was 12±1.9 years old, 50.4% of the sample were boys. 43.4% was classified as OW-O. The daily intake of water, including foods, was 1263.1±656 ml with a higher consumption in those with a normal weight compared with OW-O (1,555±605.2 vs 891.4 ± 468.7 ml, respectively; $p<0.05$).Meanwhile the average intake of whole dairy was 1.5±0.65 for normal weight vs 1.1±0.590 serving/day in OW-O; p=0.493). Also sugar added milk consumption was similar in both groups (normal: 1.2±0.461 vs OW-O:1.0±0.63 serving/day; p=0.123)

*Conclusion:* A low water consumption was reported in this population. In young Mexicans, milk is the third

most important source and there were no differences in dairy products between normal weight and OW-O.

Key words: *hydration, dairy, dietary water, adolescents*.

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## Promoting the right nutrition and hydration in schools by community nursing

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*Method:* We conducted a qualitative descriptive study by two nurses from a health center of Cartagena on 40 Primary pupils of two schools in Cartagena during 30-31 March 2015 to train teachers and students on healthy nutrition-hydration so as to assess previous and acquired knowledge by the students.

Data were obtained through an open question survey about nutrition, hydration, balanced diet and healthy eating prior to a talk and various educational games (food pyramid, drawings, plasticine games...) to strengthen knowledge. In the second day of school we conducted the same survey, assessing their recently learned skills. Teachers were in charge of strengthening the information provided during the school quarter, revealing in previous surveys that were conducted in the classrooms a basic knowledge with a few trends.

*Results:* They didn´t know which foods are healthy or not and the minimum daily liquid amount required. Some children considered bakery as a must in breakfast and dinner. 95% of students improved their knowledge about nutrition.

*Conclusions:* Educational activities should be included within existing health programs in all schools. Health education guided by healthcare professionals is better captured by the students at an early age, because is in this age is when they will shape their eating habits and lifestyles.

Key words: *nutrition, hydration, school, nursing, primary care*.

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## Water consumption, body composition and cardiometabolic parameters in children

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*Introduction:* Beverage consumption and its possible association with the current obesity epidemic and metabolic syndrome is under investigation in recent years, but water intake is probably the most underestimated or poorly measured of all beverages. Water is essential for life and plain water instead of other caloric beverages is one approach to decrease energy intake and therefore could play an important role to fight against obesity and cardiovascular disease.

*Method:* A cross sectional study was conducted in 366 schoolchildren aged 9 to 11 years from Cuenca′s province in Spain. Body composition and cardiometabolic parameters were measured and averaged 24h recalls to obtain water and beverage consumption. Cardiorespiratory fitness (CRF) was assessed by the 20m shuttle run test.

*Results:* In linear multiple regression (adjusted by sex, aged and CRF) we found an inverse association between water (ml) /Kg weight with BMI, Fat mass, Fat free mass, Waist circumference, insulin levels, MetS index, HOMA-IR ($p<0.000$), and with arterial pressure parameters, SBP ($p<0.010$), DBP ($p<0.028$) and Mean Arterial Pressure ($p<0.012$) and also, direct associations with HDL cholesterol ($p<0.001$).

*Conclusions:* Higher consumption of water/kg weight was negatively associated with BMI, Fat mass, Fat free mass, Waist circumference, insulin levels, MetS index, HOMA-IR, DBP, SBP, MAP and positively with HDL cholesterol in children. Water consumption is associated with numerous health benefits and an adequate intake of water could contribute to obesity and cardiovascular disease prevention in children and consequently in adulthood.

Key words: *water, body composition, cardiometabolic risk*.

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## Influence of oral intake of water in improving memory and visual acuity

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*Introduction:* Water is an essential nutrient since it intervenes in the major metabolic functions of the human body, being necessary to the proper functioning of our brain. A decrease in water intake is associated with states of confusion, irritability, lethargy and cognitive function loss. Brain's dehydration hurts (lower level of neurotransmitters) nerve transmission and decreases blood circulation in brain what may affect to mental performance. People with a proper hydration have better scores on intelligence tests.

*Objetive:* The main objective of this study is to know the relationship between water intake/hydration of a group of University students and their cognitive function.

*Method:* This information was collected from personal data (age, sex, and tobacco use), anthropometric measurements (weight, height, BMI -body mass index-), fluid intake, physical activity, and a measurement of intelligence test to fifty students (WAIS test with a total of thirty-six variables for each of the subjects).

*Results:* It was observed a statistically significant relationship between water consumption of youths and their visual acuity/memory, as well as better scores in the intellectual quotient.

*Conclusions:* A higher level of hydration can cause a beneficial effect on the information systems of memory and visual acuity, contributing to the improvement of the intellectual quotient.

Key words: *hydration, cognition, memory, intellectual quotient*.

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**Hydration habits in Spanish elite athletes**

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*Introduction:* The concept of dehydration is defined as a risk to the health of athletes and their performance. Many athletes reach very high levels of dehydration due to water loss through sweat and low fluid intake.

*Objective:* This study aims to assess the state of hydration of athletes who come to the consultation by completing a questionnaire about their habits regarding fluid intake. The questionnaire consists of 28 questions on hydration. In addition, information on sports history and personal data of each athlete were required.

*Method:* A sample of 58 athletes participated in the study, 37.9% were men and 62.1% women, with a mean age of 29.1 years (SD = 5.5). They participated voluntarily and data collection was conducted from April to July 2015.

*Results:* The results showed that more experienced athletes presented higher intake of litres of liquid than the less experienced athletes, and this difference approached the statistical significance. This suggests an effect of experience on the hydration of the athletes. More research in this field is necessary.

Key words: *dehydration, water, liquid, sport*.

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**Study on risk creatine and dehydration in athletes training in a gym**

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*Introduction:* Creatine is a supplement widely used by force athletes or whose goal is to gain muscle mass storing water in the intracellular space. Creatine has the ability to remove plasma water from the bloodstream into skeletal muscle in a process called muscle myofibrillar hydration or hydration. Although this benefits the skeletal muscles, less water is available to other tissues since most cell physiological and chemical reactions in the body need water.

*Objective:* To present the use of creatine as an ergogenic supplement, and possible adverse effects related to hydration.

*Method:* Cross-sectional study in adult males between 18 and 35 years. You are advised to use 0.3 grams of creatine per kilogram for several weeks. The administration form is the most commonly used initial charge and maintenance; when supplementation before and after training; and consumption takes place largely with the addition of carbohydrates.

