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Nutrición Hospitalaria

ÓRGANO OFICIAL DE LA SOCIEDAD ESPAÑOLA DE NUTRICIÓN PARENTERAL Y ENTERAL
ÓRGANO OFICIAL DEL CENTRO INTERNACIONAL VIRTUAL DE INVESTIGACIÓN EN NUTRICIÓN
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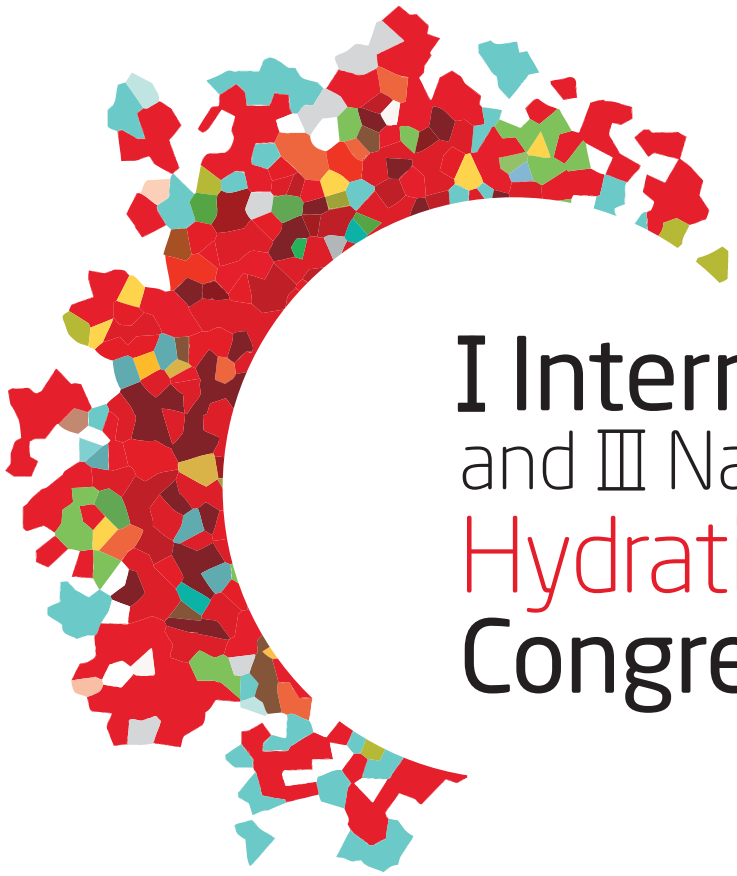

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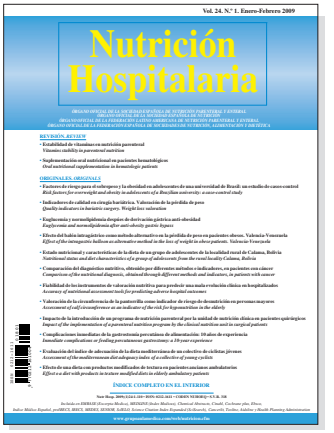

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Publica trabajos en castellano e inglés sobre temas relacionados con el vasto campo de la nutrición. El envío de un manuscrito a la revista implica que es original y no ha sido publicado, ni está siendo evaluado para publicación, en otra revista y 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).

IMPORTANTE: A la aceptación y aprobación definitiva de cada artículo deberán abonarse 150 euros, más impuestos, 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.

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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.

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

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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.
- Declaración de que es un texto original y no se encuentra en proceso de evaluación por otra revista, que no se trata de publicación redundante, así como declaración de cualquier tipo de conflicto de intereses o la existencia de cualquier tipo de relación económica.
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1.2 Página de título

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

Nombre completo y apellido de todos los autores, 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.

Podrá volverse 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).

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.

Encabezando nueva página se incluirá la traducción al inglés del resumen y las palabras clave, con idéntica estructuración. En caso de no incluirse, la traducción será realizada por la propia revista.

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

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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.

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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Las citas bibliográficas deben verificarse mediante los originales y deberán cumplir los Requisitos de Uniformidad del Comité Internacional de Directores de Revistas Médicas, como se ha indicado anteriormente.

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Las referencias a textos no publicados ni pendiente de ello, se deberán citar entre paréntesis en el cuerpo del texto.

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.

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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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2.2 Original breve: Trabajo de la misma característica que el original, que por sus condiciones especiales y concreción, puede ser publicado de manera más abreviada.

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

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

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

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

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

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

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- Filiación
- Dirección para correspondencia
- Texto máximo 400 palabras
- Una figura o una tabla
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La publicación de una Carta Científica no es impedimento para que el artículo *in extenso* pueda ser publicado posteriormente en otra revista.

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Tipo de artículo	Resumen	Texto	Tablas y figuras	Referencias
Original	Estructurado 250 palabras	Estructurado 4.000 palabras	5	35
Original breve	Estructurado 150 palabras	Estructurado 2.000 palabras	2	15
Revisión	Estructurado 250 palabras	Estructurado 6.000 palabras	6	150
Notas clínicas	150 palabras	1.500 palabras	2	10
Perspectiva	150 palabras	1.200 palabras	2	10
Editorial	—	2.000 palabras	2	10 a 15
Carta al Director	—	400 palabras	1	5

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El Comité de Redacción acusará recibo de los trabajos recibidos en la revista e informará, en el plazo más breve posible, de su recepción.

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Los autores puden sugerir revisores que a su juicio sean expertos sobre el tema. Lógicamente, por motivos éticos obvios, estos revisores propuestos deben ser ajenos al trabajo que se envía. Se deberá incluir en el envío del original nombre y apellidos, cargo que ocupan y email de los revisores que se proponen.

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Abono en concepto de financiación parcial de la publicación. En el momento de aceptarse un articulo original o una revision no solicitada se facturará la cantidad de 150 € + 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

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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 I International and III National Hydration Congress (I Congreso Internacional de Hidratación y III Congreso Nacional de Hidratación), sin cuya ayuda no hubiera sido posible la realización de este proyecto.

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SUMMARY

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SESSION 5

CLOSING CONFERENCE

ABSTRACTS

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INAUGURAL CONFERENCE

Chair: Prof. Ángel Gil, PhD. Professor of Biochemistry and Molecular Biology. University of Granada. Granada. Spain.

Fluid consumption in a sample of healthy French children, adolescents and adults

Speaker: Pascale Hébel, PhD. Thesis in Statistics. Head of Department. Research Center for the Study and Monitoring of Living Standards-CREDOC.

Objective: Assess the intake of fluid in healthy French children, adolescents, adults and seniors, considering amounts, types of beverages, time and place of consumption.

Design: The present article presents the self-reported intake of beverages, recorded in a quota sample recruited to be representative of the French general population. Intake was assessed on the basis of a seven-day report of all intakes (fluid and solid), with recording of occasions, circumstances, location, people present, etc. Food and portion reporting was made easier by the use of a validated reference book showing various portions of common food and beverage choices (Suvimax, 2000). The energy and nutrients (including water) content was obtained from a French food composition table (Favier et al, 1995). Special attention was devoted to beverages. Six categories of beverages were considered: water (all kinds), hot beverages (tea, coffee, etc), sodas (regular or "light"), dairy drinks, juices and fruit-flavoured drinks, and alcoholic beverages. Energy and nutrient intakes were also studied, as well as the circumstances of each intake occasion.

Setting: Interview in free living persons, carried out in 2002-2003, 2006-2007, 2009-2010.

Subjects: 221 baby children (age (3-5), 439 children (aged 6-11), 599 adolescents (aged 12-19), 716 adults (aged 20-54), 485 seniors (aged 55 and over) in last survey.

Results: The average total intake of fluid was 1-1.3 litre a day depending on age groups. Small proportions of each group reached the intake levels recommended for the French population. Water accounted for about one half of daily fluid intake. Other types of beverages varied with age (e.g. dairy drinks in children and adolescents; alcoholic drinks in adults and seniors). Intake of sodas (including regular and "light) was highest in adolescents (184 ml a day). Beverages were mainly consumed at home, at the time of meals. In all age groups, people who reached the recommended level drank over 1 litre of water daily plus a more varied selection of other beverages, than people who did not.

The greater part of the ingested beverage in all age groups is water and it is consumed alone, with meals and at home. Beyond this general observation, consumed beverages are very different depending on the age of individuals. Children and adolescents consume mainly milk drinks, fruit juices and BRSA (soft drinks), while alcoholic beverages and hot drinks are mainly consumed by adults and seniors. More than half of the different classes do not follow the recommendations on beverage consumption (53% of kindergarten, 71% of primary, 86% of adolescents, 66% of adults and 78% of seniors). Current data indicate that energy from beverages represents about 10% of daily energy intake. In evolution, we can see generational effects; new generations drink more soft drinks and juice but less alcoholic drinks at the same age than other generations.

Conclusions: This is the second description of fluid intake in French children, adolescents, adults and seniors, considering amounts, types of beverages, time and place of intake and consistency with recommendations according to Bellisle and al (2010). It reveals that few people in all age groups reach the recommended intake levels, those who do drink more water and consume more types of beverages.

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Key words: fluid intake, self-reported surveys, children, adolescents, adults, seniors.

SESSION 1

Chair: Pilar Riobó, MD, PhD. Head of Nutrition and Endocrinology Service. Hospital of Jimenez Díaz Foundation. Madrid. Spain

Hydration in the healthy: challenges and opportunities

Susan Shirreffs, PhD.

Scientist at New Product Research. GSK Consumer Healthcare. London. United Kingdom.

In the healthy adult population with a normal physiology being euhydrated should be the typical hydration status. The contribution to daily water intake from food can be significant, but the majority of people probably consume most of their water from drinks.

A minor, temporary hypohydration or hyperhydration will be corrected by homeostatic mechanisms; thirst to stimulate water intake, absence of thirst to attenuate consumption, and an increase or decrease in urine formation to modify water losses. But whilst urine production is not under voluntary control, water intake can occur in the absence of thirst or be absent in the presence of thirst if the physiological signals are ignored.

Causes of hypohydration can be varied including sweat loss, diuresis, diarrhea and restricted intake of water from foods and drinks. It may occur deliberately or inadvertently. Challenges to euhydration may occur when water losses are exaggerated or when water intake is reduced. Typically, when water is lost from the body it is lost with accompanying electrolytes and there are certain circumstances when electrolyte take with or in close temporal association to water intake is beneficial.

Key words: healthy adults, euhydration.

Beverage and water intake in European countries: measurement techniques

Mariela Nissensohn, PhD.

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In the field of nutrition, fluid intake has always been a challenge to assess adequately. Nutritional surveys often collect data regarding beverage consumption but they are difficult to compare due to their different sources and different methodologies. Biomarkers of beverage intake are able to assess dietary intake/hydration status without the bias of self-reported dietary intake errors and intra-individual variability. Although some biomarkers have been proposed to assess hydration status since some years ago, to current date there is no consensus about which biomarkers truly reflect changes of hydration status in response to beverage intake.
Our work was divided in two parts: In the first part we examined the available techniques used for assessing beverage intake in European epidemiological studies and described the most frequent method applied to assess it. Information on beverage intake available from European surveys and nutritional epidemiological investigations was obtained from gray literature. Twelve articles were included and relevant data were extracted. The selected studies were carried out on healthy adults by different types of assessments. The most frequent assessment tool used was the 7-d dietary record. Only a German study used a specific beverage assessment tool (Beverage Dietary History).

In the second part we searched for beverage intake questionnaires available in the scientific literature to assess beverage intake and hydration status and their validity against hydration biomarkers. After the scientific literature search was conducted, only two articles were selected. Two different questionnaires were designed to capture the usual beverage intake. They were validated against Urine Specific Gravidity biomarker (USG). The first tool was the Water Balance Questionnaire (WBQ) and reported no correlation with USG. The second questionnaire was the Beverage Intake Questionnaire (BEVQ), a quantitative food frequency questionnaire (FFQ) that also found a negative correlation with USG.

Conclusion: From the limited data available we concluded that consumption of beverages is quite different between European countries making the need for a valid assessment tool for beverage intake of paramount importance. Current epidemiological studies in Europe focusing on beverage intake are still scarce. We also concluded that FFQ appears to measure beverage intake more accurately than WBQ when compared with biomarkers. However, the WBQ seems to be a more complete method to evaluate the hydration balance of a given population.

Further research is clearly needed to properly establish the amount of beverage intake in European population and to understand the meaning of the different correlations between intake estimates and biomarkers of beverage intake in different population groups and environments.

Key words: beverages intake, hydration biomarkers, epidemiological European studies.

Hydration an aerobic exercise performance: impact of environment and physiological mechanisms

Michael N. Sawka, PhD.

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Physical exertion with exposure to environmental heat, cold and high-altitude can induce body water fluxes and deficits. Total Body Water is tightly regulated (~76% of Lean Body

Mass) with normal daily variation (Coefficient of Variation) being < 1% of body mass. Body water deficits > 2% of body mass are defined as hypohydration and can occur from sweat loss (hyper-osmotic hypovolemia), and diuresis from cold, hypoxia or pharmacologics (iso-osmotic hypovolemia). Hyper-osmotic hypovolemia generally elicits a plasma volume reduction proportional 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 the extracellular fluid compartment. The impact of hypohydration on physical performance has received considerable research attention and resulted in much scientific controversy, despite relatively consistent finding for any given set of experimental conditions. Hypohydration does not consistently impair anaerobic performance or skeletal muscle strength; however, it can adversely impact on aerobic performance particularly in situations accompanied by a vascular vasodilation.

Aerobic performance can be quantitated as maximal intensity (e.g., maximal aerobic power) or submaximal intensity (time-trial or time-to-exhaustion), with recent studies employing time-trial protocols. Maximal intensity studies are relatively few, but demonstrated that hypohydration generally impairs VO_{2max} in hot environments (with larger water deficits inducing greater VO_{2max} impairment), but not always in temperate environments. The earliest systematic studies of hypohydration and submaximal intensity exercise capacity were conducted in the early 1940's by Adolph and colleagues; they had Soldiers attempt extended (many hours) self-paced marches in the desert during different ambient temperature conditions, while carrying different amounts of water, to determine the distance they could walk over a day. The less water carried and the hotter weather acted together to reduce walking distances. Subsequently, there were many laboratory studies examining hypohydration and submaximal intensity aerobic performance. Those studies demonstrate that hypohydration does not generally impair submaximal intensity performance in cold-temperate environments; however, in warm-to-hot environments hypohydration consistently impairs aerobic submaximal intensity performance. Unfortunately, previous studies have employed very different experimental procedures so their results were difficult to combine into trends. Our laboratory conducted a series of experiments employing similar procedures, but systematically altering skin temperatures from ~20° to ~38°C. For this paper, we define cool/cold skin as < 30°C, warm skin as 30° to 34.9° C and hot skin as 35°C and above. It is recognized that skin temperature effects on cutaneous blood flow/ volume are a continuum with warm-hot skin associated with high skin blood flow and reduced cardiac filling; while hypohydration is associated with reduced cardiac filling. We found that hypohydration begins to impair aerobic performance when skin temperatures exceeds 27°C, and even warmer skin exacerbated the impaired submaximal intensity aerobic performance (additional -1.5% impairment or each 1°C skin temperature elevation above 27° C). Acute exposure to high-altitude causes a systemic vasodilation that can be accompanied by body water deficits from hypoxia-mediated diuresis with high sweat losses. We recently examined the impact of high-altitude (3,048 m) exposure and hypohydration on submaximal intensity aerobic performance in a warm environment (eliciting skin temperatures of ~33°C). Submaximal aerobic performance was impaired by ~10% from high-altitude exposure (*vs.* euhydrated at sea-level), by -19% from hypohydration (at sea-level) and by -34% from hypohydration with high-altitude exposure. Therefore, hypohydration and high-altitude exposure combine to additively impair submaximal aerobic performance.

Multiple physiological mechanisms are likely responsible, for hypohydration impairing submaximal aerobic performance, which include: 1) cardiovascular strain from plasma volume loss (absolute hypovolemia) and tissue vasodilation (relative hypovolemia) that are sensed by baroreceptors; 2) elevated tissue temperatures in active muscle, tissues, CNS and skin that are sensed by thermal receptors; 4) metabolic changes (from tissue under perfusion and Q^{10} effects) including elevated glycogen utilization that are sensed by metaboreceptors; 5) altered brain structure and work load from water redistribution; and 6) altered perceptual cues; which are all integrated through the CNS to reducemotor drive to skeletal muscles.

Key words: aerobic performance, dehydration, hyperosmolality, hypohydration, hypovolemia.

Dehydration, thirst mechanisms and fluid intake in the elderly

W. Larry Kenney, PhD.

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Under "unstressed" conditions of daily life, fluid intake is governed by factors other than thirst. Most large surveys show that daily fluid consumption is the same in healthy, independently living 65-80 year old adults as in 20-35 year olds. However, timing of drinking and beverage choice often vary. Dehydration in the elderly (1) accompanies or results from clinical conditions and/or medication use, or (2) reflects a response to fluid deprivation or fluid loss.

The sensation of thirst is blunted in older subjects during and after exercise- and heat stress-induced dehydration (but not saline infusion).Thirst is a complex physiological phenomenon, involving multiple feedback loops. The primary drivers of the sensation of thirst are high serum osmolality (sensed by osmoreceptors in the brain) and low blood pressure (sensed by low-pressure baroreceptors in the central vasculature). Human and animal data support the hypothesis that thirst deficiency in the elderly is due to a reduced ability to sense a volume deficit, i.e., hypotension or low blood volume. Osmoregulation is relatively intact with progressive aging but new evidence shows that central processing of signals by satiety centers in the brain changes with aging.

Healthy older adults restore all of the fluid losses eventually, but replenishment is slower than in young adults. This age effect appears to be progressive, although the rate of decline is highly variable (no longitudinal data available).

Key words: osmolality, baroreceptors, heat stress, satiety, aging.

SESSION 2

Chair: Prof. Marcela González-Gross, PhD. Professor at the Department of Health and Human Performance. Technical University of Madrid. Spain.

Hydration of body cell mass and fat free mass: functional effects in elite athletes

Luís B. Sardinha, PhD.

Professor and Head of Exercise and Health Laboratory. Faculty of Human Kinetics. University of Lisbon. Portugal.

At the cellular body composition level, body mass includes cells, extracellular fluids and extracellular solids. The cellular mass is further divided into fat and body cell mass that includes the body components involved in biochemical processes and energy metabolism. The sum of body cell mass, extracellular fluids and extracellular solids forms the fat-free mass compartment. Both components, body cell mass and fat-free mass are considered the "metabolically active" body components. Total body water can be expressed as the sum of intracellular water and extracellular water. Intracellular water is a body cell mass component and the hydration of fat-free mass includes intracellular and extracellular water. Fat-free mass hydration is relatively stable in adult humans, while water distribution in the intracellular and extracellular compartments is highly variable between subjects and within subjects over time under different conditions, including the training status of athletes. When the extracellular water to intracellular water ratio is approximately 1, there is a normal fat-free mass hydration. When this ratio is greater than 1.2, there is a fat-free mass overhydration, while when the same ratio is less than 0.8 there is a fat-free mass dehydration. Considering that water plays a major role in nutrient transport, waste removal, maintenance of cell volume, and thermal regulation, water changes in the extracellular and intracellular pools may have relevant effects on cell function. This means that total body hydration does not take into account the relative role of cellular level of body composition and the related functional effects of the major ions found in the two cellular water pools.

Using dilution techniques such as deuterium and sodium bromide to estimate total body water and extracellular water, respectively, cross sectional and prospective observational studies with elite athletes have shown that intracellular hydration (total body water-extracellular water) seems to be more related with functional testing than the extracellular water pool. This lecture will address the methodological and biological issues and challenges related to cellular hydration that elite athletes need to deal with in order to maintain or improve their performance.

Key words: body cell mass, hydration, elite athletes.

Dehydration and team sports performance

Juan del Coso Garrigós, PhD.

Head of the Exercise Physiology Laboratory. Camilo José Cela University. Madrid. Spain.