*Results:* 34.5% of people who use creatine have or have had side effects, mainly weight gain, but do not manifest signs of dehydration at the indicated dose.

*Conclusions:* Although at lower doses of 3 grams there is no scientific evidence that risk of dehydration occurs, the recommendation is to maintain a high fluid intake (200-250 ml of water per 2.5 grams of creatine) since this water needs to be stored and if the availability is low, it decreases absorption and retention within the cell. There is no evidence that taking creatine in normal doses increases heat stress or adversely affects the performance of the athlete in warm environments.

Key words: *supplementation, creatine, dehydration*.

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**Efficiency of the hydration and nutrition institutionalized elderly with pressure ulcers**

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*Introduction:* It is estimated that the incidence of pressure ulcers in the general population is 3.3% between 70 and 75 years. It is estimated that 60% of pressure ulcers develop in the hospital and more than 70% occur in people over 70 years. The elderly are the most

affected age group. Retrospective studies confirm the occurrence of pressure ulcers (UPP) in stage II institutionalized within six months patients.

*Objective:* To evaluate the efficacy of an adequate nutritional and fluid intake on progress in healing pressure ulcers.

*Method:* Descriptive study of 12 institutionalized elderly with pressure ulcers varying degrees according to the National Group for the Study and Consultancy pressure ulcers (GNEAUP). Anthropometric and biochemical data were collected to assess nutritional status. A water supply (1 cc. water x kcal day) (30 cc water / day x weight kg) is recommended.

*Results:* Of the 12 elders participating on the study, a quarter has UPP grade I, 25% Grade II, Grade III Grade IV 16.7% and 33.3%. The favorable healing evolution of pressure ulcers in hiperproteica residents receiving oral supplementation and adequate water intake is faster than those who only eat diet cooking, getting the first at the end of this study better PUSH scores on the scale.

*Conclusions:* The (UPP) in institutionalized elderly patients contribute to increased morbidity and mortality and nursing workload. At least 95% of injuries are preventable with proper nutrition and a good water supply to keep the skin moisturized and more elastic, and the use of other preventive measures.

Key words: *hydration, nutrition, pressure, ulcers*.

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## Water compartmentalization and hydration state of patients attending to a cardiac rehabilitation program

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*Introduction:* Alterations in cardiovascular functions can change body water distribution. Therefore it would be interesting to include the control of this parameter in programs of cardiac rehabilitation (PCR) so as to keep body water in a healthy range.

*Objective:* To evaluate the effects of PCR on patients' hydration.

*Method:* Study was performed in two groups of patients suffering from a cardiovascular event: 1) PCR: 135 patients attending to a PCR (105 men, 30 women); 2) NOPCR: 70 patients not attending to a PCR (50 men, 20 women). Body water and phase angle were measured by bioelectrical impedance (TANITA MC-980MA multifrequency).

*Results:* In PCR group, total water in men was higher (43.77±0.63 vs. 40.44±0.72 kg) ($p<0.05$) than NOPCR group, and as for women, total water (37.13±1.49vs. 32.54±1.52 Kg) and intracellular water also increased with regard to NOPCR group (20.39±0.94vs.17.02±0.81 kg) ($p<0.001$ and $p<0.01$ respectively). In addition, a major phase angle exists in left body (4.98±0.23 vs. 6.11±0.18 kg in men and 3.87±0.17 vs. 5.15±0.33 kg in women) and both legs in the PCR group (4.89±0.21 vs. 6.05±0.19 kg in men and 4.02±0.29 vs. 5.21±0.31 kg) ($p<0.05$).

*Conclusions:* Subjects attending PCR showed a higher amount of total and intracellular water and higher phase angle, revealing a better state of hydration, and also a better integrity of the cell membrane and distribution of water between compartments.

Key words: *cardiac rehabilitation, hydration, body water; phase angle*.

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## Hydration status and associated dietary factors in children

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*Introduction:* An appropriate hydration is essential for normal body function and water may be obtained from beverages and foods.

*Objective:* To evaluate the hydration status and its relation to beverages and food intake in children.

*Method:* 172 (50% male), 7-11 years-old children completed a 24h urine collection. The Free Water Reserve was used to assess the hydration status. A 24 hours food recall corresponding to the day of urine collection was collected and a lifestyle and socio-demographic questionnaire was filled by parents. Anthropometric data were obtained. Food and beverage groups were created and unconditional logistic regression models were fitted in order to estimate the magnitude of the association between the contribution of beverages/food's water content and the hydration status.

*Results:* 57.6% of children were classified as at risk of hypohydration. A significant higher consumption of water (276.2 (± 208.4) vs. 188.2 (± 187.4) g/day) and fruit juices (77.6 (± 139.4) vs. 14.4 (± 57.2 g/day) was reported by euhydrated boys and girls, respectively,

compared to hypohydrated ones. A lower consumption of water and juices 100% was associated with a higher risk of hypohydration (OR = 2.16, 95% CI: 1.02 – 4.58, p = 0.045), adjusting for confounders.

*Conclusions:* Almost 60% of children were at risk of hypohydration. Water and fruit juices were significantly associated with a better hydration status.

Key words: *children, dietary Intake, hydration status.*

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**Beverage consumption habits amongst the Spanish population: association with total water and energy intake. Findings of the ANIBES study**

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*Introduction:* Inadequate hydration is a public health issue that imposes a significant economic burden. In Spain, data on hydration status are scarce. There is a clear need for a national study that quantifies total water and beverage intake and explores associations between types of beverages consumed and energy intake.

*Method:* The ANIBES study is a national survey of diet and nutrition conducted in a representative sample of 2,285 healthy subjects aged 9 to 75 years in Spain. Food and beverage intakes were assessed using weighed food and beverages records by age and gender. Time and day of beverage consumption were also recorded.

*Results:* On average, total water intake (TWI) was 1.66 L (SD 673.03) for men and 1.58 L (SD 596.24) for women, below the EFSA recommended adequate intake. Mean total energy intake (EI) was 1810 Kcal/day (SD 504.4). The contribution to the total EI from beverages was 12%. Water was the beverage most consumed, followed by milk. Out of 8 different types of beverages, the variety score was positively correlated with TWI (r = 0.39); and with EI (r = 0.23), suggesting that beverage variety is an indicator of higher consumption of food and drinks. Multiple regression models showed that replacing 100 g of caloric beverages with 100 g non-caloric drinks was associated with a reduction in EI of 50 kcal, or 40 kcal if EI from food was unchanged. Using within-person data, each 100 g change in caloric beverages was associated with 43 kcal change in EI or 34 kcal if EI from food was constant.

*Conclusions:* The present study demonstrates that well-conducted national surveys such as the ANIBES study have the potential to yield rich contextual data that can be linked to health and nutrition policies. Although neither men nor women consumed sufficient amount of TWI when compared to the EFSA reference value, further work must be warranted to explore correlations with biological markers of hydration status by population sub-groups.

*Acknowledgements:* The study was financially supported by a grant from Coca-Cola Iberia through an agreement with the Spanish Nutrition Foundation (FEN).

Key words: *total water intake, energy intake, beverages, Spain.*

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**Drinking habits in a sample of university students. Relationship between the adherence to the Mediterranean Diet and BMI**

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*Introduction:* The university pariod is marked by changes in food consumption patterns. Hydration habits affect students' physical and cognitive performance.

*Objective:* analyze beverage consumption, calculate the total water intake and compare it with the recommendations of the EFSA and analyze its relationship with the adherence to the Mediterranean Diet and BMI in a sample of university students.

*Method:* This is a descriptive cross-sectional study on a sample of 1978 students from the Rey Juan Carlos University of Madrid (2010/2011 academic year). The frequency and amount of beverage consumption was determined by Hendrick 2010. To assess the adherence to the Mediterranean Diet the TestkidMed was used.

*Results:* The average consumption of water from all drinks was 1673.6 ml/day in women and 1701.8 ml/day in men. The most consumed beverages were water (886.22 ml / day), dairy (341.38 ml / day), juices (202.17 ml / day), coffee and tea (171, 86 ml / day) and soft drinks (155, 10 ml / day). The average value in the test Kidmed was 6.18(± 2.61), 32.5% of cases reported high adherence, and 53.2% medium adherence. Only the 14.3% was classified as low adherence, showing a significant association between low adherece and younger subjects (≤ 20 years). This age group showed a higher proportion of underweight and greater total water consumption was observed.

*Conclusions:* The sample does not meet the minimum recommendations set out by EFSA but women are more in line with those recommendations. Further studies on the habits of hydration in university population are needed.

Key words: *hydration, adherence to the Mediterranean Diet, Kidmed.*

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## Hydration patterns among a Latin American sample

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*Introduction:* Water is essential to health, but is often overlooked. This can result in vulnerable individuals missing out on the support they need to help maintain a healthy level of hydration.

*Objective:* To evaluate the liquid intake habits of a Latin American population and if they know and support the current policies and recommendations of hydration.

*Method:* A record of fluid intake was obtained from 342 participants from Mexico and Uruguay and then compared with current consensus about hydration by the EFSA.

*Results:* The average fluid intake ranges from 1,900 mL/day, in females, to 2,600 mL/day in males, both above EFSA's recommendation. Though water contributes the largest part to total fluid intake (mean of 1,440 mL/day in Mexico and 1530 mL/day in Uruguay), bottled water consumption was much higher (100% of the sample) than tap water, at least in Mexico. Hot beverages (50.5%), milk (36.7%) and carbonated soft drinks (32.4%), in Mexico, and hot beverages (41%), specially mate, in Uruguay, follow water in highest consumption. 8.5% vs. 35.2% of Mexicans and 10.6% vs. 50.8% of Uruguayans knew or not, respectively, the recommendations for hydration. Only 14% followed them.

*Conclusions:* Large differences in consumption habits were reported and were not enough to get the individual fluid intake recommendation. Knowledge of differences in beverage consumption patterns is important for nutrition policymakers. Better understanding of the many factors that influence beverage consumption levels is needed.

Key words: *hydration, fluid intake, Latin American.*

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## Whole body water after 16 weeks of high intensity interval training in Metabolic Syndrome patients

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*Introduction:* Exercise is a cornerstone in the treatment of metabolic syndrome (MSyn). However exercise implies acute whole body water losses (i.e. sweating) which, if not properly recovered lead to chronic hypohydration.

*Objective:* To determine if a high intensity interval training (HIIT) program with "ad libitum" hydration strategy during exercise sessions is able to reduce fat maintaining euhydration in MSyn patients.

*Method:* Forty-two MSyn patients (15 women and 27 men; 54.0±7.9 years old) participated in a 16-week training program based on 3 sessions per week of HIIT performed in a cycle-ergometer (i.e., 5 x4-min at 90% of the maximal heart rate (HRmax), interspersed with 5x3-min at 70% of HRmax). During exercise sessions participants were allowed to drink water "ad libitum". Body weight (BW), fat mass (FM), lean mass (LM), and whole body water (WBW) were measured before and after intervention using electrical bioimpedance analysis (Tanita TBF 300, Japan).

*Results:* After training participants loss 1.0±3.1 kg of BW (P=0.045) without changes in FM and LM (-0.2±3.2 kg; P=0.690, and -0.8±4.5 kg; P=0.264, respectively). WBW losses represented a 60% of the BW lost during training (0.6±3.5 kg; P=0.286). FM changes were inversely correlated with WBW changes (r=-0.747, P<0.001).

*Conclusion:* Hydration status was maintained after training, however participants did not reduce FM. Maintenance of WBW could enhance exercise-related FM reductions.

Key words: *metabolic syndrome, interval training, hydration.*

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## Assessment of the body water content in the Spanish Women's National Waterpolo Team

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*Introduction:* The regular practice of physical exercise generates in the human body a series of acute and

chronic answers, which include physiological adaptations that lead to improvement of physical performance. However, there are some factors that influence negatively such as dehydration which is motivated by water loss through sweat and low fluid intake.

*Objective:* To observe the water content and body composition in the Spanish women's National Waterpolo Team.

*Method:* The population sample was composed of 18 female athletes (Spain national water polo team) aged between 18 and 31, weight from 59 to 108 kilograms and height from 162 to 178 centimeters.

*Data collection was conducted in May 2015, with a hydration questionnaire and analysis of body composition with the bioelectrical impedance method (InBody 720), by which the variables of total body water (TBW), intracellular water (ICW) and extracellular water (ECW) were obtained.*

*Results:* The results show that all athletes had an optimal water content, in total body water, intracellular and extracellular water variables, according to the established normal values. Their liquid intake was suitable.

Key words: *dehydration, water content, body composition.*

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**Hydration included in graphical representations of food based dietary guidelines worldwide: an overview**

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*Introduction:* An adequate hydration status is essential to maintain all our physiological and cognitive functions. These functions are directly correlated to age, gender, body composition, physiological status, level of physical activity and temperature/humidity of environment.