Most field and court team sports are characterized by intermittent activities at near maximal effort interspersed with intervals of low intensity exercise or rest. Such activity patterns are associated with high metabolic demands that produce moderate-to-high body temperatures and a significant loss of body water and electrolytes by sweating. Sweat evaporation dissipates the excess of metabolic heat produced during exercise but it might also affect the body homeostasis of water and electrolytes if these nutrients are not appropriately replenished by drinking. In team sports, the sweating response is influenced by the specific characteristic of the sport such as the frequency and intensity of the efforts, the duration of the play and the pauses during the match and the clothing and equipment worn. In addition, indoor team sports are performed under well-controlled environmental conditions while outdoor team sports are subjected to the stress imposed by the environment conditions. Hot and/or humid environments can increase the amount of sweat lost during exercise. Generally, a dehydration equivalent to a body mass loss of 2% is considered the threshold for reduced physical performance, especially in hot environments. Apart from the physical demands, team sports players perform decision-making actions combined with continuous technical and tactical movements. Thus, dehydration in team sports can affect both the physical performance and the mental qualities related to concentration, precision and decision. An inadequate rehydration during training or competition can also increase the likelihood of suffering heat-related illnesses.

The prevention of dehydration in team sports is obtained with routines performed before, during and after exercise. *Before:* Players should be encouraged to begin exercise well hydrated by ingesting individualized amounts of fluid 2 h before exercise. Consuming beverages that contain sodium or salted snacks will help to stimulate thirst and to retain the liquids consumed before exercise. *During:* Dehydration and fluid demands will be very different among players despite all of them perform the same training routine or play with the same intensity. This is mostly produced by the high inter-individual variability in the sweating responses. It is recommended to estimate the individual sweat rates by measuring body mass before and after exercise. The individualization of players' rehydration bottles might aid in the prevention of dehydration during exercise. Most investigations with team sports have also shown a great inter-individual variability in sweat electrolyte concentrations and it is necessary to pay special attention to "salty sweaters". The use of beverages that include moderate amounts of electrolytes (mainly sodium) will reduce electrolyte deficits during exercise and might prevent muscle cramps in cramp-prone players. The intake of sports drinks, with 6-8% of carbohydrate concentration, might offer some advantages over water rehydration in training or competitions with duration longer than 60 minutes. The accessibility, temperature and palatability of the drink are also important pieces of the fluid intake regime since they will influence the physiological responses of rehydration. Simple tools as body mass scales, urine specific gravity refractometers or urine

colour charts can be used for assessing dehydration or hypohydration in the field setting. *After:* A fluid volume equivalent to 1.5 times body mass lost during exercise is recommended. Water ingestion is recommended while the inclusion of sodium (food or drinks) is essential for retention of the water consumed after exercise. To improve the attitudes and behaviours regarding hydration and fluid replacement of team sports players, it is important to increase players' knowledge about the effects of dehydration on performance and the benefits of a proper rehydration. Finally, certain sport situations exclusive of elite teams, such as the existence of more than one competition per week and the continuous domestic and international travelling, require more investigation to elucidate fluid requirements of elite team sports players.

Key words: hydration, fluid balance, sodium, thirst, sweat.

Dehydration and endurance performance in competitive athletes

Bob Murray, PhD.

FACSM. Founder and principal of Sports Science Insights, LLC. United States of America.

The negative impact of dehydration on physiological function and physical performance was noted in the scientific literature during the late 1800s, although the performance-sapping impact of dehydration was undoubtedly apparent for centuries before that to anyone who labored without adequate fluid intake. The reduction in body water from normal levels (also referred to as hypohydration) is associated with unavoidable changes in physiological function that become increasingly greater as dehydration worsens. Specifically, a wide variety of cardiovascular, thermoregulatory, metabolic, and central nervous functions are measurably altered and the combined effect of those alterations degrade performance capacity, especially when physical activity is performed in warm environments (e.g., > 15° C). When dehydration occurs during physical activity in the heat, the resulting performance decrements are greater than when similar activity occurs in cooler conditions, a difference thought to be due at least in part to the greater cardiovascular and thermoregulatory strain associated with heat exposure. Physical performance during prolonged, continuous exercise in the heat is consistently impaired by levels of dehydration ≥ -2% body mass, and there is accumulating evidence that lower levels of dehydration (< -2% body mass) can also impair performance, even during relatively short-duration, intermittent exercise. Future research is bound to improve our understanding of how low-level dehydration impacts physical performance, but on the basis of the existing scientific evidence, it can be said that when performance is at stake, it is always better to be well hydrated than dehydrated, a generalization that holds true in athletic, occupational, and military settings.

Key words: dehydration, performance, hypohydration.

Ingestion of salt and fluid: effects on blood volume and exercise performance

Ricardo Mora Rodríguez, PhD.

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One of the more visible responses to prolonged exercise in a hot environment is a progressive elevation in heart rate as the subjects become dehydrated and hot. As a consequence, for a given exercise intensity, heart rate could be increased by 10-30 beats when exercise takes place in the summer time *vs.* winter time. The increases in heart rate have implications for exercise prescription. Heart rate is often used as an index of exercise intensity when athletes and patients train to improve their performance and health, respectively. Large differences in heart rate due to environmental conditions (hot *vs.* thermoneutral) despite similar absolute workload insinuate that heart rate is an invalid index of exercise intensity when exercising in a hot environment. However, in recent studies it has been shown that maximal aerobic capacity (i.e., VO_2max) also declines during exercise in hyperthermic or dehydrated subjects (Gonzalez-Alonso et al., 2003). Thus, some authors argue that heart rate remains a useful index of exercise intensity because the increase in heart rate is proportional to the increase in the relative VO_2max due to the reduction in absolute VO_2max (Wingo et al., 2012). However, it is unknown if lowering exercise intensity during exercise in the heat in an attempt to maintain the target heart rate would undermine the training adaptations.

Dehydration accompanies hyperthermia and causes plasma volume reductions which accentuate heart rate drift resulting in cardiovascular strain. In turn, cardiovascular strain is closely associated with the perceived exertion and reductions in exercise performance. The plasma volume reductions with dehydration could be partially compensated by the use of plasma volume expanders. The infusion of plasma volume expanders has been used to investigate if that manipulation could alleviate the cardiovascular and thermal strain caused by exercise induced dehydration (Montain and Coyle, 1992). A more ecological approach is to use pre- exercise salt and fluid ingestion with the intention of expanding plasma volume. This manipulation has received an increasing amount of attention in the literature in recent years. In four studies, pre- exercise salt and fluid ingestion improved performance, measured as time to exhaustion, either during exercise in a hot (Hamouti et al., 2012; Sims et al., 2007) or thermoneutral environment (Nelson et al., 2008). In my talk I will present detailed information from these studies and discuss the mechanisms behind this ergogenic effect.

Key words: heart rate, stroke volume, cardiovascular drift, plasma volume expansion, performance.

CONFERENCE

Chair: Prof. Carmen Gómez-Candela, PhD. Head of Clinical Nutrition Department. La Paz University Hospital. Madrid. Spain.

Thirst and hydration status in daily life

Speaker: Prof. Mindy Millard-Stafford, PhD. Professor and Associate Chair of School of Applied Physiology. Georgia Institute of Technology. Atlanta. United States of America.

Water is an essential nutrient for all persons and is obtained mostly by drinking beverages along with contributions from food (~20% of total daily fluid). Daily water requirements have been systematically evaluated through water balance, water turnover, and/or water consumption studies. Numerous population-based survey data also have been published recently. The scientific basis for a common U.S. recommendation of drinking "8 glasses of 8 ounces of water per day" is lacking; consequently, limited evidence is available to assure drinking less will do *no* harm but neither does it validate that this dose (1.89 L) is optimal for health. A 2013 report from the Centers for Disease Control and Prevention indicated 7% of adults in the U.S. report no daily drinking of tap or bottled water, 36% drank 1-3 cups, 35% drank 4-7 cups, while 22% drank > 8 cups. The likelihood of drinking < 4 cups of water per day increased with age (> 55 yr), geographically cooler climates, low fruit/vegetable intake and sedentary lifestyle (< 150 minutes per week). This report is not inconsistent with 2005-2008 nationally-represented government survey data (NHANES) indicating U.S. adults drank an average of 4.3 cups of water per day. A reference document for Adequate Intake (AI) published by the Institute of Medicine (2004) acknowledges a range of daily fluid intake values can maintain daily hydration status with a median AI for healthy adult men and women (age 19- 50 yr) as 3.7 and 2.7 L per day (for those not physically active or exposed to hot weather). This AI is not different for older individuals (> 50 yr). The 2010 European Food Safety Authority AI for water is 2.5 and 2.0 L for men and women, respectively. Does the AI, however, assure optimal hydration status? Published data available suggest that with the exception of some diseases and special circumstances (strenuous exercise, long airplane flights, and climate), most adults are probably drinking enough total fluid (when accounting for all sources of water from all types of beverages combined with food). A recent investigation which examined hydration status biomarkers and thirst when ingesting the IOM median water intake will be discussed.

For the majority of healthy populations, fluid balance is maintained via thirst, a feedback-controlled variable, regulated acutely by central and peripheral mechanisms. However, voluntary drinking is also a behavior influenced by other environmental, social, and psychological cues. For example, during cold exposure, thirst is significantly blunted independently of hydration status or activity. Therefore, whether "thirst-guided" drinking maintains optimal hydration is a multi-factorial issue. Thirst perception is typically assessed by subjective ratings using categorical or visual analog scales. However, the timing of thirst perception may not correlate with the volume of fluid individuals ingest during periods of voluntary drinking. In cystic fibrosis patients who become dehydrated, drinking behaviour does not match their fluid loss due to this population's greater need for sodium which is lost in excess in the sweat. Whether ratings of perceived thirst or ad libitum drinking are preferred metrics of human thirst remains unclear. Understanding the neural correlates and activation pattern of brain regions associated with thirst due to dehydration is currently under investigation. The recommendation "drink to thirst" is frequently given to healthy individuals during daily life. However, factors and conditions (e.g., age, disease) that influence thirst as a biomarker should continue to be investigated along with improved non-invasive methodological techniques.

Key words: fluid balance, fluid intake, water, beverages.

SESSION 3

Chair: Prof. María Kapsokefalou, PhD. Associate Professor in Human Nutrition. Agricultural University of Athens. Athens. Greece.

Dehydration in geriatric patients and bioimpedance analysis

Rainer Wirth, PhD.

Doctor of the Department of Internal Medicine and Geriatrics. St. Marien-Hospital Borken. Borken. Germany.

Dehydration is a major problem of healthcare of the older population. Epidemiologic data suggest a prevalence of about 10% in the general older population and of about 30% in nursing home residents. Although dehydration is very common, there is no generally accepted definition and the diagnostic criteria are uncertain. Several clinical signs of dehydration, such as dry mouth or persisting skin folds, are not specific and have low sensitivity. The best clinical marker is a dry axilla with a specificity of 82% and a sensitivity of 50%. Laboratory data reflecting renal function and hydration status may be more precise, but they are influenced to a great extent by renal function and nutrition. Osmolarity of plasma is a good marker of pure fluid loss but it does not reflect the loss of salt and water, which is very common in older patients.

As bioelectric impedance analysis (BIA) agrees well with reference methods in the evaluation of total body water (TBW) in healthy subjects, there is hope that BIA may contribute to an objective diagnosis of dehydration. Up to now, only few studies have been performed to verify the diagnostic usefulness of BIA in assessing hydration status. Studies in patients undergoing hemodialysis have demonstrated that BIA is a useful and valid tool in assessing shifts of TBW in a longitudinal and intraindividual approach. However, the diagnostic value of single measurements seems to be very low. The only study comparing BIA measurements with the clinical judgment of hydration status in older patients demonstrated a poor level of agreement. Reasons for this low concordance are various. BIA is measuring the conductivity of the human body, which is dependent on the content of water and electrolytes. Many patients show disturbances of electrolytes such a hyponatremia, leading to falsely low measurements of hydration. In addition, TBW is very much dependent on the relation of fat mass (FM) and fat-free mass (FFM) of each individual. Fat is nearly free of water, whereas FFM consists of 73% water. As older persons show a great variance of body composition, i.e. relation of FM and FFM, measurement of TBW can hardly reflect hydration status without being certain about the exact FFM.

While BIA is an elegant technique of body composition analysis in healthy subjects, its application has several limitations in patients and in evaluating hydration status. Thus, future developments may overcome these limitations.

Key words: geriatric, dehydration, bioelectric impedance analysis.

Evolution of the assessment of hydration status: eliminating the problems and advancing the practice with bioimpedance

Henry Lukaski, PhD.

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Non-invasive assessment of hydration status remains a critical need in clinical medicine, particularly in acute settings. An increase of 3-4 L is detectable as pitting edema whereas a sub-clinical increase in fluid volume without edema and mild to moderate dehydration are difficult to diagnose. Traditional methods to assess hydration status including isotope dilution are not amenable for point-of-care use, and standard clinical evaluation methods (e.g., physical examination, laboratory studies and change in body weight) are either impractical or insensitive to discriminate normal from altered hydration status for an individual.

A noninvasive approach introduces a safe, radio-frequency alternating current and measures passive electrical characteristics of the body to classify acutely and monitor serially the hydration status of individuals. The use of alternating current and single (50 kHz) frequency with multiple regression equations to predict total body water (TBW) or extracellular water (ECW), or multiple (2 kHz to 2 MHz) frequencies and *in vitro* biophysical models (Cole and Hanai) to calculate TBW and ECW and approximate intracellular water (ICW) results in estimated fluid volumes that are too imprecise for clinical use.

Contemporary bioimpedance methods overcome these limitations derived from questionable assumptions of constancy of composition of the fat-free body and the imprecision of mathematical prediction models, based on body weight, to classify (under-, normal or overhydration) and rank (more or less than before intervention) hydration status. They use 50-kHz measurements of whole-body resistance (R) and reactance (Xc), normalized for standing height and plotted on the RXc graph to illustrate an impedance vector that has length, which is inversely related to TBW, and direction, characterized by the phase angle (arc tan Xc/R) that indicates tissue hydration status and cell mass. This method is termed bioimpedance vector analysis (BIVA). Vector position on the RXc graph is interpreted relative to the bivariate distribution R/H and Xc/H of vectors derived in healthy people and expressed as 50, 75 and 95% confidence intervals shown as ellipses. Individual vectors outside of the upper pole of the 50% ellipse are classified as dehydration whereas vectors outside of the lower pole of the 50% tolerance ellipse are described as fluid overload. Changes in tissue hydration status less than 500 mL can be detected with BIVA. The principal use of BIVA is the assessment of hydration status in patients with fluid

overload or dehydration, which is helpful in the prescription of treatment.

An alternate application of bioimpedance measurements is the comparison of the individual R, Xc, impedance, and phase angle values with normative data (ranges) from a healthy population based on gender and age. Because impedance and R values indicate TBW and ECW, respectively, interpretation of individual measurements utilizes the biometric of "at, below or above" the expected values for the healthy population. This application recently was modified to include Z-scores for an individual to classify hydration status as well as nutritional status assessment and muscle function among hospitalized and elderly patients.

The practical advantages and clinical value of bioimpedance measurements to identify alterations in hydration status acutely and serially emphasize the opportunities for its use in other applications including surveillance and monitoring effects of intervention.

Key words: resistance, reactance, bioimpedance vector analysis, impedance spectroscopy.

CONFERENCE

Chair: Prof. Ryszard Gellert, MD, PhD. Professor of Nephrology and Head of Department of Nephrology. Centre of Postgraduate Medical Education. Head of Nephrology Unit. Bielański Hospital. Warsaw, Poland.

Hydration, morbidity and mortality in vulnerable populations

Speaker: Prof. Ronald J Maughan, PhD. Professor of Loughborough University. Loughborough. United Kingdom.

Deprivation of water for more than a few days inevitably leads to death, though there are occasional reports of much longer survival without access to water in exceptional situations, highlighting the individual susceptibility to the effects of absence of water intake. Such extreme conditions, however, are seldom encountered in daily living for most of the population. It is normal for small fluctuations in body water content to occur throughout the day with no perceptible effect on health or performance. Losses incurred due to sweating, respiratory loss, through vomiting and in urine and stools, are replaced through the intake of fluids and foods at intervals throughout the day. Chronic mild dehydration may be common in some population groups, including especially the elderly.There may be an association, although not necessarily a causal one, between low habitual fluid intake and some chronic diseases, including urolithiasis, constipation, asthma, cardiovascular disease, diabetic hyperglycaemia, and some cancers. Acute hypohydration is recognised by many clinicians as a precipitating factor in a number of acute medical conditions in the elderly. The risk of infection in the elderly has also been linked to poor fluid status, and the mortality rate can be as high as 50% in the absence of early diagnosis. According to analysis of the death certificates of care home residents in England and Wales between 2005 and 2009 carried out by the Office for National Statistics, dehydration was responsible for 667 deaths during this period, compared to 157 that were ascribed to malnutrition. Impairments of cognitive function may occur at moderate levels of hypohydration, but the methodology in many of these studies is poor, both with regard to assessment of hydration status and to the functional tests applied. Even short periods of fluid restriction leading to a loss of body mass of 1-2%, however, lead to reductions in the subjective perception of alertness and ability to concentrate and to increases in self-reported tiredness and headache. In the elderly with already impaired function this may lead to a spiral of further reductions in fluid intake, and there is some evidence of an association between functional status, as assessed by the Barthel index, and water turnover. The most vulnerable individuals may receive more attention from staff, while those with moderate levels of impairment may be at greater risk of inappropriate fluid intake. Overhydration is not always benign and may be associated with bone loss and increased fracture risk in the elderly. Though there is limited published information, and added heat stress may increase symptoms in susceptible individuals. Epidemiological evidence from patterns of morbidity and mortality suggest that all-cause mortality is increased when high temperatures persist for more than a few days. The limitations of this evidence must be recognised, and it seems likely that the number of heat fatalities is underreported due to lack of reports. In the last decade or so, a very substantial number of papers have been published with analysis of patterns of morbidity and mortality during periods of exceptional weather, with the primary focus of most of these studies being on very high, rather than low, environmental temperatures. The elderly are most vulnerable to periods of extreme heat, and young children may also show to be susceptible, but effect is seen across the whole age range. At least part of the mortality observed during a heat wave is the result of a harvesting effect, also referred to as *short-term forward mortality displacement*. It has been observed that for some heat waves, there is a compensatory decrease in overall mortality during the subsequent weeks after a heat wave. Such compensatory reduction in mortality suggests that heat affects especially those so ill that they "would have died in the short term anyway". In other surveys, however, no such effect has been established, suggesting that is not simply an elimination of the most susceptible individuals. Epidemiological surveys cannot establish causal relationships, and there seem to have been few attempts to analyse the effectiveness of the preventive measures that have been implemented in the aftermath of major heat waves. Even though some of the evidence is not entirely consistent, prudence suggests that it may be wise to maintain good hydration status.

Key words: euhydration, dehydration, overhydration, morbidity, mortality.

SESSION 4

Chair: Claudio Maffeis, MD. Head of the Unit of Clinical Nutrition and Obesity. Regional Centre for Juvenile Diabetes. University of Verona. Verona. Italy.

Do minor changes in hydration status influence mood and cognition?

David Benton, PhD.

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Although at some point severe dehydration inevitably disrupts bodily functioning there have been many popular suggestions that it is common for even mild dehydration to disrupt the functioning of the brain, with adverse consequences for mood and mental performance. Therefore the evidence that minor levels of dehydration are disruptive was considered – a topic that has been to date little studied. Children are a potentially vulnerable group that has produced the most consistent findings. Children in particular are said to be at risk of dehydration as they are often dependent upon others for the provision of fluid, they are more active and they have a greater surface-to-mass ratio than adults. Four intervention studies have reported improved performance in children aged 7 to 9 years. In these studies children, eating and drinking as normal, have been tested on occasions when they have and not have consumed a drink. After a drink both memory and attention have been found to be improved.