*Objective:* To evaluate hydration recommendations in graphical representations of Food Based Dietary Guidelines (FBDG) worldwide through literature review.

*Method:* FBDG have been studied in 79 countries on 6 continents. The study includes official and non-official FBDG created by universities or scientific associations.

*Results:* Ten out 79 countries have not got FBDG. Ninety-seven graphical representations have been analyzed with the following distribution: Africa (4%), Near East (4%), Asia and the Pacific (13%), North America (20%), Latin America and Caribbean (22%), Europe (37%). 46.4% of them presented a pyramid format, 18.5% a circle/plate format and 32.9% presented others. 60.8% of FBDG included items related to hydration; the most frequent item was water (97%) and only 12.3% included in addition other beverages (milk, fruit juices, coffee and tea).

*Conclusions:* Official and non-official FBDG are not equally distributed among countries, the most common used format was pyramid model (65%). Hydration science has led some institutions to include water as an essential and necessary item in FBDG. These results show that hydration guidelines should be given greater attention in the future.

Key words: *hydration, food based dietary guidelines.*

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**Relationship between the hydric and nutritional knowledge of water and health in students of a Spanish penal institution**

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*Introduction:* Students consider that water ingested during meals fattens and they therefore reduce their consumption. Health Education (HE) diagnosed the erroneous previous knowledge of Hydration and Nutrition to avoid unhealthy habits and adopted a healthy hydric-nutritional style (Pozo et al., 2015).

*Objective:* To detect the hydric-nutritional knowledge of water and its impact on health.

*Method:* From 803 prisoners, we selected a sample size of 30 students of the Penal Institution of Badajoz. A questionnaire which was validated and analyzed quantitatively ($\alpha$=95%) with the SPSS program and qualitatively with the program NVivo was used, with three variables: gender, age and Body Index Mass (BIM).

*Results:* Quantitatively, male students (p=0.001), of 18-27 and 38-47 years (p=0.040) in age and overweight (p=0.000) have more erroneous hydric-nutritional knowledge. Qualitatively, according to gender, 86.6% considered to have conceptual errors, and depending on the age and gender, 80% and 73.3% considers that interventions should be performed in HE.

*Conclusions:* The investigated students' present erroneous hydric-nutritional knowledge; students consider that water consumption contributes to their weight and that ingested water does not have an impact on their hydra-

tion status. It is necessary to carry out interventions in HE to improve their knowledge and their healthy state.

Key words: *health education, hydration, nutrition, knowledge*.

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## Body water percentage and its relationship with fat percentage, BMI, physical activity and fitness level

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*Introduction:* A proper corporal hydration, physical activity and physical fitness level are three factors closely related to people's health.

*Objective:* This study aims to determine the relationship among body water percentage, assessed with anthropometric parameters and the amount of physical activity and also fitness level of a group of university women students.

*Method:* 57 women aged 21.02 ± 2.45 years were measured and weighed by Tanita Segmental BC-418MA with the purpose of obtaining results of body water, BMI and body fat percentage. Ipaq-Short Form was used to quantify physical activity. As for the fitness level, the test was conducted by Forest Service, and thus determine VO2Max (n = 36) by using the Polar Team program. For the Pearson correlation (r), SPSS 22.0 for Windows was used.

*Results:* The results indicate significant correlations ($p < 0.001$) between both body fat percentage and BMI, and between the VO2Max ($p < 0.05$) and body water percentage.

*Conclusions:* Body water percentage decreases as body fat percentage does, and BMI increase when increasing VO2max. The body fatty tissue composition and the fitness level modified the body water percentage of the analyzed group.

Key words: *body water percentage, body fat percentage, VO-2Max.*

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## Water intake and body water percentage, role of physical activity in university women students

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*Introduction:* Physical activity and proper hydration status have a direct impact on health.

*Objective:* This work aims to analyze the water intake and hydration status in university women students who present different levels of physical activity.

*Method:* 57 university women students, age of 21.02 ± 2.45 years were classified according to Ipaq-Short Form in sedentary (n = 10), medium physical activity (n = 37) and high physical activity (n = 10). Water intake was analyzed in each group by a food and beverage intake record during a period of seven days, they were transformed into energy and nutrient intake by Nutriber (version 1.1.1.3r); and water percentage of the total body weight by bioimpedance (Segmental Tanita BF-418). Nonparametric Kruskal-Wallis test was used (SPSS 22.0 for Windows).

*Results:* Results showed significant differences between sedentary and medium physical activity groups ($p < 0.05$) and between sedentary and high physical activity groups ($p < 0.05$). In both cases the sedentary group shows the higher body water percentage. According to the levels of physical activity, water intake has not shown significant differences among groups.

*Conclusions:* None of the groups drink the amount of water recommended for their age. Despite this, hydration is compatible with a normal intake and it is higher in the sedentary group than in those doing some physical activity.

Key words: *percentage body water, water intake, physical activity.*

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## Influence of alcohol consumption on hydration status in healthy adults

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*Introduction:* Both osmolality and water intake are considered key biomarkers of the hydration status, which is necessary for adequate cellular homeostasis and wellbeing. However, alcohol intake has been shown to affect the hydration status due to an elevated diuresis effect.

*Objective:* To evaluate the influence of alcohol consumption on the hydration status of healthy adults.

*Method:* This study was performed in 123 adults (25-45 y, 69% women). Blood samples were collected to analyze osmolality levels and a 72 h-recall food ques-

tionnaire was used to assess total water intake (TWI): drinking water, liquids (soft drinks, juices, milk, beer, wine and spirits) and solid foods, along with alcohol intake (grams). Mann-Whitney U test was performed to analyze sex differences and correlations were performed by the Spearman test adjusted by sex.

*Results:* No significant differences were found for TWI in men (2.19 L/d) and women (2.21 L/d). Men consumed insufficient TWI according to EFSA recommendations (men=2.5 L/d). Osmolality and liquids intake were significantly higher in men ($P<0.05$), as well as the general intake of alcoholic beverages ($P<0.05$). A positive correlation between osmolality and alcohol consumption was found in men ($P<0.05$), but not in women.

*Conclusion:* A shift in the liquid intake pattern in men, by decreasing alcohol intake and promoting water drinking might be advisable in order to lower osmolality levels and achieve a better hydration status.

Key words: *hydration, alcohol, gender, healthy adults*.

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**Beverages consumption and energy contribution from the ANIBES study**

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*Introduction:* The purpose of this ANIBES study was to contribute to updating data of dietary energy intake and its main sources from food and beverages.

*Objective:* To evaluate alcoholic and non-alcoholic beverages intake and percentage of energy input by beverages in The ANIBES study.

*Method:* The sample was representative and composed of residents in Spain between 9 and 75 years old. Study participants were provided with a tablet device and trained in how to record information by taking photos of all food and drinks consumed during three days. Food records were returned from the field in real time by coders. VD-FEN2.1 software was used to calculate energy intake and food consumption records.

*Results:* In The ANIBES study, the average consumption of non-alcoholic beverage was 851 g/person/day and alcohol beverage consumption was 99 g/person/day. Within the group of non-alcoholic beverages water is the most consumed beverage (570 g/d) followed by sugared soft drinks (88 g/d). For alcoholic beverages the low alcohol content drinks are largely the most consumed beverages (97 g/d). Energy contribution from non-alcoholic beverages was 3.9% and from alcoholic beverages 2.6% of the total energy intake. Juices and nectars provide 2.9% of the total energy intake in children. Sugared soft drinks represent 3.4% of total energy intake in adolescents. Low alcohol content beverages represent 2.6% and 3.3% of the total energy intake in adults and elderly respectively.

*Conclusion:* The most consumed beverage group was the non-alcoholic beverages, representing 3.9% of the total energy intake.

*Acknowledgements:* The study was financially supported by a grant from Coca-Cola Iberia through an agreement with the Spanish Nutrition Foundation (FEN).

Key words: *energy intake, ANIBES study.*

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**Weights, measures and portion sizes for foods and beverages: findings from the ANIBES-study in Spain**

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*Introduction:* The purpose of The ANIBES Study was to contribute to updating data of dietary energy intake and its main sources from food and beverages.

*Objective:* Establish a consensus about consumer food serving from the portions that had been used in The ANIBES Study.

*Method:* The data used were obtained from photos taken by The ANIBES Study participants through their tablet devices. Subsequently, codified, analyzed and collected by experts.

*Results:* NON-ALCOHOLIC BEVERAGE: Sugared soft drinks, Juices and nectars, Other drinks, Coffee and infusions, Unsweetened soft drinks and Water (Portion size (PS):200 and Serving size (SS):225); Sports drinks and energy drinks PS:500/SS:225. ALCOHOLIC BEVERAGES: Low alcohol content beverage (beer PS:200/SS:200, wine PS:90/SS:90); High alcohol content beverage (spirits PS:35/SS:35, rum PS:50/SS:50). GRAINS: Bread PS:30/SS:50; Bakery and pastry PS:50/SS:90; Grains and flours PS:10/SS:35; Pasta PS:70/SS:70; Breakfast cereals and cereal bars PS:30/SS:30. MILK AND DAIRY PRODUCTS: Milks PS:200/SS:225; Cheeses PS:40/SS:40; Yogurt and fermented milk PS:125/SS:125. EGGS: Egg PS:64/SS:64. SUGARS AND SWEETS: Chocolate PS:25/

SS25; Sugar PS:12/SS:12; Marmalade and jam PS:15/SS:20. OILS AND FATS: Olive oil PS:10/SS:10; Other oils PS:10/SS:10; Butter, margarine and shortening PS:15/SS:15. VEGETABLES: Vegetables PS:200/SS:200; Potatoes PS:170/SS:170. PULSES: Chick pea, kidney beans and lentils PS:70/SS:70. FRUITS: Fresh fruits PS:200/SS:200; Canned fruits PS:150/SS:150; Dried fruits PS:10/SS:30; Nuts and seeds PS:25/SS:25. MEAT AND MEAT PRODUCTS: Meat PS:150/SS:150; Sausages and other meat products PS:20/SS:80. FISH AND SHELLFISH: Fresh fish PS:200/SS:200; Shellfish PS:150/SS:150; Canned fish PS:82/SS:82.

*Conclusion:* This study will allow the creation of a new consensus document of consumer food serving, in order to suggest recommendations regarding the Spanish population.

*Acknowledgements:* The study was financially supported by a grant from Coca-Cola Iberia through an agreement with the Spanish Nutrition Foundation (FEN).

Key words: *portion-size, serving-size, ANIBES study.*

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## Hydration status and water sources in 9-10 year soccer players

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*Introduction:* Physical activity leads to an increased water loss via sweating, which may increase the risk of dehydration.

*Objective:* To evaluate the hydration status and its relation to food intake in a group of children that play football.

*Method:* 36 male 9-10 years children were invited to participate in this study, and 30 completed a 24 h urine collection. The Free Water Reserve (FWR) was used to assess the hydration status; additionally, a food record corresponding to the day of urine collection and a lifestyle, and socio-demographic questionnaire was filled with parents help. Anthropometric data were obtained. Food and beverage groups were created and models of unconditional logistic regression were fitted in order to estimate the magnitude of the association between the contribution of food's water content and the hydration status.

*Results:* 43.3% of children were classified as at risk of hypohydration. Compared to children who reported low fruit and vegetable intake (at or below the median), those with higher intake (above median) were at decreased risk of hypohydration (OR = 0.19, 95% CI 0.04 - 0.94, p = 0.041).

*Conclusions:* Almost half of this sample of 9-10 years soccer players was at risk of hypohydration. Fruit and vegetables intake was significantly associated with a better hydration status.

Key words: *children, hydration status, sport.*

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## Hydration level and mood status in adolescents. The Up & Down Study

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*Introduction:* Optimum hydration is essential for a proper functioning of the organism. Adolescence is a period in which there is adoption of eating habits and also psychological changes, where mood status is a very important health factor.

*Objective:* To assess possible interactions between hydration and mood status in a group of adolescents from Madrid.

*Method:* This is a cross sectional substudy from the Up & Down Study. Multifrequency bioimpedance was used to assess the hydration status (Extracellular Water Volume, ECW). The PANASN questionnaire was used to create a factor which was stablished in four levels: very low, low, high and very high, in order to assess mood status.

*Sample:* 101 healthy adolescents (both sexes) between 13 and 16 years old.

*Results:* 42.90% of the adolescents who were below the optimal ECW range reported a low mood status. 51.70 % of adolescents within the optimal ECW range reported a high mood status. 29.60% of subjects above the optimal ECW range showed very low mood, meanwhile 18.50 % of them showed a very high mood status.