In young adults, given the efficiency of homeostatic mechanisms, it would seem a priori unlikely that failing to drink for relatively short periods, in a temperate climate, would disrupt bodily functioning. The topic is, however, difficult to study as there is a need to measure rapid and small changes in hydration status. It is argued that the most accurate index of hydration status in real time, when serial measurements are made in close proximity, is to consider changes in weight. Studies are reported where electronic scales were used to establish changes of a few grams in body weight, sensitive enough to measure the minor losses of fluid associated with breathing and perspiration. Young adults sat at 30 degrees Celsius for four hours during which they lost 0.65% of body weight although it was only 0.40% if they had drunk 200 mls of water during the morning. In those who had not drunk water better memory and mood were associated with a smaller fall in body weight and a greater rise in body temperature. In those who had drunk water better memory and mood was associated with a greater fall in body weight and a smaller increase in body temperature; that is a greater intake and excretion of water was associated with better functioning. The data were consistent with the view that even a small degree of dehydration is disruptive and that avoiding a loss of fluid is associated with better functioning.

Key words: children, body weight, minor dehydration, memory, mood.

Impact of mild or moderate dehydration on cognitive performance

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The European Food Safety Authority in its 2011 report claimed that an adequate hydration contributes to the maintenance of normal physical and cognitive functions. This refers not only to groups more vulnerable to dehydration, such as children and the elderly, but also to young adults. Healthy young adults are also at risk of a decrease in their cognitive performance when hydration is not adequate. However, few studies have examined the impact of mild or moderate dehydration on cognitive performance. This is an emerging area of research, that requires a solid base of new evidence in the future from the study of large samples of participants of both genders, with suitable control of factors that are known to lead to biased results.

Changes in the amount of electrolytes in the body that occur when dehydrated can alter brain activity and the functioning of the monoaminergic and cholinergic neurotransmitter systems involved in cognitive processing. It has also been found that dehydration is associated with changes in blood-brain barrier permeability and decreases in the blood flow in some areas of the brain. A state of dehydration leads to the activation of the hypothalamic-pituitary-adrenocortical axis and to the subsequent production of stress hormones with negative effects on perception, spatial ability and memory.
The principal findings from published studies examining the impact of dehydration on cognitive skills allow to state that being dehydrated by just 2% impairs performance in tasks that require attention, psychomotor and immediate memory skills. A level of dehydration of more than 2% also resulted in marked decreases in alertness and concentration ability and increased fatigue, tiredness and drowsiness in young subjects. In contrast, the performance of long-term and working memory tasks and executive functions is more preserved, especially if the cause of dehydration is moderate physical exercise.

The lack of consistency in the evidence published to date is largely due to the different methodology applied and an attempt should be made to standardize methods for future studies. These differences relate to the method used to cause dehydration and the type of drink used to rehydrate, as well as to the characteristics of the participants (i.e. gender, circadian typology). Regarding the gender, the impact of mild to moderate states of dehydration on cognitive performance is greater on women than on men. However, most studies include either men only in their samples or participants of both genders, without studying them separately and

without controlling the menstrual cycle in women. Another important aspect is the assessment of cognitive performance taking into account the type of task, measures of response, and time of day when recordings were carried out. The use of very simple experimental tasks could not lead to sensible results, while the most complex neuropsychologic tasks have been designed to evaluate patients' deficiencies and not always provide significant results in healthy subjects evaluated for capacity of performance under different conditions. The use of the functional magnetic resonance imaging technique, which allows the evaluation of brain activity during cognitive performance, has shown a higher neuronal activity in healthy participants dehydrated in order to achieve the same performance level in executive functions (such as planning and visuo-spatial processing). This pattern suggests that there is an inefficient use of brain metabolic activity following a mild dehydration state compared to an adequate hydration state.

Key words: cognitive performance, dehydration, attention, memory, functional magnetic resonance imaging.

Headache and hydration: scientific evidence

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Non-experimental evidence has suggested a positive effect of increased water intake on headache, but most of the provided evidence has been based on case reports and few epidemiological studies. Two randomized clinical trials assessing the effect of increasing water intake on headache have been published to date (Spigt et al, 2005 & 2011) and at least one experiment on the effect of fluid restriction on headache incidence has been performed (Shirreffs et al, 2004).

The study carried out by Spigt et al. (2005) on 18 migraine patients examined the effects of regular water intake on migraine. An average reduction of 21 hours of headache time in 2 weeks was observed at the end of the 3 month follow-up period. Authors recognized some potential biases (mainly due to a small sample size) in their pilot study. As a result, five years later authors conducted a second randomized controlled trial in primary care with two groups including a follow-up period of 3 months to study the effects of increased water intake on headache (Spigt et al., 2011). Fifty (50) patients were randomized to the control group and 52 patients to the intervention group. Inclusion criteria included patients who had had at least two episodes of moderately intense headache or at least five mildly intense episodes per month and a total fluid intake of less than 2.5 l/day. The subjects in the intervention group were instructed to increase the daily water intake by 1.5 l. The main outcome measures were Migraine-Specific Quality of Life (MSQOL) and number of days with at least one moderate headache per month. Drinking more water resulted in a statistically significant improvement of 4.5 (confidence interval: 1.3-7.8) points on MSQOL. In addition, 47% patients in the water group reported significant improvement (6 or higher on a 10-point scale) on perceived intervention effect against 25% in the control group. However, drinking more water did not result in relevant changes in the number of days with at least one moderate headache, as observed in the pilot study. On the other hand, Shirreffs et al. (2004) investigated the physiological responses and subjective feelings resulting from 13, 24 and 37 h of fluid restriction (FR) and compared the results with a euhydration (EU) trial of the same duration in fifteen healthy volunteers. The subjects reported feelings of headache during the FR trial and also that their ability to concentrate and their alertness were reduced.

Considering the positive effects observed on the participants, it seems reasonable to recommend headache patients to increase their daily intake of water and fluids for a short period of time to assess whether they experience improvement; particularly in those patients with liquid intakes below recommendations.

Key words: hydration, headache, evidence.

SESSION 5

Chair: Prof. Andreu Palou, PhD. Professor of Biochemistry and Molecular Biology. University of Baleares. Palma de Mallorca. Spain.

Fluid intake between and during exercise bouts: a consideration for perception of sweat loss

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Much effort has been made to determine the optimal approach for athletes to rehydrate during and between training bouts and competition. Previous position stands by influential organizations in the sports medicine field included more blanket style recommendations. However, the key tenet in developing and implementing more currently promoted strategies is to base fluid consumption on volume of sweat loss. This more individualized approach is meant to deter extreme hypo- or hyperhydration which can be due to the large variability in both sweat losses and thirst sensation between athletes. Our laboratory has recently conducted multiple investigations concerning during and between training bout fluid intake and perception of sweat losses for both endurance and intermittent sprint sport athletes with several interesting trends emerging.

The first is that the message of individualized sweat loss strategies based on change in body mass before and after training is not recognized or incorporated by the majority of recreational or lower level athletes, and that the majority of athletes simply drink to thirst or based on an abstract version of what they perceive to be adequate.

Our second discovery was that athletes do not accurately estimate their sweat losses. In separate cool and hot environments, runners were found to repeatedly underestimate their sweat losses by ~50% when filling race aid station style paper cups with water to represent their perceived sweat losses. A similar trend was observed in collegiate basketball players during prolonged (150 min) in-season practices when players were asked to fill their practice and game sport bottles with water to estimate their sweat losses. Underestimation does not appear to be biased between genders.

The third trend that developed in our investigations was that athletes who reported weighing themselves before and after training sessions were surprisingly no better estimators than counterparts who did not. Athletes often reported not recognizing that change in body mass is due primarily to water loss or failed to consider variables that distort sweat loss calculation including; weighing in sweat saturated clothing, not considering fluid intake during training, and lack of recognition of sweat evaporation.

Increased efforts through popular media need to be used as avenues to further promote the proper procedures of developing individualized hydration strategies. Recommendations to keep a personalized sweat loss journal would also allow for increased accuracy in determining during and between bout fluid needs while limiting the need for frequent change in body mass assessments.

Key words: hydration, urine specific gravity, sweat perception, recreational athletes.

Hydration and human physiological function during rest and exercise

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Body water deficit or dehydration can pose a major challenge to the regulation of human physiological function and exercise capacity, particularly during prolonged and intense exercise in hot environments. The impact of dehydration upon physiological function is exemplified during whole-body exercise by significant overtime reductions in cardiac output and blood flow to locomotor muscle, skin and brain in conjunction with parallel internal body hyperthermia and, in some conditions, compromised muscle metabolism and aerobic capacity. Cardiovascular strain is closely associated with concurrent dehydration-mediated reductions in blood volume and hyperthermia and can be fully or partially restored by (1) ingesting fluids during exercise, (2) exercising in cold environments or in the supine position, (3) working at intensities that require a small fraction of human cardiovascular capacity and (4) when physiological function is assessed under resting and small muscle mass exercise conditions.

A salient feature of dehydration-induced cardiovascular strain is the decline in stroke volume, which is apparent even under resting and small muscle mass exercise conditions. However, the impact of dehydration upon physiological function depends on the magnitude of the metabolic and cardiovascular demand. For instance, cardiac output, limb blood flow and muscle metabolism are stable or increase during small muscle mass exercise or resting conditions, but are significantly impaired during whole-body moderate to intense exercise. In either exercise modality, however, a fall in left ventricular filling and ejection fraction, rather than impaired left ventricular function, appears to explain the stroke volume decline. During prolonged and maximal exercise, dehydration is also associated with an accelerated drop in perfusion and oxygen supply to the human brain. Yet, the consequences of diminished oxygen supply on aerobic metabolism are greater in the exercising muscles than the human brain because of the much smaller functional oxygen extraction reserve across any exercise intensity in contracting muscles compared to the brain.

This presentation will discuss recent advances in our knowledge and understanding of the physiological consequences of dehydration and fluid replacement on human physiological function at rest and during exercise. Emphasis will be placed on the evidence that dehydration indeed influences physiological function and the potential underlying mechanisms.

Key words: physiological strain, fatigue, hyperthermia, dehydration, blood flow.

CLOSING CONFERENCE

Chair: Gregorio Varela-Moreiras, PhD. Professor of Nutrition and Bromatology. Head of Health and Pharmacist Sciences Department. CEU San Pablo University. Madrid. Spain.

Will reducing sugar-sweetened beverage consumption reduce obesity? Evidence supporting conjecture is strong, but evidence when testing effect is weak

Speaker: Kathryn A. Kaiser, PhD. Office of Energetics, Dean's Office. School of Public Health. University of Alabama at Birmingham. Alabama. United States of America.

We provide arguments to the debate question about the effects of reducing sugar-sweetened beverages (SSBs) on obesity and update a previous meta-analysis with recently published studies on effects of SSBs on body weight/ composition indices (BWIs). We abstracted data from randomized controlled trials examining effects of consumption of SSBs on BWIs. Six new studies met these criteria: (i) human trials, (ii) > or = 3 weeks duration, (iii) random assignment to conditions differing only in consumption of SSBs and (iv) including a BWI outcome. Updated meta-analysis of a total of seven studies that added SSBs to persons' diets showed dose-dependent increases in weight. Updated meta-analysis of eight studies attempting to reduce SSB consumption showed an equivocal effect on BWIs in all randomized subjects. When limited to subjects overweight at baseline, meta-analysis showed a significant effect of roughly 0.25 standard deviations (more weight loss/less weight gain) relative to controls. Evidence to date is equivocal in showing that decreasing SSB consumption will reduce the prevalence of obesity. Although new evidence suggests that an effect may yet be demonstrable in some populations, the integrated effect size estimate remains very small and of equivocal statistical significance. Problems in this research area and suggestions for future research are highlighted.

Key words: obesity, randomized controlled trials, soft drinks, weight loss.

Abstracts

Perception of hydration in a group of university students. Differences regarding their body masd index

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Introduction: Proper hydration is important, but could be essential in those with weight control problems.

Objective: The aim of this study was to investigate the drinking habit patterns of young people, what is considered correct/recommended, and to analyse the differences regarding body mass index (BMI).

Methods: A group of 113 university students aged 18-27 completed an open-ended-questionnaire with questions about general concepts of hydration, beverage consumption patterns and self-reported anthropometric data. The students were classified according to their BMI (< or ≥ p50). Statistical analysis was performed using SPSS (version 19.0), and differences with $p < 0.05$ were considered significant.

Results: Those with BMI ≥ p50 considered they should drink more (2.19 ± 0.37 L/day *vs.* 1.98 ± 0.41 L/day for those with lower BMI, $p < 0.05$). Reported beverage consumption was also higher in those with BMI ≥ p50 (1.92 ± 0.56 L/day *vs.* 1.59 ± 0.52 L/day) ($p < 0.01$).

Conclusion: University students with higher BMI seemed more aware of the importance of hydration, and they reported consuming more beverages. But neither they nor those with lower BMI meet the target set for adequate liquid intake.

Acknowledgements: This work was carried out with funding from the "Research Funding Program for Consolidated Groups Santander-UCM" (Ref: GR35/10-A).

Key words: hydration, perception, beverage consumption, BMI.

Relation between hydration and jump performance; differences between young elite and regional basketball players

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Introduction: Hydration has been classically associated with aerobic performance. However, less is known about the relationship between anaerobic performance and hydration parameters.

Objective: Our aim was to analyse the association between jump performance and total (TBW) or intracellular (ICW) hydration.

Methods: Two teams were assessed (elite level (T1, n = 11): age, 17.45 ± 1.5 years; height, 198.6 ± 9.7cm; regional level (T2, n = 10): age, 15.30 ± 1.2 years; height, 179.0 ± 5.3cm). Hydration was estimated by bioelectrical impedance. Dual-energy X-ray absorptiometry (DXA) was used to estimate fat free mass (FFM), fat mass percent (FMP) and limb soft lean tissue (LSLT). FFM hydration (FFMh) and body cell mass (BCM) were calculated. Countermovement jump (CMJ) and CMJ with free arms (CMJA) were measured with a jump map. Partial correlation analyses adjusted to LSLT between jump and hydration variables were carried out. Differences between teams were also analysed.

Results: Significant correlations were found between ICW and CMJ ($r = 0.705$, $p < 0.01$). As expected, significant differences were found between T1 and T2 for CMJ (6.77 ± 2.22 cm; $p < 0.01$) and CMJA (15.41 ± 2.18 cm; $p < 0.001$); however, ICW was the only significantly different hydration variable among level groups (61.14 ± 0.81% *vs.* 59.48 ± 1.29%; $p < 0.01$).

Conclusions: Our findings suggest that ICW must be an explanatory mechanism for jump capacity, mainly when less coordinative skills are involved. Differences between jump performances among levels of competition could be partially explained by ICW. More research is necessary to confirm our results.

Key words: young athletes, body composition, intracellular water.

Hydration characteristics of male elite climbers

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Introduction: Significant scientific documents describe the deleterious effects of reduced total body water (TBW) on endurance performance. However, the influence of hydration on muscular strength, power and high-intensity endurance is poorly understood.

Objective: The aim of this study was to show the differences in hydration status between two levels of performance in elite climbers.

Methods: Thirteen male elite climbers, who had participated in the 2004 International Federation of Sport Climbing

(IFSC) World Cup, completed a fasting body composition assessment. TBW was estimated by bioelectrical impedance analysis (SanoCare); FFM hydration and body composition were also calculated. The IFSC ranking was used to classify the performance. Seven were ranked within the top 30. A Mann-Whitney test was carried out to analyse differences between groups. Partial correlations between IFSC ranking and hydration variables were performed and adjusted according to fat percentage.

Results: TBW was greater in climbers who classified within the first 30 (66.05 ± 2.88% versus 61.95 ± 3.59% obtained for climbers with positions after these 30). A relationship between individual ranking and hydration status was also found. These associations must be considered for a better profile of adiposity. It has been speculated that high levels of FFM hydration must be related with performance.

Key words: total body water, bioelectrical impedance analysis, performance, elite climbers.

Total body water levels in professional football players

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Introduction: Continued training produces a decrease of total body water levels with impairment of performance. Significant scientific evidence has documented the deleterious effects of reduced total body water (TBW) on endurance exercise performance.

Objective: The purpose of this study was to investigate the relationship between TBW and player position in football players.

Methods: One hundred twenty-five male professional football players participated in and completed a fasting body composition assessment. TBW and hydration of fat-free mass was estimated by bioelectrical impedance analysis (Tanita SC 240 MA, Japan) in the 2011-2012-2013 pre-seasons. All the athletes were divided by player position (goalkeepers (n = 12), defenders (n = 37), midfielders (n = 57) and forwards (n = 19)). Descriptive statistics (mean± sd) were calculated and one-way analysis of variance to test differences among player positions was performed. Partial correlations were performed and adjusted by percentage of fat. The level of significance for the statistical test was 0.05.

Results: Percentage of TBW was greater in midfielders (61.68 ± 3.09%) followed by forwards (61.23 ± 2.66%), defenders (59.97 ± 2.52%) and goalkeepers (61.68 ± 3.09%), (f-ratio 3.55, p = 0.017). Associations between TBW and player position were not significant when adjusted for fat percentage.

Conclusions: These associations must be considered for a better profile of adiposity and are probably related to a body composition mainly of muscle mass.

Key words: total body water, football players.

Bioactive compounds with antioxidant activity in milk- and soy milk-juice based beverages

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Introduction: Milk-juice beverages lack a precise definition and legal recognition even in the most recent legislation. These beverages provide an essential water intake (90%) and their fruit contents contribute vitamin C, provitamin A, minerals (K, Mg, P), fibre, sugars and organic acids. Skimmed milk contains protein, lactose and minerals (Ca, P) and soy-milk protein, fat, carbohydrates, minerals (K, P) and isoflavones. Furthermore, they are a good source of bioactive compounds with potential antioxidant activity helping to promote health.

Objectives: To determine the bioactive compounds, vitamin C and polyphenols and the in vitro antioxidant activity (FRAP) in twenty-four milk- and soy-beverages marketed in Spain.

Methods: Ascorbic acid was analysed by HPLC-DAD. Polyphenols and FRAP assay were determined by spectrophotometry.

Results: The vitamin C values were much higher than those shown on the labels, suggesting that the main intake of this vitamin is due to its inclusion as an additive. The highest concentration of polyphenols was found in the mixed beverages containing orange, apple, pineapple and/or grape as the main fruits. Total antioxidant activity (FRAP) was positively correlated with ascorbic acid (r2 = 0.893) and polyphenol (r2 = 0.896) contents.

Conclusions: Due to the existing legal gap in the scope of these products, we are unable to determine whether the results agree with legal criteria. A regulatory framework would be clearly advantageous for consumers, ensuring they are given full information about the contents and composition of these products.

Key words: ascorbic acid, polyphenols, FRAP.

Meeting water requirements and affective capacity in a group of institutionalized elderly people

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Introduction: Liquid intake can be reduced by many factors, especially in those with psychiatric and cognitive problems, and it may have important health consequences.

Objective: The aim of this study is to analyse to what extent institutionalized elderly people meet water requirements and to evaluate the relationship between water intake and affective capacity in this population.

Methods: This study included 176 institutionalized elderly people from Madrid (Spain) (65-90 years old) whose diets were recorded using a precise weighing method over seven consecutive days. Total water intake (TWI) (food and beverage) was calculated using DIAL software. Water requirements were calculated using 30 mL/kg/day. Affective capacity was assessed using the Geriatric Depression Scale (GDS). Subjects were grouped into non-depressed (GDS ≤ 5) and depressed (GDS > 5).

Results: 77.8 ± 19.5% of the participants met the requirements for water intake (13.7% of the participants took water amounts above the required dose) and the mean GDS score was 5.4 ± 3.5 (43.7% had depression). An inverse relationship between GDS score and TWI ($r = -0.382$; $p < 0.001$) was observed. Non-depressed elders had higher TWI (1543 ± 214.3 *vs.* 1419 ± 243.3 mL/day, $p < 0.001$), higher beverage consumption (672.0 ± 170.6 *vs.* 587.7 ± 174.4 mL/day, $p < 0.01$) and better CWR (81.7 ± 19.9 *vs*.74.9 ± 19.0 %, $p < 0.05$) than depressed elders. Also, it was found that a higher water intake is a protective factor against depression (OR: 0.982; CI: 0.966 - 0.998; $p < 0.05$).

Conclusion: Depression affects the adequate consumption of water.

This work was supported by Unilever Netherlands via the Universidad-Empresa project (138/2000).

Key words: water requirements, elderly, depression, GDS.

What do children drink?

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Introduction: Water is essential for organs and tissues to function properly. 6- to-8-year-old children should drink 1.7 litres of water per day, 20% of which is provided by food.

Objective: To become familiar with fluid intake in children from 6 to 8 years old.

Methods: Observation-based descriptive and multi-disciplinary study carried out in Toledo. A 24-hour reminder was used for three days, assessing fluid intake and different groups of drinks.

Results: A total of 178 children (45.1% of those initially screened), mean age 6.73 (DT 0.69) completed the study. 51.4% of them were girls. The average intake was 1663 ml (DT 361.4), with an average of 135 ml higher in girls ($p = 0.013$). 16.9% of the participants presented lower intake than recommended (1360 ml) with differences in gender (22.1% in boys and 12.1% in girls, $p = 0.058$). 86.7% had consumed soft drinks, 15.6% with meals and up to 20.8% on weekends. 19% had tasted coffee.

Over the weekend children consumed fewer dairy products than at school (29.2% *vs.* 45.15%) but more juice (63.1% *vs.* 50.4%).

Conclusions: Acceptable participation. Sufficient average intake. A difference was found by gender regarding fluid intake in 6-year-old children. This is different from other studies (conducted with 9-year-old children). Daily milk and water intake is recommended while soft drinks should be consumed occasionally. Coffee should not be consumed. People are not aware of the importance of hydration. This is even more significant with vulnerable people such as children.

Key words: children, hydration, water, soft drinks.

The importance of hydration to the skin

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Introduction: The skin is the largest organ in the human body. In addition to other functions, skin maintains the integrity of its structure and connects it with the environment. This role is fulfilled thanks to its own hydration mechanism, which at the same time maintains the skin flexible and resistant. However, due to diverse factors we are exposed to on a daily basis, the skin's natural mechanism is not enough, so it is necessary to provide extra help to prevent dryness and peeling. Skin care, as well as its hydration, is essential at all ages and all times of the year. With the passage of time, sebaceous glands are less active and the skin loses its capacity to retain water, therefore drying easily.

Objectives: To establish the external factors which facilitate skin dryness. To maintain the internal and external hydration of the skin with the use of external products.

Methods: Introduction of basic recommendations through talks and workshops. Dissemination through posters in hospitals, primary health care centres and schools (parents and children).

Results: Using the required methods, assistance can be given to satisfy one of the most important basic human needs. Recommendations and basic care will be adapted according to age and priority.

Conclusions: Skin care is vital to healthy and sick persons. Because of the environment, our health habits and the natural ageing process are crucial factors in the skin's loss of moisture. Preventing dehydration is in our hands.

Key words: sebaceous, gland, primary health care.

Physicochemical and organoleptic analysis of bottled natural mineral waters

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Introduction. Natural mineral water is distinguished from others by its nature (mineral content, dietary elements and other components), its chemical profile and its original purity. A further differentiating aspect is its taste and odour.

Objectives: To analyse and compare the key physicochemical components in the classification of bottled natural mineral waters according to current legislation and to perform a sensory evaluation.

Methods: The study samples came from bottled natural mineral waters of the same brand but from different springs. The physicochemical analysis was conducted in accordance with Royal Decree 1798/2010 of 30 December, which regulates the exploitation and commercialization of natural mineral waters and spring waters bottled for human consumption. The sensory analysis was carried out using a taste panel from the Seminar of Gastronomy and Oenology Studies at the University of Granada.

Results: The physicochemical analysis results made it possible to classify the samples as weakly mineralised and low-sodium waters, among other characteristics. The sensory analysis showed significant differences in the characteristics of the waters according to the springs from which they came.

Conclusions: These classified and characterised waters are indicated for the preparation of infant foods and low-sodium diets, due to their low sodium content and weak mineralisation. Their contribution to the recommended intake of various minerals is significant; therefore, their consumption is recommended for daily hydration.

Key words: hydration, bottled mineral water, sensory, taste.

Subcutaneous hydration in terminal stage patients

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Introduction: It is a common practice for oncological patients to be taken care of in a hospital in the final stage of their life. One reason for that is the family's concern about the issues facing a terminal patient, chief amongst them the reduction or inability to intake fluids orally.

Objective: To reduce the symptoms characteristic of the terminal stage that cause the deterioration of the conscious state. The presence of the feeling of thirst and other signs and symptoms negatively impact the patient's quality of life, which causes anxiety for the family and the patient.

Methods: With the use of clean serum, the infusion rhythm oscillates between 20 and 100 ml/h. It can be administered along the subclavian pectoral area, abdominal region, thighs and arms. The puncture spot should be changed every 7 days, and the needle location should be inspected daily. The required materials for the puncture are butterfly needles or teflon cannules.

Results: This is the simplest parenteral method to hydrate or supplement the oral intake of liquids. It does not prolong the agony, requires no hospitalization, presents very few complications and thus allows caretakers to continue with their efforts to alleviate the suffering and improve the patient's quality of life.

Conclusions: The choice to help a terminal patient's hydration and nutrition carries physiopathological, emotional and ethical implications. The therapeutic team walks a fine line between the real needs of the patient and the real needs of the family.

Key words: hydration, subcutaneous hydration, terminal patient, palliative care.

Importance of hydration during childbrith: scientific evidence

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Introduction: Pregnancy, childbirth and the postpartum period are normal health processes in women. However, labour is mistakenly treated like a disease. Hydration needs are not satisfied during the childbirths that occur in Spanish hospitals. Women spend long hours fasting or with IV fluids in order to prevent Mendelson's syndrome caused by aspirating gastric contents, just in case a Caesarean section can be necessary.

Objectives: To find out if it is necessary to restrict oral hydration during childbirth.

Methods: Descriptive study of the available evidence, using a literature review databases such as Cuiden, Medline, Cochrane or Science as a data collection tool.

Results: Olsson et al., found that the incidence of Mendelson's syndrome is 0.05%. The Spanish Society of Gynaecology recommends not restricting fluids at birth and especially during prolonged processes. The Federation of Midwives Associations, through its Normal Delivery Initiative, recommends the intake of food and fluids according to a woman's needs during normal labour and also state that this is not the norm.

Conclusions: There is no existing evidence that fasting lowers the risk of aspiration. In normal labour without any risk factors, the probability of Mendelson's aspiration syndrome is minimal. The recommendation after preparing this review is to consume isotonic drinks on a regular basis during normal labour.

Key words: hydration, normal delivery.

Importance of hydration in diabetes insipidus caused by a postpartum hemorrhage: a real case

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Introduction: A real case of a woman who suffered a pituitary gland infarction following a postpartum haemorrhage after a Caesarean section is presented. This necrosis caused the development of diabetes insipidus. The patient was a 35-year-old first-time mother without any health problems; her pregnancy was normal and controlled. A Caesarean section was performed after a failed labour induction.

Objectives: To become familiar with the importance of hydration in diabetes insipidus.

Methods: Descriptive study of the available evidence of hydration in diabetes insipidus in general and in this case in particular.

Results: In this case the treatment was based on the pharmacological pattern of vasopressin and assessment of fluid balance, in order to maintain a urine output of less than 2000 ml. Generally, diabetes insipidus is treated, depending on the case, with vasopressin and an assessment of hiccups or hypernatremia is done, taking special care to prevent dehydration.

Conclusions: To highlight the importance of an adequate intake of water in this disease, as it can result in dehydration and patient's decompensation. For this reason, nursing care should focus on health education regarding dietary habits and adherence to treatment, as well as on recognizing the symptoms of decompensation in diabetes insipidus.

Key words: hydration, diabetes insipidus.

Basal hydration status in Spanish high performance athletes. Assessment by bioelectrical impedance

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Introduction: To achieve optimal athletic performance, it is essential to maintain a good state of hydration.

Objective: The aim of this study was to assess the total body water (TBW) in basal conditions by bioimpedance (BIA) in elite athletes.

Methods: Resistance and reactance were measured by quadripolar electrodes (BIA 101, Akem) in a sample of 229 white athletes, 104 women and 125 men, aged 16 - 40, covering 17 disciplines and under controlled conditions. As a result, TBW, intracellular water (ICW), extracellular water, (ECW), body cell mass (BCM) and extracellular mass (ECM) values were obtained. The anthropometric parameters recorded were height, weight and skinfold-thickness for the estimation of fat free mass (FFM).

Results: TBW: 41.2 l (59.3%), higher in males (47 l, 61.7%) than in females (34.3 l; 56.3%); ECW: 16.9 l (41.3%), higher in males in absolute vales and lower in percentages (18.6 l; 39.6%) than for females (14.9; 43.4%); ICW: 24.3 l (58.7%), higher for males (28.4 l; 60.4%) than for females (19.5 l; 56.6%); BCM: 33.3 kg, higher for males (39.9 kg) than for females (26.4 kg); ECM: 23.1 kg, higher for males (25.2 kg) than for females (20.4 kg). Younger females obtained a lower % ICW. Differences were found based on the type of discipline and a significant correlation ($r = 0.9$, $p < 0.0001$) was observed between FFM and resistance/size.

Conclusion: Athletes have higher % TBW than the general population and this is associated with their higher lean component.

Key words: bioelectrical impedance, body water, athletes.

Evaluation of liquid intake in triathletes

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Introduction: When doing physical exercise it is important to take into account liquid intake. Bad hydration produces a decrease in athletic performance and is inadequate from a nutritional point of view.

Objectives: The aim of this work was to evaluate liquid intake in a group of triathletes, before, during and after completing the triathlon.

Methods: A 4-day dietary interview was conducted with 11 triathletes, 8 men (21-33 years old) and 3 women (23-28 years old). The triathletes respectively trained 13 and 10 hours per day, 6 days per week. The majority of the triathletes trained fewer hours in the gymnasium than recommended and therefore the training time was lower than the plan. The individual anamnesis showed that all the sportsmen rest one day a week and each of them engages in sports activities 10 months per season (October-July).

Results: The results obtained from the dietary interview showed that the triathletes had a sufficient consumption of liquids, mainly water (2.5 - 3 L). They also consumed enough isotonic beverages when they had a day of heavy training or

on the day of the competition. The consumption of alcohol is not common among triathletes and in general it seems that the participants in the study are highly aware of how to be correctly hydrated.

Conclusions: Overall, correct hydration was observed in the study group. Nevertheless intake should be monitored, especially when the competition begins.

Key words: triathlon, hydration, isotonic beverages.

TBW assessment by deuterium dilution in Spanish adolescents

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Introduction: Total body water (TBW) assessment is a cornerstone in validating equations to estimate body composition components such as fat mass and fat free mass. The deuterium dilution technique (D_2DT) is considered the gold standard method to assess TBW. However in Spain there are no reference data about using D_2DT. The knowledge of specific references for the Spanish population must be a goal for biological studies of Spaniards.

Objective: Our aim was to assess TBW using D_2DT in a sample of Spanish adolescents.

Methods: 224 specimens of urine from 150 adolescents (113 girls and 111 boys) were taken to analyse. A dose of 0.1 grams of $2D_2O$ per Kg of body weight was administered, followed by a 4-hour stabilization period. The isotope (deuterium oxide (D_2O)) dilution method was used to measure TBW with an isotope-ratio mass-spectrometer. Average values by sex and Tanner stages were calculated for %TBW and TBW. A general linear model was used to analyse differences and interactions between groups.

Results: %TBW was significantly different between boys and girls (58.98 ± 5.59% *vs.* 55.5 ± 4.28%, $P < 0.001$). Significant differences were found among 12-year-olds and other age groups (15, 16, 17 and 18; $P < 0.05$) but not for older groups ($P > 0.05$).

Conclusions: This study was the first of its kind in Spain measuring TBW in vivo using D2DT. These data can be useful to validate new methods and equations from bioimpedance analysis to estimate TBW.

Key words: total body water, deuterium, maturation, sex.

Evaluation of decreased total antioxidant capacity of sulphurous water

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Introduction: Sulphurous water (SW) hydration plays an important role in antioxidant strategies against the oxidative damage associated with aging and related degenerative disorders

Objectives: 1) To determine the total antioxidant capacity (TAC) of SW and, 2) to evaluate its decrease to achieve better results after ingestion.

Methods/Design: TAC was determined 4h before collecting the SW. 1.5 ml aliquots were taken and kept at room temperature, in a refrigerator (4°C), or frozen at -25°C and -80°C. The TAC was determined in the SW aliquots one week, one month, three months and one year after sampling. The assessment of the TAC of SW was performed using the CUPRAC-BCS method, based on the reduction of copper (II) using a chromogenic reagent.

Results: TAC remained unchanged for one week in all SW aliquots. After one month, only the SW aliquot preserved at -80°C maintained its TAC, those stored at -25°C and 4°C decreased their TAC and the aliquots stored at room temperature lost their TAC. After 6 months only the aliquot preserved at -25°C and -80°C retained its TAC and after a year only the one preserved at -80°C maintained its TAC.

Conclusions: 1) The antioxidant benefits of hydration with SW can only be achieved if the intake is done within the first week after the removal from the spring. 2) Antioxidant benefits are maintained over time while preserving the SW at the right temperature.

Key words: total antioxidant capacity, sulphurous water hydration, oxidative stress, aging.

Effects of oral salt supplementation on physical performance during a half-ironman triathlon

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Introduction: Ultra distance athletes frequently consume salt supplements during competitions to compensate for the loss of electrolytes by sweating.

Objective: To investigate the effectiveness of oral salt supplementation on improving exercise performance during a half-Ironman triathlon.

Methods: Twenty-six experienced triathletes were matched for age, anthropometric data and training status and randomly placed into the salt group (113 mmol of Na+ and 112 mmol of Cl-) or control group (cellulose). The experimental and control treatments were provided in unidentifiable capsules and were ingested during the race. Participants competed in a real half-Ironman triathlon and race time was measured by means of chip timing. Pre- and post-race, maximal force during an isometric strength test, maximal jump height, and blood samples were obtained. Sweat samples were obtained during the running section.

Results: Total race time was lower in the salt group than in the control group (307 ± 32 *vs.* 333 ± 40 min; p = 0.04). After the race, the reduction in isometric strength was lower in the salt group (-10.6 ± 0.8% *vs.* -13.4 ± 0.8%; p =0.01) although jump height was similarly reduced in both groups (-14.0 ± 5.3 and -18.4 ± 3.5%). Sweat losses (4.0 ± 1.1 L) and sweat Na+ concentration (48.4 ± 15.9 and 45.7 ± 20.9 mM) were similar between groups. However, body mass tended to be less reduced in the salt group than in the control group (-2.8 ± 0.9% *vs.* -3.4 ± 1.3%; p = 0.09). Post-race serum Na+ and Cl- concentrations were higher in the salt group ($p < 0.05$).

Conclusion: Oral salt supplementation might be effective way to increase performance and to maintain serum electrolyte concentrations during a real half-Ironman competition.

Key words: sodium, hyponatremia, endurance exercise, hydration, sweat, thirst.

Dehydration and performance in trail and ultra-trail races. Differences between sexes

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Introduction: The most direct method to calculate the degree of athlete dehydration is the body weight (BW) loss calculation. Although a loss of 1% BW is associated with a loss of physical performance, decreases of 2-3% BW are tolerable.
Objective: To analyse the incidence of dehydration in trail races and its relationship to physical performance, noting if there is a different response between participants in marathons or ultramarathons, as well as between men and women.

Methods: We analysed 320 trail runners (269 men, 51 women) (age: 37.4 ± 7.4 years) in the Aneto Ultra-Trail 2012 in all of its three distances (96 km + 5960 m, 67 km + 3870 m, 42 km + 1950 m). BW was calculated before and after the race.

Results: The subjects lost 2.27 ± 1.7 kg ($p < 0.001$) (3.12 ± 25% BW). There are no statistically significant differences between the losses experienced by the trail and ultra-trail runners: 42 km (-2.16 ± 2 $p < 0.001$), 67 km (- 2.39 ± 1.6 $p < 0.001$) and 96 km (2.3 ± 1.4 $p < 0.001$). A relationship exists between physical performance and the alterations of BW (42 K $r = -0.203$ $p < 0.05$) (67 K $r = -0.237$ $p < 0.05$) (96 K $r = -0.275$ $p < 0.05$). When comparing men and women, this relationship is observed in male runners in ultra-trail races (67 K $r = -0.246$ $p < 0.05$) (96 K $r = -0.298$ $p < 0.05$).

Conclusions: Although we know that performance is a multifactor variable, dehydration is an agent that determines the athlete's capacity for physical work and can be controlled and trained.

Key words: dehydration, performance, endurance, body weight.

Relationship between body weight changes and composition of urine in ultra-trail races

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Introduction: When the air temperature is higher than the body temperature, evaporation of sweat is the only physiological mechanism to prevent the body from over-heating, but excessive sweating causes dehydration. The most direct method to calculate the degree of dehydration in the athlete is the body weight (BW) loss calculation. BW loss along with urine osmolality or urine density are the most valid criteria to assess dehydration.

Objective: To compare methods to assess dehydration in ultra-trail runners.

Methods: We analysed 44 trail runners (36 men and 8 women) (age: 36.7 ± 7.3 years) in the Aneto Ultra-Trail 2012 in all of its three distances (96 km + 5960 m, 67 km + 3870 m, 42 km + 1950 m). BW was measured before and after the race. Density and urinary osmolality were analysed at the end of the race.

Results: The subjects lost an average of 2.27 ± 1.7 kg ($p < 0.001$) (3.7 ± 2 BW). There are no statistically significant differences between the losses experienced by the participants in the marathon (-2.66 ± 1.7 $p < 0.001$ 3.6%), 67 km distance (-2.85 ± 1.2 $p < 0.001$ 3.9%) and 96 km distance (2.66 ± 1.4 $p<0.001$ 3.4%). 14% of the trail runners lost more than 5% BW. The urine density was 1024.89 ± 5.6 g/L and the osmolality 913.79 ± 227.6 mOsm/kg.

Conclusions: There is significant dehydration in trail and ultra-trail runners, which is evidenced both by alterations in BW and urine density, with a correlation between both values.

Key words: dehydration, density, osmolality.

Patterns of beverage consumption in a group of Spanish adults

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Introduction: Adequate water intake is necessary to ensure appropriate body performance. Daily loss of body water is continuous and must be recovered.

Objective: To analyse dietary total water intake (TWI) at different meals and evaluate the main sources of fluids.

Methods: Dietary intake in a sample of 466 adults, aged between 18 and 50, was studied using a 3-day food record (including one weekend day). TWI was calculated from water content in food and beverages using DIAL Software.

Results: Mean TWI was 2030.03 ± 734.2 mL/day. Water was mainly consumed at lunch (706.5 ± 253.4 mL), followed by dinner (532.2 ± 272.16 mL), breakfast (305.7 ± 168 mL), mid afternoon (184.2 ± 206.3 mL), midmorning snack (173.1 ± 240 mL) and other moments of the day (55.7 ± 134 mL). The main food sources of water were beverages (including water) (1057.4 ± 330.6 mL), dairy products (303.2 ± 150.2 mL), vegetables (228.7 ± 117.9 mL) and fruits (188.2 ± 179.6 mL).

Conclusions: A high amount of the TWI comes from food sources, which means that the population does not consume enough water. Therefore, increasing beverage consumption is advisable. Furthermore, it should be also recommended that beverage consumption be better distributed throughout the day, instead of concentrating it at main meals.

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Key words: water, meals, food sources.

Effect on non-alcoholic beer as a hydration beverage on subjective sleep quality

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Introduction and Objective: Beer is known for its hydration properties but it also contains hops (Humulus lupulus L.), a plant with sedative effects. Sleep deprivation affects the homeostasis of the physiological functions of the organism. Beer is the only beverage that contains hops. Our objective was to determine the effect of non-alcoholic beer on the participants' sleep quality.

Methods: The test was conducted in a population of 30 university students during the official exam period. The experimental period was 3 weeks; the first 7 days served as a control and during the following 14 days the individuals ingested non-alcoholic beer during dinner. To quantify and analyse nighttime sleep, the Pittsburgh Sleep Questionnaire Index (PSQI) was used.

Results: The results revealed that one non-alcoholic beer ingested during dinner significantly improved ($p < 0.05$) the PSQI Global Score, as sleep latency (the time period measured from going to bed until the onset of sleep) decreased ($p < 0.05$) with respect to the control.

Conclusion: The consumption of non-alcoholic beer at dinner is recommended in order to improve the quality of sleep, in addition to providing optimum hydration.