*Conclusions:* In view of these results, adolescents should be advised about the most beneficial range of the hydration status they have to show in order to achieve the best mood rate. Further research studies are needed in order to find out possible associations.

Key words: *hydration, mood status, adolescence.*

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## Importance of water consumption in a group of young women with overweight and obesity

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*Introduction:* Water consumption is associated with a significant effect on body weight loss because it seems to increase the basal metabolic rate, to suppress appetite before meals and to be associated with adequate dietary habits (high consumption of fruits and vegetables). Thus, water consumption would be important in overweight/obese people who want to lose weight.

*Objectives:* To analyze water consumption in a group of overweight/obese women and its relationship to body weight.

*Method:* 58 women (20 to 35 years) with body mass index (BMI) over 25 kg/m2 were studied. Diet was registered using a "Food record questionnaire" for 3 days, including a Sunday. Weight and height were measured and body mass index calculated. Physical activity was recorded by a questionnaire activity.

*Results:* Average water consumption was 1.19 ± 0.540 L/day. 70.7% of the women did not reach the recommended 2 L/day. Women with lower water consumption (<p50=1.8 L/day) had higher BMI than those who consumed more than this amount (29.96 ± 3.20 vs. 27.82 ± 2.30 kg/m$^2$). For every 1 mL of water consumed, BMI decreased 0.0021 kg/m2 (R2 = 0.1479, p = 0.0332) considering factor activity and energy intake as covariates.

*Conclusions:* The consumption of water is inadequate in women with overweight and obesity and associated negatively with BMI, so it is advisable to encourage its consumption in this population.

Key words: *water, women, overweight, obesity.*

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## Hydration habits of a group of university students

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*Introduction:* A good hydration has acquired a big importance in recent years. Water is an essential component of nutrition, but there are other kinds of drinks which also contribute to hydration. However, it is important to establish the nutritional profile of different beverages commonly consumed and their contribution to the overall diet.

*Objective:* Determine hydration habits of university students.

*Methods:* Transversal and descriptive study in a sample of 102 nursing students of Autónoma University of Madrid. Water and other liquids intake habits were gathered through an on-line, anonymous and self-filling survey. A descriptive analysis on these data was developed.

*Results:* The 15.7% (16) of the sample were men and the 84.3% (86) women, with an average age of 23 years old and in a range of 20 years. 79.4% (81) were trained in Nutrition. All of them used to drink water on a daily basis, and a 59.8% (61) used to do it systematically several times per day, regardless they were thirsty or not. In relation to the daily consumption of other type of drinks, 13.7% (14) used to drink soft-drinks or energetic beverages, being 36.3 % (37) with sugar and 35.3 % (36) light. Additionally, 76.5% (78) used to drink milk daily, 31.4% (32) coffee and 6.9% (7) infusions. Regarding the quantity consumed, 69.3% (70) used to drink between four and eight glasses of water, 89.2% (91) used to take also a soft-drink, 73.5% (75) a glass of milk, 87.3% (89) a coffee with milk and 89.2% (91) an infusion. On the other hand, only 3% (3) used to drink wine or beer on a daily basis and none of the respondents used to drink alcohol at this frequency. In this case, 38.5% (37) used to drink a can of beer and 50.5% (48) a glass of wine. Among 2% (2) of the students that used to drink alcohol 2 or 3 times per week, 40.2% (41) used drink only one unit. Finally, 38.2% (39) considered they were always well hydrated.

*Conclusions:* Most of the students that have participated in this study, comply with the recommendations on liquid intake for the Spanish population. The drinking of water predominates over other liquids that also contribute to keep the hydration, but which help increasing the energetic content of the diet.

Key words: *Hydration, drinking habits, water, university students.*

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## Calorie reduction in soft drinks during the last 5 years on the Spanish market

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*Introduction:* The soft drink industry has a significant economic and social weight in the world. It's a leader in providing a variety of products in order to improve consumer's choice.

*Objective:* To understand how soft drinks sold in the Spanish market (2,000 references) in the last five years have varied in the number of calories.

*Method:* Data on nutritional composition of soft drinks from a sample of 80% of the total market was collected by ANFABRA, Chair of communication and education on healthy lifestyles.

*Results:* Between 2009 and 2015 calories per litre of all soft drinks placed in the Spanish market fell by 19%. The fourth part of soft drinks contributes less than 4 calories per 100 ml.

*Conclusions:* The soft drinks sector has shown a strong commitment to innovation and promotion of low and no calorie products, without compromising taste while making it possible to choose a drink based on taste, needs, activity or moment of the day.

Key words: *soft drinks, calories, innovation.*

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## Short-term oral liquid ingestion decreases human milk osmolality

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*Introduction:* previous studies have reported stability of human milk osmolality in situations of liquid restriction and a decrease in cow milk osmolality in conditions of controlled water ingestion.

*Objective:* To confirm any possible influence of short-term water ingestion and restriction in human milk osmolality.

*Method:* 26 mothers of breastfed infants aged 3-6 months were invited to come twice and stay for 90-min in an educational meeting with nutritionists from CeSSIAM. Treatment-1 (tx-1) consisted in consuming 1l of water over 90-min; treatment-2 (tx-2) consisted in being abstained from fluid intake for 90-min. Breastmilk and urine samples were obtained before and after each treatment and measured to determine volume; subsequently, two aliquots were stored at -20oc prior to analysis. Urinary (Uosm) and milk (Mosm) osmolality were measured in a Voguel Löser 815 osmometer. Statistical analyses were performed in SPSS version 20.

*Results:* Maternal mean age was 24 y, 42% of the babies were girls. Median baseline and final (90-min) Uosm for Tx-1 were 628 and 248 mOsm/kg ($p<0.001$), corresponding values for Mosm, 284 and 276 mOsm/kg ($p<0.001$). Median baseline and 90-min Uosm for Tx-2 were 632 and 655 mOsm/kg ($p=0.320$), corresponding values for Mosm, 282 and 280 mOsm/kg ($p=0.325$). There was significant different in the change of Mosm ($p=0.013$) as well as in the change of Uosm ($p<0.001$) between treatments.

*Conclusions:* We found asymmetrical change in breast milk osmolality after water consumption and water restriction; while fluid restriction does not influence Mosm and Uosm, liquid ingestion impacts human milk and urine by decreasing osmolality.