Key words: Sleep, Pittsburgh, hops, beer, stress.

Study of hydration knowledge among university students from Extremadura

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Introduction: It is known that proper hydration is crucial for maintaining homeostasis in all physiological processes. It has been shown that a 2% decrease in body hydration leads to a reduction in intellectual capacity. For this reason, our objective was to evaluate knowledge about hydration in a university student population.

Methods: The study was conducted among a population of 110 university students from Extremadura University (62 healthy female and 48 healthy male students, 21 years old). It is important to clarify that after an initial assessment, the students showed no knowledge about hydration. Two sessions of education on human hydration based on the "*Libro Blanco de la Hidratación*," ed. SEDCA.2013, were held. The results were quantified and analysed by a hydration knowledge questionnaire completed by the participants.

Results: The results revealed that knowledge increased 59% among this university population after the two educational sessions on human hydration. In particular, the female population university showed greater hydration knowledge (62.66%) than the male population in the university (51.42%).

Conclusion: Education on human hydration, in particular among male university students at Extremadura University, is recommended.

Key words: university students, hydration, knowledge, health.

Study of the relationship between hydration and hypertension in elderly people

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Introduction: Hydration is a fundamental factor in the elderly, since at this stage of life a major risk of dehydration may exist due to the decrease in the organism's water content. Moreover, a lower sensation of thirst, fear of drinking because of incontinence problems and increased needs due to different diseases have been observed.

Objectives: To establish a correlation between liquid intake and hypertension in elderly people.

Methods: A validated food frequency questionnaire (FFQ) was completed for 50 elderly people from the Valencia metropolitan area to study food intake. Moreover, the pathologies of people studied in this work and their own treatments were recorded.

Results: The analysis of variance (ANOVA) revealed significant differences ($p < 0.05$) between the liquid intake of people without pathologies (2.20 ± 0.27 L) and those with hypertension and without diuretic treatment of this pathology (1.42 ± 0.25 L). Moreover, a Pearson's test was conducted to evaluate whether there was a relationship between hypertension and sodium intake. As expected, the Pearson's test revealed a positive correlation ($r = 0.3595$, $p < 0.05$) between sodium intake and hypertension.

Conclusions: The results obtained from this study suggest that not drinking enough water can lead to hypertension. This fact can be explained because the human body can retain sodium to compensate for a low liquid intake.

Key words: hydration, elderly people, hypertension, sodium, liquid intake.

Education for health: hydration recommendations during childhood and adolescence

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Introduction: Children are one of the groups most at risk for dehydration. Hydration requirements vary depending on the environment, physical activity and type of nutrition. It is possible to establish healthy habits through proper nutritional education.

Objective: To provide hydration recommendations for children and adolescents.

Methods: A literature review of studies on liquid intake recommendations among the population. The search was conducted using Medline and Google.

Results: The recommendations are the same for 4-8 year old-children (group 1), while in the range of 9 to 13 there are differences between boys (group 2) and girls (group 3). The values proposed by EFSA are 1,600, 2,100 and 1,900 mL/day respectively. In the case of FNB, values are 1,700, 2,400 and 2,100 mL/day respectively. The beverage consumption patterns found in the literature are developed for an adult diet of 2200 kcal. On this basis, a model for children and teenagers was calculated, taking into account the groups of beverages suitable for these ages (water, milk and juices) and considering the appropriate energetic intake recommendations. The results suggested a consumption of 1260 mL/day of water, 400ml/day of milk and 100 mL/day of juices for group 1; 1680, 540 and 135 mL/day respectively for group 2; 1570, 500 and 125 mL/day respectively for group 3.

Conclusions: Liquid intake recommendations should form a part of proper health education.

Key words: hydration, education, health, childhood, adolescence.

Bodily water compartment changes after detraining in young football players

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Introduction: Football training and competition can induce chronic dehydration, which in turn influences performance. The detraining period (DP) may help to recover physiological functions; however there is a lack of knowledge about chronic hydration. Our aim was to evaluate changes in total-body water (TBW) and its compartments (extracellular [ECW] and intracellular water [ICW]) after a six-week DP.

Methods: Twenty-eight male football players (age = 13.5 ± 0.82 years, height = 170.9 ± 4.25 cm, body mass = 64.26 ± 6.97 kg) completed a body composition assessment at the end of the season and after finishing the DP. TBW and ECW were estimated by bioelectrical impedance and ICW was calculated. ECW and ICW/TBW ratios were also calculated. The effect of the detraining period was established by impairment of VO_2max. A Wilcoxon test was carried out to analyse differences before and after DP.

Results: Increases of TBW 32.44 ± 3.59 *vs.* 34.75 ± 4.08 kg ($P < 0.001$), ECW: 13.62 ± 1.26 *vs.* 14.40 ± 1.37 kg ($P < 0.001$) and ICW: 18.90 ± 2.44 *vs.* 20.36 ± 2.73 kg ($P < 0.001$) were observed after DP. The ICW/TBW ratio was lower before DP than after it (0.581 ± 0.01 *vs.* 0.583 ± 0.01, $P > 0.05$); regarding the ECW/TBW ratio, inverse results were found (0.419 ± 0.01 *vs.* 0.62 ± 0.03, $P > 0.05$).

Conclusions: Our data suggest that after six weeks of a DP, football players increase TBW, ECW and ICW and show no changes in ECW/TBW and ICW/TBW ratios. The physiological implications of these results will be described in future studies.

Key words: total body water, ECW, ICW, detraining.

Hygienic-dietary measures for the prevention of pregnancy and primary urinary tract infections

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Introduction: Urinary tract infections (UTI) are one of the most frequent medical complications in pregnancy beside anaemia, and its importance lies in the impact that they can have on maternal health and on the progress of the pregnancy.

Objectives: To become familiar with the main hygienic-dietary measures to prevent urinary tract infections during pregnancy.

Methods: A literature search was performed using: PubMed, Elsevier, Cochrane, Medline, IME, Cuiden and the University of Almería Library.

Results: Interventions used to prevent UTIs in pregnant patients may be pharmacological (antibiotics) or non-pharmacological.

The first preventative measure is the confirmation that the patient has a UTI in order to receive treatment. In addition, patients should be instructed to perform the following behavioural changes: to increase their fluid intake, post-defecation anal cleansing, post-coital urination, constipation correction and cranberry juice intake.

Conclusions: Special emphasis on the prevention of UTIs is needed from the midwife's antenatal clinic. If the woman is instructed on hygienic dietary modification measures from the beginning of her pregnancy, complications throughout her pregnancy may be prevented.

Key words: pregnancy, urinary tract infection, prevention.

Role of the midwife in preventing dehydration in the newborn

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Introduction: Breastfeeding provides the best food for a newborn and also provides significant benefits to the mother. However, during the early days, problems can lead to potentially serious complications, such as impaired development, malnutrition and dehydration.

Objectives: To become familiar with the main signs of dehydration in the newborn.

Methods: A literature search was performed using: PubMed, Elsevier, Cochrane, Medline, IME, Cuiden and the University of Almería Library.

Results: The most common type of dehydration is hypernatremic dehydration associated with inadequate breastfeeding. This is due to the low milk intake because of infrequent or poor suction. This also causes ineffective breast emptying, which leads to the production of less milk.

The main signs of dehydration in the newborn include lethargy, jaundice, crying and irritability. Stool and urination are scarce and dark.

The treatment of hypernatremic dehydration requires the hospitalization of the baby.

Conclusions: Breastfeeding should be encouraged since birth. Health staff should review the correct early breastfeeding signs to make sure the baby is breastfeeding successfully. The primary postnatal care midwife should check the newborn and be able to recognize the signs of dehydration signs in case they should arise.

Key words: prevention, dehydration, newborn.

"Your best action, hydration" health campaign

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Introduction: From July to September 2013 the "Your best action, hydration" health campaign was conducted to educate the populace about the importance of preventing dehydration in order to enjoy an enhanced quality of life and better health.

Methods: During the campaign, pharmacists throughout Spain offered pharmacy customers personalized guidance regarding hydration.

To this end, they used a technical consensus document and a brochure for customers featuring "10 Dehydration Prevention Tips".

These materials were distributed to pharmacies through the General Council of Spanish Pharmacists. Member pharmacists were also able to consult and download materials at www.portalfarma.com.

Results: A total of 46 Spanish provinces participated in the health campaign "Your best action, hydration", from whose pharmacies a total of 667,950 brochures were distributed amongst the general population, offering them "10 Dehydration Prevention Tips."

Conclusions:

- Pharmacists play an essential role informing and providing advice to the public about healthy lifestyle habits.
- The widespread participation in this educational campaign led to preventive and awareness-raising efforts that were essential in the education drive carried out by Spanish pharmacists.
- There is a need for educational health campaigns to establish preventive and informative programmes for people according to their specific needs.

Key words: hydration, mineral salts, water, liquids.

Effects of dehydration in nurses during busy shifts

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Introduction: We know many nurses with health problems related to dehydration. They are busy taking care of patients, speaking to families, answering doctor's calls, meeting with their bosses, etc. Being thirsty and becoming dehydrated are all too common. But unfortunately, it is also very dangerous. When people become dehydrated —and everyone has felt this at one time or another— various symptoms may appear, such as headaches, blurred vision, irritability, mood swings, and fatigue. If the dehydration worsens, complications like decreased blood pressure, dizziness, and even fainting can occur.

Objectives: To make health professionals aware of the need to maintain good hydration during working hours.

Methods: How is it possible to prevent dehydration in nurses?

Drink more water. Many people are not sure of the amount of water they should consume. This is just a recommendation. And carry a water bottle.

Listen to your body. Do not wait until you fall over from dehydration and be aware of how you feel physically during the day.

Results: We found many effects of dehydration in nurses.

Conclusions: Making sure that nurses consume an adequate amount of water is vital for their daily life functions. They need to learn the importance of hydration by consuming the right amount of water every day. Nursing shifts should not hinder health.

Key words: nursing, nurses, dehydration, busy shift.

Risk of dehydration underwater

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Introduction: It is ironic that while you are scuba diving you can run the risk of dehydration underwater even though you are surrounded by millions of gallons of water.

Objectives: Is there a relationship between dehydration and headaches?

Methods: None of the divers who were correctly hydrated suffered from migraines or headaches. The divers who were not correctly hydrated did.

Results: Inadequate fluid in the neck and head blood vessels causes headaches, which are the first indication that you may be facing dehydration. Before the dive, examine your urine to ensure that it is clear. Once you have resurfaced, re-hydrate slowly.

Conclusions: It is ironic but true. A scuba diver can become dehydrated if there is an inadequate quantity of water in the body. This can cause major problems, since water is crucial for the smooth functioning of a dozen biophysical systems and biochemical processes. At the cellular level, chemical reactions in the cellular require water. At the tissue level, water keeps the tissues flexible and plump. Water is also needed for blood production and circulation through the cardiovascular system.

Key words: dehydration, headache, scuba diving.

Hospital La Paz hydration protocol: an initiative to prevent dehydration and hyperhydration in hospitalized patients

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Introduction: Patients in risk groups or in a clinical risk situation may have a compromised hydration status. A previous study developed in our hospital demonstrated a high percentage of abnormal hydration status, mainly in elderly patients (18% dehydration and 24% hyperhydration). Hydration status after hospital admission can influence morbidity and the length of hospitalization.

Objective: The aim of this study was to develop a clinical hydration protocol for hospitalized patients.

Methods: Based on previous clinical experience in our hospital, we decided to create a consensus document to improve clinical practice and to guarantee a normal hydration status in all patients. Our commission carried out monthly meetings during 2013 to review and consolidate the previously acquired knowledge.

Results: The final clinical protocol was presented as an organizational chart. The protocol flow includes the following steps: 1) Risk group identification (elderly, children, pregnant, neurological and psychiatric patients and other clinical risk situations); 2) Hydration status (clinical signs and biochemical parameters); 3) Classification of hydration status as: normal-hydration, dehydration or hyperhydration, as well as type and severity; 4) Requirements of water, sodium, potassium, chloride and glucose; 5) Rehydration therapy, including quantity of fluid to be administered, treatment time, access route and contraindications; 6) Proposal for standard protocol prescription of intravenous fluid therapy. 7) Follow-up assessment.

Conclusion: We consider that this hydration protocol is very important for clinical practice and it is now going to be implemented in our hospital. The final results of this implementation will be evaluated.

Key words: hydration protocol, dehydration, hyper-hydration.

Analytical study of hydration in child population. Learning drinking routines

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Introduction: The importance of drinking water for children meets a basic health need. In the school environment, it is one of the activities included in the early childhood education stage, as part of teaching autonomy in routine activities and the development of basic health and well-being habits while building personal initiative skills in early childhood (3 to 5).

Objectives:
- To acquire hygiene and hydration habits.
- To strengthen autonomy in personal hygiene and hydration activities.
- To progressively acquire a number of values: responsibility, perseverance, knowledge.

Methods: An analytical study of routine learning in children between the ages of 3 and 5 at set times throughout the school day was carried out, encouraging the child's independence regarding the need to drink. The measurable parameters of the methodology used were: direct and systematic observation of the children, assessment of the hydration activities performed, anecdotal recording of incidents, and family input.

Results: 50% of the three-year-old children drink well and independently; 80% of four-year-olds achieve these routines and 100% of the five-year-olds drink independently when they need it.

Conclusions: 100% of five-year-olds drink independently when they need it.

Key words: hydration, child population, routine, autonomy.

Influence of beverage characteristics on drinking patterns and hydration status

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A good hydration status is essential to maintain health at an optimum level. Both food and beverage intakes can contribute to maintaining the correct nutritional status. Children and elderly people are population groups with a high risk of dehydration. However, adolescents are also a susceptible group with respect to maintaining adequate hydration levels, despite the fact that they drink a lot of beverages other than water, which they find tasteless. In fact, they only drink water if there is no other option, since they prefer tasty beverages with higher mouth-feel sensations than water. Beverage consumption habits have recently changed, partially influenced by the increased availability of different types of beverages during the last few years. Consumer preferences for a drink may be due not only to genetic, psychological and environmental factors, but also to the specific characteristics of each beverage. In addition, the different sensations transmitted by the various beverages are important qualities for consumers at all ages and influence their choice. Indeed, taste and mouth-feel sensations influence drink preference and are associated with their consumption, not only in children and young people but also in adults. In conclusion, these characteristics could be used to influence beverage patterns, leading to an improvement in liquid intake and consequently promoting a better hydration status.

Key words: attributes, beverage, preference, hydration.

Hydration status according to urinary sodium excretion in adolescents

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Introduction: High sodium intake may have an impact on hydration status since the excretion of excess sodium requires excretion of water through urine.

Objective: To assess hydration status according to urinary sodium excretion in adolescents.

Methods: 130 adolescents took part (80% female, 14.2 ± 1.5 years) and 24h urine samples were collected and screened for validity (using 24h urinary creatinine excretion in relation to body weight). Sodium intake was assessed by 24h urinary sodium excretion and hydration status was assessed using urinary osmolality (UOsm) and urinary volume (UV). Hydration markers were compared according to the median excretion of sodium.

Results: Median urinary sodium excretion was 2691.0 mg/day in girls and 3622.6 mg/day in boys. The following descriptive (mean ± standard deviation) data for hydration markers were obtained: UOsm - 593.2 ± 187 mOsm/kg in girls and 720.1 ± 163.9 mOsm/kg in boys; UV – 1127 ± 488.1 mL/day in girls and 1,026.9 ± 349.2 mL/day in boys. No significant differences were found in UOsm according to urinary sodium excretion between both genders ($p = 0.81$ in girls and $p = 0.16$ in boys), but UV was higher among those with lower sodium excretion ($p < 0.01$ in both genders).

Conclusions: Hydration status in adolescents estimated by UV was better in subjects with lower sodium excretion.

Key words: sodium, hydration status, urinary osmolality, urinary volume, adolescents.

Infantile dehydration

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Introduction: Dehydration is a disturbance that occurs in a wide variety of circumstances affecting water and salt losses. In Spain diarrhoea is a common cause of mortality among children younger than five. The most commonly associated disease among infants is infectious diarrhoea.

Parental report and clinical signs of dehydration are essential to physicians for diagnosis, classification and to create a treatment plan.

Mild: when total fluid loss reaches 5% or less.

Moderate: when total fluid loss reaches 5-10%.

Severe: when total fluid loss reaches more than 10%, considered an emergency case.

Objectives: To prevent and reduce the rate of child dehydration. To establish the level of dehydration in order to treat it more efficiently.

Methods: Children presenting mild to moderate dehydration should initially be treated with oral rehydration therapy and for those with severe dehydration or hypovolemic shock, the indicated treatment is intravenous therapy.

Results: Prevention is especially important in cases of intense diarrhoea dehydration.

Breastfeeding is exclusive during the first 4-6 months as are measles vaccination and the administration of vitamin A.

Conclusions: A prompt and accurate choice of treatment for dehydration and the accompanying electrolyte imbalances are important for the child's outcome.

Key words: dehydration, children, diarrhoea, imbalances.

Evaluation of water intake and food sources in schoolchildren from Madrid with different physical activity levels

Selected for oral communications

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Introduction: Inadequate fluid intake may contribute to lower cognitive and exercise performance in children.

Objective: To evaluate water intake and food sources in schoolchildren with different physical activity levels in the Community of Madrid.

Methods: 564 schoolchildren (258 boys and 306 girls) aged between 9 and 12 were studied. Dietary data was obtained by applying a food intake record (3 days) and precise weighing. Water intake was compared with the dietary reference intake. Physical activity levels were obtained by applying a questionnaire and criteria established by the IOM. All calculations were made using SPSS (v 19.0) and the statistical significance was set at $p < 0.05$.

Results: 3.5 percent of schoolchildren had a sedentary level (S), 77.7% had a low level of physical activity (LA) and 18.8% were physically active (A). Mean total water intake was 1,504.6 ± 389.9 mL/day (S:1,475.5 ± 520.2 mL/day, PA:1,498.7 ± 388.9 mL/day and A:1,534.6 ± 368.1 mL/day; $P > 0.05$). 90% and 95% of S, 97.9% and 99.8% of LA and 98.1% and 100% of A did not meet the dietary reference intake for total water intake and for total beverages (including drinking water), respectively. The major food sources were beverages (S: 46.4%, LA: 38.5%, A: 37.1%, $P < 0.05$), dairy products (S: 24.1%, LA: 27.7%, A: 28.9%, $P > 0.05$), vegetables (S: 8.8%, LA: 9.7%, A: 9.7%, $P > 0.05$) and fruits (S: 7.9%, LA: 10.6%, A: 10.7%, $P > 0.05$).

Conclusions: Most of the children studied had an inadequate water intake, independently of physical activity level. It would be advisable to increase water intake through beverages and water-rich foods.

Key words: water intake, food sources, schoolchildren.

Exertional rhabdomyolysis in the military: hydration role

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Introduction: Rhabdomyolysis literally means the breakdown of striated muscle cells with the release of potentially toxic cellular contents into the bloodstream. Exertional rhabdomyolysis (ER) typically occurs in response to excessive, prolonged or repetitive exercise, and is a common disorder encountered in military settings. ER is a significant threat during physical exertion, particularly if it includes inadequate hydration.

Objectives: To review the ER burden in the military and highlight the role of hydration in its prevention.

Methods: A search was made of the expression "exertional rhabdomyolysis" AND ("army" OR "navy" OR "military")" on the PubMed database on 1 August 2013. Articles were selected for full text reading by evaluating the abstracts. When relevant, the references in these articles were also checked.

Results: Last year, the crude incidence rate of ER among U.S. military members was 27.8 per 100,000 person-years and the annual rates of ER increased 30% from 2008 to 2012. Dehydration is an adverse consequence of insufficient liquid

consumption and its occurrence during physical exertion is a risk factor for ER. Fluid replacement guidelines should be met as a preventive measure, with specific orientations being available for the military. Each serviceman must pay attention to thirst, body weight loss and/or dark urine to increase water intake if necessary.

Conclusions: ER can have serious and fatal consequences so prevention is very important. Water intake should comply with current guidelines.

Key words: rhabdomyolysis, military, dehydration.