Key words: *urinary-osmolality, milk-osmolality, fluid-ingestion, fluid-restriction, Guatemala.*

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## Taste workshops for children: importance of being hydrated

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*Introduction:* Spanish Nutrition Foundation (FEN) and the Royal Spanish Academy of Gastronomy (RAG) were the pioneers to present the idea of including gastronomy and healthy eating habits into the European education system. This initiative was approved on 12th march 2014 by the European Parliament and since then, both institutions, in collaboration with the Ministry of Education, Culture and Sports, have been working on innovative audiovisual and multimedia materials for children. Nutrition education contributes to children's improved understanding and practice of healthy lifestyles behaviors. One essential topic consist of having a well hydration status, and children are a vulnerable population much more prone to dehydration than adults.

*Objective:* To develop a serial of videos for children between 3 and 9 years old with cooking and nutrition lessons and recipe demonstrations to be used as educational resources in the official curricula.

*Method:* Videos focused on food groups, nutrients, gastronomy, active lifestyles and importance of being hydrated. A nutritionist, a cooker and two muppets participated in them.

*Results:* The videos include five sections: introduction, theory class, recipes –in case of hydration we recorded recipes with different water content foods-, video summary and final test. We have presented a summary of them in Spain Pavillion in Expo Milano 2015 and will use as an education tool for teachers.

*Conclusion:* Videos can be used as nutrition education tools to reinforce language, listening and motor skills

as well as food and nutrition concepts, specially, the importance of being hydrated.

Key words: *beverages, education, children, hydration.*

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## Correlation but no association of sugar sweetened beverage consumption with systolic and diastolic blood pressure among Mexican adolescents

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*Introduction:* Mexico has positioned itself as the largest consumer of sugar sweetened beverages (SSB). It has been proposed that the consumption of SSB is associated with increased prevalence of overweight and obesity as well as other cardiovascular risk factors, including hypertension.

*Objective:* To determine the relationship between the consumption of SSB patterns and blood pressure in a Mexican sample of adolescents.

*Method:* A cross-sectional study including 242 adolescents was conducted in Mexico City; anthropometric measurements were taken as well as blood pressure according to AHA recommendations to diagnose hypertension and a 24h recall was obtained.

*Results:* A higher prevalence of hypertension was observed in men than women (13.9vs11.7%; $p< 0.05$) with a mean systolic blood pressure higher in boys compared with girls (103.1±11.4 vs 99.8± 10.5 mmHg; $p<0.05$). A consumption of 5±5.8 servings a day (s/d) of SSB was reported. Soft drinks and juices were consumed in average of 2.39±4.5 and 1.29 ± 2.3 s/d, respectively. No differences between soft drinks or juice were reported according to the presence of systolic/diastolic hypertension and normal blood pressure (2.91±5.4 vs 2.24±4.2; 1.36±1.67 vs 1.27±2.43 s/d, respectively; $p>0.05$). A high correlation between soft drinks and juices consumption and systolic blood pressure ($r=0.985$ $p < 0.001$; $r=0.987$; $p < 0.001$, respectively). Also, the correlations for diastolic blood pressure and soft drinks and juices intake were $r=0.987$ and $r=0.613$, both with a $p<0.001$. Also, a lower consumption of sodium was observed in children with systolic hypertension (2046.3±1581.8 vs 1510.1±1294.7; $p=0.05$ for systolic) and no differences were observed for children with diastolic hypertension.

*Conclusion:* There is no association between SSB and systolic and diastolic blood pressure among Mexican adolescents.

Key words: *blood pressure, sugar sweetened beverage.*

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## Water intake in Mexican adolescents. Differences regarding the presence of cardiovascular risk factors

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*Introduction:* Proper hydration is important for maintaining homeostasis in all physiological processes and avoid some diseases. Cardiovascular risk factors (CVRF) are more common in the young population.

*Objective:* To analyze water intake of Mexican adolescents according to the presence of CVRF.

*Method:* A cross sectional study including adolescents was conducted in Mexico City; anthropometric measurements (weight, height and waist circumference) were taken, as well as blood pressure according to AHA recommendations to evaluate hypertension. A 24h recall was obtained and analyzed with the Food Processor Software. Body mass index (BMI) was calculated and subjects were classified as overweight / obese (OW-O) according to CDC percentiles.

*Results:* 242 adolescents were evaluated; the average age was 12±1.9 years, 50.4% of the sample were boys. A global prevalence of hypertension was of 15%. 43.4% was classified as OW-O meanwhile only 27% presented abdominal obesity (AO) according to waist circumference. The daily intake of water, including foods, was 1263.1±656 ml with a higher consumption in those with a normal weight compared with OW-O (1,555±605.2 vs 891.4±468.7 ml, respectively; $p<0.05$). No differences between those with normal blood pressure and hypertension were found (1,327±693.4 vs 1,265±644.6 ml, respectively; $p>0.05$). Also, the water intake was similar in those without AO in contrast with those with OA (1,350.5±727.8 vs 1,236±545 ml; $p=0.254$).

*Conclusion:* There is a high prevalence of CVRF among Mexican adolescents. Low water consumption was reported in this population and it seems to be related to overweight and obesity but not to hypertension or abdominal obesity.

Key words: *water intake, adolescents, hypertension, obesity.*

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## Fruits and vegetables as important contributors to an adequate hydration status

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*Introduction:* A healthy hydration status can only be achieved with a proper balance of water and mineral. In this sense fruits and vegetables are good sources of both of them, furthermore they are rich in vitamins, fiber and antioxidants and low in calories.

*Objective:* The aim of this study was to evaluate how fruit and vegetable contribute to the Total Water Intake (TWI), and to the mineral intake (Na, Mg, K).

*Method:* 466 Spanish adults aged 18–50 years (260 women and 206 men). Dietary data was obtained from a 3-day food record (including one weekend day). Dial software was used to calculate fruit and vegetable intakes as well as their contribution to TWI (g/day) and the mineral intake.

*Results:* Water from fruit and vegetables represented a 77% of non-beverage water intake. Mean TWI was 2,030±734 g/day and non-beverage water intake 534 g/day. Fruit at vegetable contributed with 25% of the total Mg intake, 37% of total K intake, and only 3% of total Na intake.

*Conclusion:* Increasing fruit and vegetable consumption can contribute to a heathier and more balance hydration status.

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Key words: *fruits, vegetables, hydration, water intake*.

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## How can a 0.7% loss of body mass influence cognitive functioning? A mechanistic investigation

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*Introduction:* The study of small changes in hydration status has been largely ignored.

*Objective:* To see if drinking water, when mildly hypohydrated (a loss of 0.7% of body mass), helps to maintain cognitive functioning and mood and to explore underlying mechanisms.

*Method:* 118 (61 male) young adults were exposed to a temperature of 30ºC for four hours and either did or did not drink two 150ml glasses of water during that time. On three occasions, once at baseline and once after each drink, they completed cognitive tests and rated their thirst, energy and task difficulty. Changes in body temperature and perspiration were monitored throughout and considered, along with thirst and ratings of difficulty, as potential mediators. Individual differences in habitual water consumption and baseline urine osmolality were also considered.

*Results:* Participants had better memory, attention and energy levels if they had drunk water but this depended upon habitual water consumption and baseline osmolality. Thirst mediated the effect of drinking on memory and energy levels, whereas perspiration mediated the effects on attention. Neither a change in temperature, nor gender, affected the results. Although participants found the tasks easier if they had drunk, these ratings of task difficulty were not found to mediate the effects on cognition.

*Conclusions:* Drinking water when hypohydrated improves cognition although the mechanisms involved vary with cognitive domain.

Key words: *hydration, cognition, mood, water, thirst*.

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## Lifestyles associated with the adhesion of the Mediterranean Diet in the elderly

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*Introduction:* Eating habits play a crucial role in the maintenance of health both at individual and population level. The Mediterranean diet (MD) and healthy eating pattern is associated with a reduction in overall mortality, cardiovascular disease and various cancers. Recent studies have shown that individuals who combine healthy lifestyles and have healthier eating habits have improved health.

*Objective:* to know which lifestyles are associated with adherence to the MD in older people.

*Method:* cross-sectional study with a total of 351 subjects over 60 years of age living in the Levant, where the relationship between adherence to the MD and lifestyle were evaluated. We excluded patients with a score of 3 or more errors in the Pfeiffer test. Statistical analyzes were performed using logistic regression adjusting for sex.

*Results:* 57.3% (201) of the sample were women and 42.7% (150) men. Adherence to the DM was positively associated with not using tobacco (OR = 0.568, 95% CI: 0.31 to 0.89) and physical activity (OR = 0.430, 95% CI: 0.24 to 0.75), but inversely with BMI (PR = 1.32, 95% CI: 0.73 to 2.37).

*Conclusions:* Adherence to the DM was associated with more healthy lifestyles such as physical activity and not using tobacco, but also with a high BMI. Similar results were found in other studies, but more research is needed to delve into the involved factors.

Key words: *mediterranean diet, elderly, life styles*.

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**Drunkorexia habits of University students**

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*Introduction:* drunkorexia is a new eating disorder characterized by a reduction in food consumption to offset the excess calories provided by the intensive consumption of alcohol (binge drinking). In particular sweets containing a high caloric density and having a low nutritional contribution are one of the main foods whose consumption is being restricted by the subjects who suffer from this disorder.

*Objective:* To evaluate the relationship between binge drinking pattern and reducing the consumption of sweets in university students.

*Method:* The sample consisted of 113 University students enrolled in Health Sciences from the University of Alicante. The students completed an online questionnaire about lifestyles and eating habits in the last 30 days.

*Results:* The results of this study indicated that the proportion of students presented an intensive alcohol intake, understood as the intake of 5 or more glasses the same occasion, was significantly higher among those students with a lower consumption of commercial sweets ($p < 0.005$).

*Conclusions:* these results could indicate that a change is occurring in the trends of eating habits and intake of alcohol among young people. Future studies should assess the magnitude of this phenomenon in order to develop prevention programmes.

Key words: *eating disorder, students, food habits*.

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**Hydration status in patients diagnosed of chronic idiopathic constipation by rome III criteria**

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*Introduction:* chronic idiopathic constipation (CIC) is a common condition which affects the gastrointestinal tract and reports an important degree of impairment in health-related quality of life. Inadequate fluid and poor fiber diet consumption is common in this condition. However, studies reporting the data are limited.

*Objectives:* to evaluate the hydration status (HS) of a CIC population using the Water Balance Questionnaire (WBQ) and other hydration markers recommended by the EFSA. The data will permit to study the relationship between the HS and the characteristic symptoms of this disorder.

*Methods:* participants will be recruited from La Paz University Hospital. Firstly, participants will complete the WBQ, 3-day food record, frequency food intake, Bristol scale, SF-36-questionnaire, usually drugs consumption and urinary color questionnaires. Secondly, a nutritionist will measure anthropometric parameters including total body water by tetrapolar-bioimpendance method and they will recommend an adequate consumption of liquids and fiber in their diet. Thirdly, the diet adherence will be assessed. Ultimately, participants will complete again the same studies at first.

*Results:* statistical analysis and preliminary results will be presented once the estimated sample size is achieved (95% confidence interval, mean difference 0.610, SD 2.2).

*Conclusion:* contribution of knowledge of the HS and nutritional profile of this population and the results could to help to take appropriate support in this condition.

*Keywords: chronic idiopathic constipation, hydration, hydration status, water balance*.

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**Hydration status of cancer patients with palliative care: hydrated or dehydrated?**

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*Introducti*on: the relationship between thirst and dehydration in terminal patients at end of life is limited and the current bibliography agree with this controversy. Due to the lacking of scientific evidences the decision to rehydrate of these patients is based on the usual clinical practice.

*Objectives:* to evaluate the hydration status of oncological patients with palliative care by Bioelectrical impedance analysis (BIA).

*Method:* this scientific initiative will evaluate the hydration status of 50 oncological patients admitted with palliative care at University Hospital La Paz by BIA, excluding those who according with their Palliative-Pronostic-Score (PaP-Score) get a 30-day survival probability <30%. It is a descriptive, observational and cross-sectional study. The main variable will be the phase angle and as secondary variables: evaluation of the nutritional status by Subjective-Global-Assessment (SGA), corporal composition (BIA) and functional capability (dynamometry). Besides it will evaluate: PaP-Score, Palliative-Performance-Scale (PPS), disability (Barthel-Test), cognitive function (Pfeffer-Test), dehydration symptoms and biochemical parameters.

*Results:* preliminary results of statistical analysis will be exposed once they achieve the estimated sample size (confidence level 95%, differences' average 0.610, DS 2,200).

*Conclusions:* the study of the oncological with palliative care patient's hydration status provides scientific evidence to implementation of action protocols to properly rehydrate those patients.

*Keywords: palliative care, hydration, palliative oncologic patient.*

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# ÍNDICE DE AUTORES

## II INTERNATIONAL AND IV SPANISH HYDRATION CONGRESS

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