Total body water as a possible marker of metabolism alteration in obese children and adolescents

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Introduction: Total Body Water (TBW) is related to obesity, but its relation to inflammation is not well known.

Objective: To evaluate whether TBW (as a hydration status marker) is associated with inflammatory markers in obese children and adolescents.

Methods: 34 obese children (7-10.9 y) and 49 obese adolescents (11-15 y) participated in this study. Height, weight, serum lipid profile, C-Reactive Protein (CRP), sE-selectin, soluble Intercellular Adhesion Molecule-1 (s-ICAM-1) and soluble Vascular Cell Adhesion Molecule-1 (s-VCAM-1) were measured and the BMI Z–score was calculated. TBW was obtained by Bioelectrical impedance. A bilateral partial correlation test was used to analyse associations related to sex, age, and/or BMI Z-score.

Results: A negative correlation was found between TBW and BMI Z-score in both children and adolescents in boys and girls, separately. In addition, TBW was also negatively correlated with CRP and sE-selectin, which were confirmed in adolescents but not in children. When analysed by sex, TBW was associated with CRP only in boys and with sE-selectin only in girls.

Conclusions: TBW may be considered a marker not only of hydration status, but also of metabolic disorder in a low-grade inflammatory process such as obesity in children and adolescents.

This work was supported by the PRONAOS Study CDTI-2008 1114 and Biosearch.

Key words: TBW, BMI Z-Score, inflammatory markers, obesity, children/adolescents.

Hydration habits and alcohol consumption in nursing students

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Introduction: Establishing healthy habits in young adults, including appropriate hydration, largely determines their future health. Thus, maintaining a correct liquid intake is essential and prevents functional and metabolic disorders, both acute and chronic.

Objectives: To study the hydration habits of university students, including their alcohol consumption.

Methods: A descriptive cross-sectional study of a sample of 157 college students, based on an on-line, anonymous and self-completed questionnaire about health habits and beverage consumption.

Results: Only 23% of those interviewed indicated that they drank at least 8 glasses of water daily. Soft drink consumption was occasional (69%); most of the men chose sugar-sweetened beverages while women chose low-calorie drinks. Regarding the intake of alcoholic beverages, students drank them occasionally, particularly spirits (73%, mean 2.59 (± 1.225) drinks / occasion) compared to wine or beer consumption (59%, mean 2.14 (± 1.029) drinks / occasion), with an average age of onset of alcohol consumption of 15.79 (± 2.439) years.

Conclusions: Hydration campaigns should be carried out to encourage consumption, due to the fact that most students do not meet hydration requirements. Finally, despite occasional alcoholic consumption, the high quantity ingested and the early age of onset of alcohol consumption should be noted.

Key words: hydration, college, alcoholic, beverages.

Bioelectrical impedance ratio and Watson formula for the calculation of total body water

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Introduction: There are several techniques for the calculation of total body water, some of which are easier to apply because they are based on anthropometric parameters, such as the Watson formula, and do not require a large deployment of equipment. However bioimpedance is also recognized as a suitable technique for the determination of total body water, especially when high-tech equipment is available with specific characteristics that allow for a more accurate determination.

Objective: To determine the relationship between bioimpedance and the Watson formula for calculating total body water.

Methods: The study was conducted with 28 professional footballers from a first division Mexican team. Four others were left out of the study as they did not meet the inclusion criteria (2 had some metal attachment, while the other two did not show up on the measurement day).

For the calculation, a Bioespace brand bioimpedance multipole apparatus, Inbody 720 with frequencies at 1, 5, 50, 250, 500 and 1000 kHz was used. The statistical analysis was done with a Student's t test using SPSS v14 software.

Results: No statistically significant differences were observed between the two techniques: bioimpedance 46.7 + 4.4 and 43.9 + 3.1 anthropometry with $p = 0.01$.

Conclusions: Since no statistically significant differences were observed, both techniques can be applied interchangeably to calculate total body water. However it is considered important to take this result with caution and consider clinical issues mentioned by the athletes.

Key words: total body water, bioimpedance, Watson formula.

Hydration knowledge and habitas. Bases for an education campaign related to beverage consumption

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Introduction: Proper hydration is essential for health, but the lack of knowledge about this subject can influence drinking habits.

Objective: The aim of this study was to analyse drinking habits and hydration knowledge in a group of young people in Madrid.

Methods: We studied 113 college students (18 - 27 years), who answered a questionnaire on drinking habits and knowledge related to proper hydration guidelines. Statistical analyses were made using SPSS (version 19.0) and the statistical significance was established at $p < 0.05$.

Results: The included students stated that they regularly consumed 1.74 ± 0.57 L/day of fluids (no significant differences were observed by gender). The same individuals stated that they considered suitable liquid consumption to be 2.10 ± 0.38 L/day (2.31 ± 0.38 L/day in males (M) and 2.08 ± 0.38 L/day in females (F), NS). Considering the fluid intake defined by the Institute of Medicine (2004) as adequate (3 L/day for M and 2.2 L/day for F), our results show that 90.9% M and 79.4% F report lower intakes and what 90.9% M and 74.5% F consider an adequate fluid consumption is lower than that recommended by the Institute of Medicine.

Conclusions: We observed a high percentage of individuals who report and inadequate intake of liquids (80.5%) and of subjects lacking knowledge about the subject (76.1%), believing that a lower liquid intake than recommended is adequate. The results highlight the need for education on proper hydration guidelines.

Acknowledgements: The study was supported by the "Research Funding Program for Consolidated Groups Santander-UCM" (Ref: GR35/10-A).

Key words: hydration, knowledge, youth, habits, fluids.

Parent smoking habits as a modulator of water intake in Madrid schoolchildren

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Introduction: Several studies show that fluid intake may be insufficient in different population groups. This raises the idea of whether smoking parents may have lower fluid intake control of their children.

Objective: To evaluate total water intake (including food and beverages) by schoolchildren in the Community of Madrid according to parental smoking.

Methods: 564 schoolchildren (258 boys and 306 girls) aged 9 -12, were studied. Data on water intake was obtained by applying a food intake record (3 days). Water intake was compared with that established as adequate by the Institute of Medicine (IOM) (2005) (2.4 and 2.1 L/day in boys and girls, respectively). Tobacco consumption was reported by parents. Statistical data was obtained using SPSS (v 19.0) and statistical significance was set at $p < 0.05$.

Results: 96.8% of children had liquid intakes lower than recommended by the IOM (2005). Those with a non-smoking mother (65.2%) injested more liquid (1533.2 ± 363.0 mL/day) than those with a smoking mother (1445.5 ± 434.2 mL/day) ($p < 0.01$) and water intake decreased as the number of cigarettes smoked increased ($r = -0.228$). However there were no differences in water intake in relation to the smoking habits of fathers.

Conclusions: Water intake was below adequate in most of the participants studied. Moreover, maternal smoking is associated with a lower intake of fluids in their offspring, and these children need special counselling to improve their hydration patterns.

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

Key words: children, beverages, water, smoking, parents.

Educational level as a modulator of hydration in a group of Spanish adults

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Introduction: Proper hydration is very important for health and can be influenced by different factors.

Objective: The objective of this study is to analyse the association between hydration habits and educational level in Spanish adults.

Methods: We studied 418 subjects (aged 18-60) from fifteen Spanish provinces, selected as a representative sample. To determine the state of hydration, urine samples were collected during a 24-hour (h) period. Hydration status was considered inadequate when: urine density was greater than 1.020 and/or urine volume less than 30 mL/h. The educational level was established using a personal interview with the individual and his or her partner. We used SPSS (version 19.0) for statistical analysis of the data. Differences were considered significant at $p < 0.05$.

Results: The individuals studied or their partners who have a degree or diploma studies (first group) maintain a better hydration level, as evidenced by their greater urine volume (1692.1 ± 699.5 mL/day) compared to individuals and their partners without graduate studies/degree (second group) (n=198, 1534.9 ± 680.1 mL/day) ($p < 0.05$). Considering urine density, no significant differences were observed, although only 41.3% of the subjects in the first group had a urine density greater than 1.020 compared to 50% in the second group.

Conclusions: There is a high percentage of individuals with mild dehydration and the situation is worse with those with a lower educational level. These individuals should receive further advice to achieve proper hydration.

Acknowledgements: This work was supported by the AESAN (Spanish Agency for Food and Nutritional Safety, Spanish Ministry of Health and Consumer Affairs), (Ref. 337/2008).

Key words: hydration, education level, adults.

Reducing sugar-sweetened beverage consumption to reduce obesity: strong evidence supporting conjecture, weak evidence of effects

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Introduction: We provide arguments about the effects of reducing sugar-sweetened beverages (SSBs) on obesity and update a previous meta-analysis with recently published studies on the effects of SSBs on body weight/composition indices (BWIs).

Methods: We abstracted data from randomized controlled trials examining the effects of consuming SSBs on BWIs.

Results: Six new studies met these criteria: (i) human trials, (ii) > or = 3 weeks duration, (iii) random assignment to conditions differing only in consumption of SSBs and (iv) including a BWI outcome. An updated meta-analysis of a total of seven studies that added SSBs to diets showed dose-dependent increases in weight. An updated meta-analysis of eight studies attempting to reduce SSB consumption showed an equivocal effect on BWIs in all randomized subjects. When limited to subjects overweight at baseline, the meta-analysis showed a significant effect of roughly 0.25 standard deviations (more weight loss/less weight gain) relative to the controls.

Conclusions: The evidence to date is equivocal in showing that decreasing SSB consumption will reduce the prevalence of obesity. Although new evidence suggests that an effect may yet be demonstrable in some populations, the integrated effect size estimate remains very small and of equivocal statistical significance. Problems in this research area and suggestions for future research are highlighted.

Key words: obesity, randomized trials, soft drinks.

Adequate hydration status promotes a minor concentration of proinflammatory cytokines in healthy people

Selected for oral communications

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Introduction: Good hydration status (HS) is necessary for an adequate homeostasis of the organism. Cytokines are secreted mainly by inflammatory leukocytes that act as intercellular mediators.

Objective: To assess pro/anti-inflammatory cytokine concentration in serum and in the aqueous phase of stools (APhS) from healthy people according to their HS.

Methods: HS data were obtained from 86 healthy individuals aged 45-65 with a BMI ≥ 18.5-< 40 kg/m^2. HS was measured by bioelectrical impedance with a standardized protocol. Cytokine serum concentrations were determined by multiple ELISAs (Luminex®-LX200). Stools were collected by the participants, frozen, and carefully transported to a laboratory where they were stored at -80ºC until their determination. The stools were ultracentrifuged and cytokines were measured in APhS with an ultrasensible cytokines array (Randox®). All samples were analysed in duplicate.

Results: The mean age was 51.2 ± 4.9 years and BMI = 28.2 ± 4.7 kg/m^2. Even when the average amount of water from food and beverages was not adequate enough (1411.6 ± 427.4 mL/day) 89.5% showed an adequate HS and only 10.5% clearly showed dehydration. Volunteers who had good HS showed lower values of IFN (2.7 ± 2.4 *vs.* 6.4 ± 4.3 pg/mL; p < 0.05) and IL6 serum (5.5 ± 13.3 *vs.* 6.4 ± 16.3 pg/ml; p < 0,01) than those who had a poor HS. MCP1 showed the same tendency (257.4 ± 827.7 *vs.* 700 ± 357.2 pg/mL; p = 0.062). IL1 from AphS showed lower values in people with good hydration than those who were dehydrated (648.3 ± 615 *vs.* 1194.0 ± 561.2 pg/mL; p < 0.05). The rest of the results did not show significant differences.

Conclusions: People with an adequate hydration status have a minor concentration of pro-inflammatory cytokines in serum and in APhS than people who showed a dehydrated status.

Key words: hydration status, cytokines, inflammation.

Body composition in Spanish children regarding the number of water fountains in schools

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Objective: To analyse the relationship between anthropometric parameters and the availability of free access water fountains in schools.

Methods: 7659 6-9-year-old Spanish children (3,841 boys and 3,818 girls) were selected to participate in the ALADINO study. Each child's weight and height, waist and hip circumferences were measured at school, and BMI, waist/hip and waist/height ratios were calculated. Overweight and obesity were defined according to the WHO Reference 2007 Growth Standards. The number of water fountains in each school was recorded. Children were classified considering if their school provided free access to water (F) or not (NF). Data were analysed using SPSS (v.19.0).

Results: 14.3% of children study in schools without free water fountains (NF). There were no differences in sex, age, weight or height of the children when comparing F with NF groups. Neither were there differences in overweight or obesity prevalence, but waist and hip circumferences, waist/hip and waist/height ratios and BMI were significantly higher in NF children (p < 0.05).

Conclusion: Free access to water sources in the school may allow for better hydration of children and could be related to healthy body composition.

Study founded by AESAN.

Key words: children, BMI, fountain, school, environment.

Frequency of consumption of sugar-sweetened soft beverages and associated factors in Spanish children

Selected for oral communications

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Objective: To analyse SSB consumption habits in Spanish children and their relation to physical activity habits and family factors.

Methods: 7659 6-9-year-old Spanish children (3841 boys and 3818 girls) were selected to participate in the ALADINO study. Each child's weight and height were measured, and BMI calculated. Parents answered a questionnaire about the frequency of consumption of some beverages and their child's activity patterns, the parents' weight and height, and other family aspects. Data were analysed regarding the frequency of the consumption of sugar-sweetened beverages (SSB) using SPSS (v.19.0).

Results: 53.5% of children never consumed SSB (Non-drinkers, ND), 36.8% consumed them 1-3 times/week and 9.6% drank SSB more than 3 times/week (frequent drinkers, FD). The children's BMI were similar in all groups. Nevertheless both the father's and mother's BMI were higher in FD groups *vs.* ND. In comparison with the ND group, in the FD group there were more children who skipped breakfast, spent >2 h/day watching TV or >1 h/day playing with computer games, and lived in families with a higher percentage of smoking parents with less education and lower income.

Conclusion: In this group of Spanish children, the frequency of consumption of SSB is not related to their BMI, but is associated with a more sedentary pattern of activity and unhealthy habits in their families.
Study founded by AESAN.

Key words: children, sugar-sweetened beverages, activity, socioeconomic, family.

Beverage consumption habits in the Cantoblanco platform food and nutritional genomics (GENYAL)

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Introduction: The Cantoblanco Nutritional Genomics and Food Platform (GENYAL) is a high-level tool for Nutrige-

nomics and Nutrigenetics studies aimed at serving research groups and companies interested in the relationship between food and health.

Objective: The aim of this study was to determine the association between beverage consumption habits and BMI, glucose, lipid profile and genetic variations in GENYAL populations.

Methods: 149 participants (40 men and 109 women), mean age: 37.5 ± 12.5 years and BMI: 24.3 ± 4.3 kg/m^2 were included in the study. A validated food frequency questionnaire was used to estimate the average consumption of sodas, light sodas, natural juices, artificial juices, infusions (coffee and tea), red wine, white wine, beer, liquor and spirits. Biochemical parameters included: glucose, total cholesterol (TC), LDL and HDL cholesterol and triglycerides. Fourteen single nucleotide polymorphisms (SNPs) in nine genes related to lipid metabolism were determined. A linear regression model was applied and adjusted for potential confounders (sex, age). A codominant model was applied for the genetic association study.

Results: Beer consumption (74.5%) was significantly associated with lower LDL levels (122.2 ± 33.3 *vs.* 142.0 ± 31.2 mg/dL, $p < 0.05$) (median 141.1 IQR 212.2 mL/day), independently of the different genetic variants found in GENYAL populations. Consumption of other beverages was not associated with BMI, glucose or lipid profile.

Conclusions: Reasonable beer consumption may be associated with favourable changes in lipid profile. In the near future a better understanding of gene–diet interactions might result in the development of personalized recommendations related to the most appropriate type of diet for preventing or delaying the development of chronic diseases according to the genotype of each individual.

Key words: beverage consumption, nutrigenetics, lipid metabolism.

Study of the non-alcoholic beverage intake by sportspeople in southern Spain

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Introduction: Sweat loss during intense exercise ranges from around 0.5 to 2.0 L/h, depending on ambient temperature, body size, and metabolic rhythm. A loss of 2-5% of bodyweight through dehydration reduces aerobic effort capacity by 20-30%.

Objectives. To study patterns of non-alcoholic beverage consumption by Andalusian sportspeople according to their sex, age, professional/amateur status and sports type (group/individual).

Methods: We recruited 485 volunteers (72.9% men and 27.1% women) from Sports Medicine Centres in Andalusia. Non-alcoholic beverage intake was estimated from a semi-quantitative food frequency questionnaire with more than 140 items. The intake of eight groups of beverages was recorded: water, juices, coffee, infusions, carbonated drinks, sugar-free carbonated drinks, isotonic drinks, and energy drinks. Statistical analysis: descriptive study (means, standard deviations) and Student's t-test ($p < 0.05$) were performed to compare beverage intake by sex, age, professional/amateur status and sports type (group/individual).

Results. Mean intake of non-alcoholic beverages was 1978.79 mL/day; water was the most consumed drink. Males drank more coffee ($p < 0.001$) and isotonic drinks ($p < 0.05$) than females. Under 19-yr-olds drank more juices; over 19-yr-olds consumed more coffee and infusions ($p < 0.001$ in all cases). Participants in group sports drank more carbonated drinks; participants in individual sports drank more coffee, infusions, isotonic drinks, and energy drinks ($p < 0.05$ in all cases).

Conclusions: Water is the main drink consumed by these sportspeople, while their beverage intake pattern varies according to sex, age, professional/amateur status and sports type.

Key words: sportspeople, hydration, water intake.

Daily beverages consumed by Spanish elderly

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Introduction: The elderly is a vulnerable population regarding water balance. There is still a lack of data about which beverages contribute to total water intake.

Objectives: To collect and assess data about the amount and type of fluids consumed by Spanish elderly who live alone.

Methods: Within a broader cross-sectional study, 68 elders (50% men) aged 55-80 were assessed regarding drinking habits with a standardized questionnaire using personal interviews. Subjects were asked about the amounts of water and different non-alcoholic beverages they drink during a usual week. Mean daily intake was considered for the analysis.

Results: Mean total daily fluid intake was 1583 ± 616 mL. Percentile distribution was P25 = 900 mL, P50 = 1250 mL, P75 = 2100 mL, P85 = 2500 mL, P95 = 3940 mL. Mean daily intake by beverage, and mean number of days of consumption were as follows: all subjects drank water daily (1024 ± 451 mL); 94% milk (245 ± 133 mL, 7 days); 85% coffee (82

± 38 mL, 7 days), 34% tea (270 ± 97 mL, 5 days), 22% juice (208 ± 56 mL, 4 days), 13% isotonic drinks (383 ± 240 mL, 2 days), 13% milk drinks (111 ± 33 mL, 5 days), 12% soft drinks (285 ± 88 mL, 3 days), and 7% light soft drinks (454 ± 267 mL, 5 days).

Conclusions: There is a high variability in the amount of fluid intake in the elders analysed. Around 25% of the subjects met the dietary reference intake recommendations. Non-alcoholic beverages (other than water, milk and coffee) contributed to the total amount of fluid intake in only 35% to 7% of the subjects.

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Key words: hydration habits, elderly, fluid intake.

Risk factors related to fluid volume deficit in elderly people

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Introduction: Dehydration is a frequent problem in elderly people, independently of whether they are hospitalized or not. It is caused by the low ingestion of water and other fluids and by difficulties that limit access to beverages, together with the fear of drinking provoked by the belief that it can increase the risk of urinary incontinence and the urgency of urination.

Health care professionals can identify the risk of fluid volume deficit as well as the factors that condition it and determine the need for medical intervention.

Objective: To identify the risk of fluid volume deficit in patients older than 75 after the hospitalization period.

Methods: Observational study of 400 patients aged ≥ 75. The study was conducted in La Paz Hospital in Madrid. The data was collected through a direct interview with the patient and a consultation of his clinical and nursing records.

Results: 69% of the patients were diagnosed with "risk of fluid volume deficit". The most related risk factors were: lack of thirst, swallowing impairment, lack of motivation and insufficient knowledge of fluid intake needs.

Conclusion: "Risk of fluid volume deficit" is a fairly common problem in elderly people and it is related to changes associated with aging, functional and cognitive capacity and the emotional state. Nursing interventions should aim to reinforce patterns of conduct that prevent this problem.

Key words: risk of fluid volume deficit, elderly, nursing intervention.

Avoidance of beverages and perceived health risks and benefits in a young adult population

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Introduction: The way a beverage is perceived can affect its choice.

Objective: The aim of this study was to evaluate the perception and avoidance of different beverages in a group of university students from Madrid.

Methods: We studied 113 university students aged between 18 and 27, who completed a questionnaire about which beverages were considered healthier or harmful, and which ones they tried to avoid. SPSS (version 19.0) was used for statistical analysis.

Results: The beverage most cited as the healthiest option was water (85.8%), followed by natural juices (36.6%), tea (9.7%) and milk (5.9%). 88.5% of the sample considered beverages with a high alcohol content the most harmful, while sugar-sweetened beverages (SSB) were cited by 17.7% of the population, without significant differences regarding sex in any case. 46.9% of the population stated they avoided some beverages. In this group the most avoided beverages were SSB (44.9%) followed by caffeinated drinks (34.7%) and those containing alcohol (32.7%). There were no differences between the beverage most cited as the healthiest and the most harmful beverages according to whether they were avoided or not.

Conclusions: Men and women have similar perceptions about beverages. No association was found between the perception of a beverage and its avoidance.

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Key words: hydration, perception, avoidance, beverages.

At what time of the day do university students report drinking liquids?

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Introduction: Adequate beverage consumption during the day is essential to maintain body hydration.

Objective: The aim of this study is to evaluate at what time of the day a group of university students usually drink liquids.

Methods: We studied 113 students between 18 and 27 from Madrid, who completed a questionnaire about beverage consumption habits, in which they reported the time of the day they usually drink. SPSS (version 19.0) was used for the statistical analysis. $P < 0.05$ was considered statistically significant.

Results: 48.5% of the students reported drinking frequently whereas 95.5% drank when they felt thirsty and 42.6% from time to time. In addition, 92.1% of the sample drank liquids with the main meals, 13.7% between meals and 8.0% after heavy meals. Those who reported drinking between meals had significantly higher fluid consumption (1.85 ± 0.52 L/day) in comparison with the rest of the sample (1.60 ± 0.60 L/day). Additionally, 68.3% declared higher beverage consumption when they were with their friends, 38.0% reported that they drink more at weekends and 26.5% after exercising. No significant differences were found according to sex in any case.

Conclusions: There was a lack of knowledge about the best time of day to drink. The results show the need for nutritional education related to hydration.

Acknowledgements: The study was supported by the "Research Funding Program for Consolidated Groups Santander-UCM" (Ref: GR35/10-A).

Key words: hydration, moment of beverages consumption, fluids consumption habits.

Beverage intake and ponderal status in children: the Cuenca study

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Introduction: Within a healthy diet, hydration is an important guarantee of health. Despite its relevance, few studies have assessed beverage intake in Spanish children and even fewer have evaluated its possible relationship to weight status.

Objective:
To evaluate fluid intake patterns and their contribution to daily dietary intake in schoolchildren.

To explore whether consumption of different beverages has any association with weight status in schoolchildren.

Methods: A cross-sectional study with 373 children aged 9 to 11 randomly selected from the Cuenca province (Spain). Measurements included socio-demographic, anthropometric and dietary intake by YANA-C software, validated for a HELENA studies.

Results: Total water intake from food and drinks was around 1531 mL/day in both sexes and intake from fluids alone was 1016 mL/day. Energy from beverages accounts for 16% of total energy intake and 40% of sugars. The most popular drink was water, followed by whole milk, and sugar-sweetened beverages (SSBs). In both sexes, overweight-obese subjects have higher consumption of skimmed milk and less consumption of whole milk than those with normal weight, although the differences were not significant. Analyses were adjusted by age, sex and cardiorespiratory fitness.

Conclusions: Our data show that fluid intake in this population is below the currently recommended levels. Overweight-obese subjects have higher consumption of skimmed milk and less whole milk than normal peers. Moreover, there are greater differences among the sexes in beverage intake. Further studies are needed in Spain to assess long-term hydration habits in schoolchildren and its possible relation to body composition.

Key words: beverages, ponderal status, children, milk.

Estimation of water intake in a female Spanish population

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Introduction: The water in foods and the water we drink must ensure that we are correctly hydrated at all ages and in all circumstances.

Objectives: To estimate the water intake of a sample of Spanish women, differentiating between drinking water and the water supplied by foods and beverages, and to identify the main sources of water in their diet.

Methods: The study sample included 3393 women from southern Spain divided into four age groups: children (≤ 9 yrs), adolescents (10-18 yrs), women of childbearing age (19-49 yrs) and women over 50 yrs old. Drinking water intake and food and beverage water intake were estimated based on a validated food frequency questionnaire (FFQ). Statistical analysis: a descriptive analysis (means and standard deviation), ANOVA test ($p < 0.001$) and stepwise regression analysis were performed.

Results: The mean water intake of the study population significantly decreased ($p < 0.001$) with age. Although the main source of water was drinking water, the water provided by foods and beverages represented 40% of total daily intake. The foods and beverages supplying the highest water intake were juice and dairy products among children and adolescents, and vegetables, fruit, meat products, beer and alcohol-free beverages among women over 18.

Conclusions: It is necessary to promote adequate water intake at all stages of life in order to ensure an optimal state of hydration.

Key words: hydration, drinking water, water from foods.

Fruit and vegetable consumption and hydration status in schoolchildren

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Introduction: In addition to the known positive health effects, fruits and vegetables (F&V) might be important dietary contributors to hydration status (HS) in children.

Objective: To quantify the effect of higher consumption of F&V on HS in a large cohort of German schoolchildren.

Methods: Free water reserve (FWR, measured urine volume (mL/24 h) minus the obligatory urine volume (mL/24 h)) was used as a marker for HS in 1286 24-h urine samples from 442 4-10-year-old participants of the DONALD Study. Dietary intakes from 12 food groups were estimated from 3-day weighed dietary records parallel to the urine samples. The contribution of F&V (solid and juices) to FWR was analysed using repeated-measures regression models (PROC MIXED).

Results: Overall median and interquartile FWR values were 175 (25,370) mL/d. Positive FWR values (euhydration) were observed in 78% of children. In the fully adjusted regression models, a significant positive association between F&V intake and FWR ($p < 0.0001$) was observed. An increase of 100 g solid F&V intake predicted an increase of ~ 46 mL/d FWR, at the same time controlling all other dietary liquid sources (e.g. drinks and whey-based milk products).

Conclusion: Besides the contribution of the usual water sources for hydration, our results suggest the particular importance of the regular inclusion of F&V in the diet for improving HS in children.

Key words: hydration, schoolchildren, F&V, water intake.

Study of pharmacy customer liquid intake habits

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Objective: To assess the liquid intake habits (LIH) of pharmacy customers and assess the associations with body mass index (IMC), sex, age, perception of thirst and types of pathologies present.

Methods: The data was taken from 503 people: 340 women and 163 men, 41.5 ± 18.2 years old, and IMC of 24.4 ± 4.3 kg/m^2. The recommended liquid intake (RLI) was considered ≥ 10 liquid glasses/day.

Results: 86% of the sample does not meet the RLI, (88% women, 81% men; $p < 0.05$). People older than 65 do not hydrate themselves sufficiently (98% people older than 65, 82% young people; $p < 0.05$). 53% of people older than 65 say they do not meet the RLI, in contrast to 34% of the young people ($p < 0.05$). 30% are unable to drink without being thirsty. People older than 65 have twice this difficulty in comparison with young individuals (42% people older than 65, 24% young people, $p < 0.05$). Obese people have better liquid intake habits (23%) than normal-weight people (13%) and among women this difference is significant. No significant differences were found between liquid intake and the number and type of pathologies.

Conclusions: According to the results, LIH are associated significantly with sex, age and IMC but not with pathologies present among the people in the sample. The profile of the user with a risk of low liquid intake corresponds to a normal-weight woman older than 65.

Key words: recommend, hydration, low liquid intake, older people.

Beverage consumption of healthy adults in Europe

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Introduction: In Europe, no recent epidemiological studies have been conducted that focus on beverage intake. Moreover, no questionnaire has been developed as a research tool for the assessment of beverage intake in the general population. Different sources and methodological characteristics raise issues of comparability that are difficult to address.

Objective: The main objective of this review was to examine the available methods used to evaluate beverage intake in European epidemiological studies and to describe the most frequent method applied to assess it.

Methods: Information on beverage intake available from European surveys and nutritional epidemiological investigations was selected from grey literature. The search was based on the document provided by the European Food Safety Authority (EFSA, 2010).

Results: Relevant information was extracted from twelve European surveys. The studies were conducted on healthy adult population (aged 18-80) between 2003 and 2011. Only the study carried out on the German population used a specific beverage assessment tool (Beverage Dietary History). The 7-day dietary record was the tool most frequently employed.

Conclusion: The limited information available and the heterogeneity of the methodology used make it difficult to draw conclusions. Results show that beverage intake is different between countries. Epidemiological studies that assess beverage intake in Europe are scarce and further research is needed to clarify the amount of beverage intake in the European population.

Beverage consumption in university students in Madrid, Spain

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Introduction: In Spain epidemiological studies that focus on beverage intake are scarce. Only few questionnaires have been developed to assess beverage intake in the youth population.

Objective: The main objective of this questionnaire was to assess the mean intake of beverages in university students from Madrid.

Methods: A total sample of 785 students aged 19 to 24 from the University Rey Juan Carlos I of Madrid was interviewed during autumn 2012.

Data were collected using a specific beverage frequency questionnaire in a healthy population of university students from Madrid. Coffee, tea and milk intake were not included in this preliminary analysis. Mean intakes and standard deviation (SD) were estimated with SPSS software.

Results: In this study we found that the average water intake was 622.6 mL/day (428.7); for natural juice 111.5 mL/day (162.1) and for sweetened juices 47.8 mL/day (112.4). Regarding soft drinks, total consumption of cola drinks was 53.5 mL/day (112.6) and for diet soft drinks the mean intake was 45.0 mL/day (132.1). The average intake of beer was 57.4 mL/day (124.9). The total non-alcoholic beverage intake was 937.8 mL/day.

Conclusion: The data from this analysis showed that water intake is higher than consumption of other beverages; however, beverage intake in this population did not meet nutritional recommendations. Further research is needed to clarify the amount of beverage intake among the young.

Association between hydration status and drugs intake amongst institutionalised elderly people

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Introduction: Dehydration is a common condition among institutionalised elderly people, a population which generally takes many drugs. However, the association of hydration status and drugs intake remains unclear.

Objectives: To ascertain the existence of an association between hydration status and the type, number and frequency of drugs intake in institutionalised elderly people.

Methods: Data were collected from 62 institutionalised elderly individuals aged between 60 and 93. Hydration status was assessed using urinary indicators (first morning urine specific gravity, 24-h urine osmolality and volume), total daily water intake and pain score. Structured interviews were performed to assess several dimensions of health status including the type, number and frequency of drugs intake. Pearson correlations and linear regression were performed to assess potential associations (p-value).

Results: Women needed a greater number of drugs than men (7.6 ± 3.6 *vs.* 3.0 ± 1.6, p = 0.025), but both take drugs 3 times per day, on average. 24-h urine osmolality was negatively correlated with the total number of drugs (p = 0.021) and with the frequency of drugs intake (p = 0.027). In addition, pain score was positively correlated with these two variables (p = 0.012 and p = 0.011, respectively). 24-h urine volume and pain score also showed significant positive associations with the frequency of drugs intake, even after the adjustment for gender (p = 0.047 and p = 0.031), respectively.

Conclusions: Our findings suggest that institutionalised elderly, who take a greater number of drugs and more times per day, show better levels of indicators of hydration status.

Key words: hydration, drugs, elderly, institutionalised.

Beverage consumption and knowledge about it according to physical activity in female university students

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Introduction: Adequate hydration is essential to preserve health, especially in people who practice physical activities because of their greater risk of dehydration.

Objectives: The aim of the study was to analyse the consumption of beverages and the knowledge about this topic in a group of young female university students in relation to the practice of physical activity.

Methods: 102 female college students aged 18-27 were asked to complete a questionnaire about beverage intake and physical activity. SPSS 19.0 was used for the statistical analysis.

Results: Women considered adequate a beverage consumption of 2.08 ± 0.40 L/day, with no significant difference between sedentary and active women. 77.3% of the sedentary and 64.4%

of the active women considered beverage consumption lower than the recommended correct (2.2 L/day). Water intake was 1.497 ± 0.66 L/day; without differences between active and sedentary women (1.50 ± 0.74 L/day *vs.* 1.49 ± 0.57 L/day, respectively). A significant positive correlation was found between the time spent in physical activities and the intake of beverages ($r = 0.238$; $p < 0.05$). 70.8% of the women did not consume the amount of beverages considered adequate by the Institute of Medicine (2004) for women (2.2 L/day).

Conclusions: Beverage consumption considered adequate by women, independently of physical activity practice, was lower than the recommended. Nutritional education on hydration guidelines is needed to meet hydration requirements in young women.

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Key words: beverages, knowledge, physical activity, women.

Lastest trends in evaluating the importance of hydration status in dialysis patients

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Introduction: Dialysis presents a challenge for patients and health professionals. The main aim in therapy is evaluating the evolution of their nutritional state while taking into account their hydration status.

Objective: Prescription of an appropriate dialysis treatment requires an exhaustive analysis of the hydration status of the patient, which must be multidisciplinary in order to obtain the most accurate results.

Methods: Systematic bibliography review of different studies that offer information about the different tools to measure hydration status and its efficiency.

Results: The state of hydration is one of the most important factors in the clinical judgment: 1) fluid prescriptions must be tailored to the fluid and electrolyte, cardiovascular status and residual renal function of the patient, and 2) various technological tools have been developed to aid the clinician such as bioelectrical impedance analysis (BIA), vena cava collapsibility index, cardiac biomarkers and blood volume monitoring.

Conclusion: Technological tools may certainly aid the clinician in the assessment of fluid state, but should always be interpreted in the clinical context of the patient. Clinical evaluation based solely on body weight, blood pressure, volume of ultrafiltration (UF) and peripheral oedema is insufficient. Controlled studies are needed to definitively establish the role of technological tools in detecting dry weight in order to have the highest prediction of success in the treatment.

Key words: hydration status, dialysis, liquid intake.

Could excessive gestational weight gain be prevented by exercise

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Introduction: 40% of normal-weight and 60% of overweight women gain excessive weight during pregnancy with adverse health consequences.

Objective: To examine the energy expended in each exercise session and its impact on weight gain within the Institute of Medicine (IOM) recommendations.

Methods: A randomized controlled trial was designed. 39 healthy pregnant women from Hospital Universitario de Fuenlabrada were randomly allocated to exercise group (EG; N=19) or control group (CG; N=20). The study was approved by the Research Ethics Committee of the University Hospital of Fuenlabrada (Madrid). Women in EG participated in a supervised exercise program consisting of three, 55-60 minute sessions per week from 9-11 to 38-40 weeks. The exercise program included 20 min of aerobic conditioning with a target of 55-60% of their heart rate reserve, and 10-15 min of strength exercises. Maternal energy expended was collected during the aerobic conditioning and strength part of each session by a heart rate monitor (Accurex Plus, Polar Electro OY, Finland). Adherence to IOM gestational weight gain recommendations was the main dependent variable.

Results: A higher percentage of women in the EG gained an appropriate amount of weight according to the IOM recommendations (82.4% *vs.* 47.6%); p=0.02; expending an average of 177.21 ± 52.81 Kcal during each session.

Conclusion: Extra energy expenditure of 177.21 ± 52.81 Kcal during each session may help to control excessive maternal weight gain during pregnancy.

Key words: pregnancy; exercise; energy; IOM recommendations.

The importance of hydration with *llex paraguariensis* in the elderly with and without Alzheimer's disease

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Objective: To assess the effect of hydration with llex-paraguariensis on attention, concentration, memory, language, praxis and depression in a group of elderly patients with Alzheimer's disease (AD) and in a group of elderly individuals without AD, compared with a placebo group.

Methods: A longitudinal, prospective, double-blind randomized clinical trial was conducted with two groups of elderly people (with and without AD). The subjects from the group without AD (n-20) were randomly assigned to either the mother tincture of the liquid extract of llex-paraguariensis, a stock solution or placebo. The group with AD (n-35) was randomly split into two subgroups, which received the stock solution and placebo respectively.

Results: The elderly without AD who took llex-paraguariensis showed improved attention, concentration, short-term and long-term memory, measured by RAVLT ($p = 0.026$) and verbal fluency-animals-tests ($p = 0.03$). The qualitative evaluation revealed better sleep patterns. The elderly with mild AD showed a statically significant difference in favour of llesparaguariensis ($p = 0.015$) compared to those who received a placebo, according to the WAIS digit span test, which assesses attention, concentration, mental control and short-term memory. The qualitative analysis demonstrated improvement in depression symptoms. The elderly with moderate AD who took the stock solution improved their psychological and behavioural symptoms, measured by NPI, and showed improvement in attention and in agitated and aggressive behaviour in the qualitative assessment. Finally, the elderly with severe AD improved their depression symptoms, which were measured by the DSM-IV criteria for major depression.

Conclusion: llex-paraguariensis had a positive effect on attention, concentration, short-term and long-term memory, and sleep in individuals without AD. In those with AD, positive effects were noted on attention, concentration, short-term memory, depression, agitation and aggressive behaviour.

Key words: llex-Paraguariensis, St. Hilaire, hydration.

Influence of hydration status on the immune system of healthy adults

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Introduction: Intestinal hydration regulates bacterial-epithelial interactions which could have an effect on the immune system.

Objective: To assess the influence of hydration status on the immune system of healthy adults.

Methods: One hundred and twenty-three healthy adults with normal weight from Madrid participated in the study. Blood samples were collected in order to analyse the levels of cytokines, using Luminex technology, lymphocyte subsets measured by monoclonal antibodies and hydration status assessed by sodium concentration.

Results: The values of lymphocyte subsets (CD3+, CD4+, CD8+, CD16+56+, CD19+) were found within the normal ranges for healthy adults, as were the cytokine levels (IL-4, IL-6, IL-10, IL-12, IL-13, IFN-γ,TNF-α). Sodium concentration or natremia is the main reflection of intracellular hydration and the levels were also in the usual values (135-145 mEq/l). The relationships between the immunological values and hydration levels were statistically evaluated using the Spearman correlation, but the results did not show any correlation.

Conclusions: Although some studies have found an association between the immune system and hydration status, these results show that cytokine levels and lymphocyte subsets do not have a correlation with hydration status in healthy adults.

Key words: hydration status, microbiota, immune system.

Hydration in relation to bowel habits in Catalonia: results from the Catalan Nutrition Survey

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Objective: To analyse beverage intake in relation to bowel habits in the adult population of Catalonia.

Methods: We included 1492 adults, aged 18-64, who participated in the Catalan Nutrition Survey 2003 and responded to a general questionnaire that included frequency of defecation. Consumption of water and beverages was obtained from 24-hour recalls (mL/day).

Results: 26.6% of the sample had a faecal deposition frequency > 1 time/day, 57.2% have a frequency of 1 time/day and 15.9% < 1 time a day. Beverage consumption differs between sexes and age groups, with the consumption of non-alcoholic beverages showing a significant increasing trend since it increases the defecation frequency in the 25-44 age group (from 1040 mL in category "< 1 time/day" to 1229 ml/day in category" > 1 time/day"); this increase is related to the increased consumption of water (from 766 to 912 mL/day). In men, this pattern is also observed in the younger group.

Conclusions: Faecal deposition frequency is related to the intake of soft drinks especially in the 25-44 age group.

Key words: hydration, water, beverages, bowel habits, adults.

Beverage consumption in relation to dieting in the adult population of Catalonia

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Objectives: To assess beverage consumption in relation to dieting.

Methods: We included 2,052 individuals (949 males and 1103 females) aged 10-75, participants in the Catalan Nutrition Survey 2003, who answered a general questionnaire that included, among others, questions on diet monitoring in the last 12 months. Beverage consumption was obtained from 24-hour recalls (mL / day).

Results: 22.6% of the sample (17.8% in males and 26.7% in females) responded that they were on a diet during the 12 months preceding the interview. When comparing the average beverage consumption in the group that was on a diet *vs.* the group that was not on a diet, there was significantly higher consumption ($p < 0.05$) of water (795.7 *vs.* 733.1 mL / day) and teas or coffees (80.9 *vs.* 71.7 mL / day) and a lower consumption of soft drinks (69.7 *vs.* 96.9 mL / day) and alcohol beverages (70.3 *vs.* 91.7 mL / day). The average beverage consumption excluding alcoholic beverages was higher in the group on a diet (1026.2 *vs.* 992.9 mL / day). Some differences by gender in the analysed age group were observed.

Conclusions: Overall diet monitoring is related to higher consumption of water and fewer caloric beverages.

Key words: hydration, water, beverages, diet, adults.

Association between hydration status and depression amongst institutionalised elderly people

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Introduction: Dehydration and depression are common conditions among institutionalised elderly people. However, the relationship between these two conditions is not known.

Objectives: To ascertain the existence of an association between hydration and depression status in institutionalised elderly people.

Methods: Data were collected from 62 institutionalised elderly individuals aged between 60 and 93. Hydration status was assessed using urinary indicators (first morning urine specific gravity, 24-h urine osmolality and volume), total daily water intake and pain score. Validated scales were used in structured interviews to assess cognitive status (mini-mental state examination, MMSE), anxiety and depression (Geriatric Depression Scale, GDS). Pearson correlations and linear regression were performed to assess potential associations (p-value).

Results: Institutionalized elderly individuals showed an average 24-h urine volume of 1551.6 (SD 507.6) mL, a 24-h urine osmolality of 485.7 (SD 154.4) mOsm/kg and a first morning urine specific gravity of 1.014 (SD 0.005). The mean pain score was 2.3 (SD 1.6). 24-h urine osmolality showed a negative correlation with GDS score ($p = 0.023$), and pain score showed a positive correlation with GDS score ($p = 0.002$).

Conclusions: Considering that a lower urine osmolality and a higher pain score are associated with a better hydration status, our findings suggest the existence of an association between depression and hydration status. Further investigation is needed to explore this relationship.

Key words: hydration, depression, elderly, institutionalised.

Association between hydration status and physical activity amongst institutionalised elderly people

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Introduction: Dehydration is a common condition among institutionalized elderly people. The identification of the main factors associated with this condition make early recognition and prevention possible.

Objectives: The main aim of this study was to ascertain the existence of an association between hydration status and physical activity in institutionalized elderly people.

Methods: Data were collected from 62 institutionalized elderly individuals aged between 60 and 93. Hydration status was assessed using urinary indicators (first morning urine specific gravity, 24-h urine osmolality and volume), total daily water intake and pain score. Validated scales were used in structured interviews to assess mobility (Barthel Index) and physical activity (International Physical Activity Questionnaire, IPAQ). Pearson correlations and linear regression were performed to assess potential associations (p-value).

Results: Institutionalised elderly individuals showed an average 24-h urine volume of 1,551.6 (SD 507.6) mL, a 24-h urine osmolality of 485.7 (SD 154.4) mOsm/kg and a first morning urine specific gravity of 1.014 (SD 0.005). The mean pain score was 2.3 (SD 1.6). Urinary parameters did not show any significant association with the Barthel Index. However, 24-h urine volume ($p = 0.034$) and pain score ($p = 0.023$) showed negative correlations with physical activity.
Conclusions: Our findings suggest that institutionalised elderly individuals who practice higher levels of physical activity have lower 24-h urine volumes and lower pain scores, which are both indicators of poorer hydration status.

Key words: hydration, activity, mobility, elderly, institutionalised.

Diet quality may be conditioned hydration status in a representative sample of Spanish adults

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Introduction: Studies suggest that energy expenditure and energy intake may be conditioned by hydration status, which suggests that they might also influence diet quality.

Objective: To analyse diet quality according to hydration status in a representative sample of Spanish adults.

Methods: A representative sample of 418 18-60-year-old individuals (196 men and 222 women) was studied. Urine specific gravity (USG) and urine 24h volume (UV) were used as indicators of hydration status, considering USG > 1.020 and UV < 30 mL/h risk of dehydration. Diet quality was determined using the Healthy Eating Index (HEI). DIAL software (AlceIngeniería, 2004) was used to process all data. All calculations were made using SPSS (v19.0). Statistical significance was set at $p < 0.05$.

Results: 45.5% and 5.0% of the participants were at risk of dehydration considering USG and UV, respectively. People with better hydration status, determined by both USG and UV, showed a better quality diet than those with dehydration (61.44 ± 13.76 *vs.* 57.06 ± 12.76 points; $p < 0.001$).

Conclusions: People with better hydration status had higher quality diets than those with dehydration.

Key words: hydration status, diet quality, Spanish adults.

Drinking habits in the Valencian population

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Introduction: Adequate hydration of the organism is of paramount importance for health.

Objectives: We aimed to assess habits related to liquid consumption, to measure hydration status (HS) and to evaluate the relationship between them.

Methods: Data from 66 individuals from the population of Moncada (Valencia, ES), between 21 and 79, were used. HS of skin was measured on the face with an Impedanciometer (Skin diagnostic s-II) and expressed as percentage (%).

Results: Of all the individuals, 40% drink ≤ 3 glasses per day; 38.7% between 4 and 5 glasses; 35.4% ≥ 6 glasses. This consumption was in general higher among elderly people (> 70years) (p70 years), although not significant enough ($p = 0.61$). Furthermore there was no significant relationship between HS and consumption of liquids ($p = 0.21$). 74% of the population consumed bottled water alone, 11% tap water, 11% drank public water and 4% had no preference. 55% of the individuals drank other liquids besides water. 56% drank both at mealtime and not.

Conclusion: Young people drink fewer liquids compared to the elderly, and 50% of young people do not drink the recommended amount of liquid. Elderly people have a lower HS despite their higher liquid intake.

Key words: water consumption, liquids, hydration, drinking habits.

Beverage consumption evaluation in Spanish homes according to the 2000-2012 food consumption survey

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Introduction: There is a constant need to update food and beverage consumption and dietary patterns and trends in Spain. The food consumption survey from the Ministry of Agriculture, Food and Environment has been the most reliable source over the last twenty years.

Objectives: To evaluate alcoholic and non-alcoholic beverage intake in the Spanish population, disaggregated by regions as well as socioeconomic levels, divided into four classes: low, medium-low, medium and high; Additionally, to analyse the beverage intake evolution in Spain.

Methods: This study is based on household consumption assessed by the National Institute of Statistics (INE) and the Spanish Ministry of Agriculture, Food and Environment (MAGRAMA), in collaboration with the Spanish Nutrition Foundation (FEN).The sample consisted of homes in the Iberian Peninsula, Balearic and Canary Islands (17,020,860 in 2009, 17,070,198 in 2010, 17,154,090 in 2011 and 17,323,687 in 2012). The data were extracted from the MAGRAMA food consumption survey.

Results: In 2012 the average consumption of non-alcoholic beverages was 316 g / person / day, and alcohol beverage consumption represented 81 g / person / day. Non-alcoholic drink consumption increased by 31.7% from 2000 to 2012, whereas this increase was only 3.3% for alcoholic drinks. By region, alcohol intake was highest in Murcia with 113 g / person / day. Average non-alcoholic intake was highest in the Canary Islands with 538 g / person / day. Regarding socioeconomic status, both alcoholic and non-alcoholic beverage consumption is highest with high and medium-high status. Alcoholic beverages provide roughly 2.2% of total energy and 0.7% of carbohydrates whereas non-alcoholic beverages provide 2.6% of the energy and 5.8% of the carbohydrates.

Conclusions: There has been a dramatic increase in non-alcoholic drink consumption in recent years and a very small change with alcoholic drinks. The energy contribution of these groups is low, mainly when compared to other European countries.

Key words: beverages, food consumption survey, energy content.

Dietary and drinking patterns in a representative sample of university students from Spain*

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Introduction: Despite the importance of food and dietary habits and patterns during university years, there have been no representative studies conducted in Spain.

Objectives: To analyse food and drink patterns in Spanish university students.

Methods: A descriptive trans-sectional study during 2012-2013. A 24 hour-recall, food frequency questionnaire (FFQ), drink consumption questionnaire and behaviour, food preference, illness and physical activity questionnaires were used. The final sample was comprised of 978 students (46.4% men; 53.6% woman) from 21 Universities.

Results: The mean menu was composed of: non-alcoholic beverages (1549 g/p/d); milk and derivatives (451 g/p/d); fruits (421 g/p/d); vegetables (382 g/p/d); meat and derivatives (244 g/p/d); alcoholic drinks (169 g/p/d); cereals and derivatives (168 g/p/d); fish and shellfish (117 g/p/d); legumes (53 g/p/d); ready-to-eat foods (39.1 g/p/d); eggs (35 g/p/d); sugar and derivatives (24.4 g/p/d); oils and fats (22.6 g/p/d). The average intake of beverages (g/person/day) and percentage of students that consumed them were respectively: water (1,430/86%) soft drinks (187.6/43%); non-sweetened soft drinks (162.8/25%); fresh juices (109.0 / 44%); canned juices (137.1/47%); fruit juice and milk beverages (17.9/5%); coffee (65.0/55%); herbal teas (36.8/32%); non-alcoholic beer (64.5/4%); beer (194.7 / 56%); wine (25.8/20%); cava and cider (18.1/11%) and high alcohol content drinks (93.9/53%).

Conclusions: Dietary and drinking patterns of non-alcoholic drinks do not differ markedly from other adult population surveys in Spain. However, for alcoholic drinks clear differences are observed: beer, wine and cider consumption is moderate, usually accompanied by food and in a social environment, which clearly differs from regular high alcohol content drinks.

*The study was supported by the Centro de Información Cerveza y Salud, Madrid, SPAIN.

Key words: trans-sectional study, beverages, nutrition, drink pattern, university students.

Hydration and menopause: a forgotten subject

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Introduction: During menopause, women experience a number of changes related to dehydration such as loss of elasticity in the skin and alterations in the hair. In addition, water needs increase due to other associated problems such as taking certain drugs, an increase in water loss and the need to maintain an adequate renal and digestive function.

Objective: To become familiar with the importance of proper hydration during menopause.

Methods: Bibliographic search in databases including Pubmed, Cochrane and Cuiden was performed. The SAS virtual library and Spanish Society of Obstetrics and Gynecology (SEGO) website were also reviewed.

Results: Basal water needs in menopause require the consumption of about 2,500-2,750 mL/day. An extraordinary contribution of water is needed to be able to prevent possible dehydration and associated electrolyte imbalance.

Conclusions: There is, at present, a constant bombardment of information aimed at menopausal women on the importance of the consumption of foods rich in calcium, soy, etc. But the importance of consuming an adequate amount of water at this stage of life is often ignored. Guidelines should be established to guide consumers, as well as various health professionals, on what liquids should be consumed.

Key words: menopause, hydration, nutrition, dehydration.

Hydration patterns in breastfeeding women

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Introduction: During the breastfeeding period, good hydration helps ensure the production of an adequate quantity of breast milk. Breast milk contains up to 90 percent water, so a breastfeeding mother must drink a sufficient amount of liquid to ensure daily milk production and to maintain a good state of hydration.

Objective: To become familiar with the correct guidelines for hydration in breastfeeding women.

Methods: A bibliographic search in Cochrane and Cuiden databases was performed. the Spanish Society of Obstetrics and Gynecology (SEGO) website was also reviewed.

Results: The estimated average production of 750-800 mL of breast milk requires supplements of 700 mL water daily. It is recommended to consume approximately 2.7 L a day of liquid, i.e. 10 glasses of water a day.

Conclusions: Surprisingly, there are very few data published regarding recommendations for water intake in this phase of a woman's life. Water and other drinks are key to ensure good hydration. Beverages with mineral salts and sugars for quick absorption can facilitate better rehydration. Natural mineral water is the best choice for hydration during breastfeeding.

Key words: breastfeeding, hydration, breast-feeding mother, water balance.

Characterization of bioimpednace measures in overweight and obese hemodialysed patients

Selected for oral communications

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Introduction: Bioelectrical impedance analysis (BIA) is a non-invasive, safe method which is usually used to analyse body composition and hydration status in hemodialysis (HD) patients.

Objective: To evaluate the influence of body size by measuring BMI and BIA-derived variables (fat mass (FM), phase angle (PA), and hydration status) in HD patients.

Methods: Cross-sectional study of 80 HD-patients (males, 65%) aged 68 ± 14.4. Diabetes mellitus as primary aetiology of disease (15.8%). Each participant underwent nutritional assessment [malnutrition-inflammation score (MIS)], including anthropomorphic parameters, and laboratory tests. Body composition analysis by vectorial bioimpedance (Akern; RJL101) was performed. Patients were classified into the categories: normal-weight, overweight and obese. Additional nutritional-inflammatory biomarkers and the interaction between them were compared. Analysis by SPSS.

Results: The mean value of BMI was 24.9 ± 4.77. Prevalence of overweight/obesity was 43.8%. Overweight/obese HD patients showed significantly higher values of PA, FM and serum prealbumin than normal-weight patients ($p < 0.01$) while 60% of malnutrition-inflammation in normal-weight was found. The higher C-reactive protein (CRP) and protein catabolic rate were significantly reduced in normal-weight/obese HD-patients. Significant interactions between BMI with BIA-derived measurements (Na/K exchange, total body water, PA), s-albumin, s-prealbumin and malnutrition-inflammation score (all $p < 0.00$, respectively) by multivariate analysis were identified.

Conclusion: Body composition analysis measured by BIA may be a useful diagnostic tool to identify alterations in the nutritional-inflammatory-hydration status in overweight/obese HD-patients.

Key words: bioelectrical impedance analysis, BMI, overweight/obesity, malnutrition, hydration status.

Hydration status in well-nourished and wasted hemodialysis patients

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Introduction: Fluid overload is an important problem in the management of hemodialysis (HD) patients. Bioelectrical impedance analysis (BIA) is a useful non-invasive method for evaluating hydration status and body compartments in the dialysis population.

Objective: The study aimed to examine the interrelationship between hydration status, nutrition, and inflammatory state in HD-patients.

Methods: We studied 60 HD patients (men: 67%; aged: 68.8 ± 14.05; time on HD: 42.6 ± 41.6 months). Primary diagnosis was diabetes mellitus (20%). Nutritional assessment by malnutrition-inflammation score (MIS) and additional nutritional-inflammatory markers were considered. Hydration status was evaluated at 30 minutes after HD session by monofrequency bioelectrical impedance analysis. Body composition and hydration status were analysed by vectorial bioimpedance (Akern; RJL101). Subjects were classified by MIS into two groups: well-nourished and protein-energy wasting (PEW). Differences in hydration status and other nutritional-related indicators were analysed. Statistical analysis was performed by SPSS.

Results: Well-nourished individuals represented 31.7% of HD patients. PEW patients had significantly lower intracellular body water (ICW) ($p < 0.01$), body cell mass (BCM) ($p < 0.01$) and phase angle (PA) ($p < 0.001$) than well-nourished patients. Na/K exchange, ICW, BCM were significantly associated with MIS by multivariate analysis. Linear regression showed a significant relation between MIS and s-prealbumin, Na/K exchange, C-reactive protein, muscle mass and PA ($r = 0.72$; *all*, $p < 0.01$).

Conclusion: PEW is a high prevalence condition characterized by the alteration of several nutritional-inflammatory indicators as well as volume overload and hypoalbuminemiain HD-patients. Hydration status should be managed when malnutrition-inflammation is present.

Key words: hyperhydration, bioelectrical impedance, protein-energy wasting, inflammation, hemodialysis.

Nursing protocol for managing dehydration in neonates

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Introduction: Dehydration in neonates consists of the loss of water and electrolytes in addition to the insufficient nutrient contribution that may vary according to the pathology that causes it. Dehydration occurs when the amount of liquid intake by the neonate is less than the amount the body expels. Neonates dehydrate faster than adults, due to the fact that the percentage of water in their body is bigger and their balance is much weaker. Dehydration can occur easily when the children have fever, diarrhoea or vomiting.

Objective: To develop a training plan for nursing professionals in order to recognize the signs and symptoms associated with dehydration in neonates quickly.

Methods: Observational descriptive design, with the aim of developing an informative poster of how to manage dehydration in neonates: detection, early diagnosis, aetiology, triggering factors and nursing activity.

Results: Dehydration is the alteration of water and minerals in the plasma of the body, in this case, in neonates. It occurs due to the lack of liquid intake and excess of water elimination.

– The aetiology of dehydration signs identifies: Presence and increase of thirst, irritability, sleepiness, sunken eyes, sunken fontanelle, few or absence of tears, dry oral mucosa, oliguria or anuria, highly concentrated urine in the diaper, slow capillary refill, pallid and cold skin.

– Therapeutic requirements: Breastfeeding, increase intakes, intravenous fluid therapy according to medical prescription.

Conclusions: The preparation of informative and protocolized posters for display in different hospital departments to make them accessible for nursing professionals is advisable. This will improve the quality of healthcare.

Key words: dehydration, neonates, protocolised posters.

Hydration condition in mountaineers on a high Spanish mountain route

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Introduction: Spain has several autonomous regions where the mortality rate from mountain accidents mortality exceeds the mortality rate for traffic and work-related accidents, representing a real public health issue. Proper feeding, hydration, training and rest are the four elements that depend exclusively on the mountaineer and contribute to lowering the probability of mountain incidents and accidents.

Objectives: To discover the hydric condition of mountaineers taking the 4 mountain refuge circular route in Huesca during the summer.

Methods: Transversal descriptive study. Giving a validated questionnaire to 489 mountaineers who met the inclusion criteria of the study, during July and August 2010, at an average altitude of 2430 metres.

Results: The average liquid consumption in summer is 444.6 mL/hour. 78% of the sample consumed an additional liquid supply BEFORE the physical activity, 99% DURING it and 94.1% AFTER it. The main reason for drinking liquids during any of the three activity phases is thirst, (76.3%, 85.9% and 82.8% of the sample respectively) and the principal liquid consumed is water.

Conclusion: The mountaineers in the sample were totally dehydrated in all of the three physical activity phases, thus increasing the chances of suffering mountain incidents and accidents directly related to dehydration. Mountaineers must meet the main recommendations of the SENC (Spanish Society of Community Nutrition), which state that the basis of pyramid hydration is water.

Key words: public health, mountain accidents, hydration.

Water intake decreases with age in Spanish elderly

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Introduction: There is a lack of studies analysing the amount of fluid intake, specifically water, in the elderly population.

Objectives: To supply data on the water intake of independent elderly people in Madrid (Spain).

Methods: Within a broader cross-sectional study, 68 moderately active (120 min exercise/week) elders (50% men) aged 55-80 were assessed for their drinking habits with a standardized questionnaire using personal interviews. Subjects were asked to recall the amounts of water drunk the day before and their usual weekly intake.

Results: Water intake represented 64% of total fluid intake. 94% of consumers drank tap water. The percentile distribution

for daily water intake based on the answers about consumption the day before was: P25 = 600 (800) mL, P50 = 800 (1000) mL, P75 = 1500 (1500) mL, P85 = 1600 (1600) mL. 14.7% of subjects stated that they drank more than yesterday and 2.9% less. There were no significant differences in water consumption between men and women. There was a very slightly negative association between age and water intake ($r^2 = 0.014$), showing that water consumption decreased as age increased.

Conclusion: There is tendency to overestimate weekly water intake in subjects ≤ P50 when compared to the day before. Water consumption declines with age in both sexes, and no significant differences were observed between elderly men and women.

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Key words: water intake, elderly, hydration.

Consumption of non-alcoholic beverages and physical activity in children and adolescents in Spain

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Objective: To analyse the patterns of non-alcoholic drink consumption in Spanish children and young people based on the type of physical activity performed.

Methods: We included a sample of 3125 2-24-year-old individuals who participated in the ENKID study and completed a food frequency questionnaire and a physical activity questionnaire. We analysed the consumption of non-alcoholic drinks (mL / day) in relation to the level of physical activity performed at school and during leisure time in energy-expenditure MET tertiles.

Results: In all age groups significant differences were observed when analysing the consumption of non-alcoholic drinks based on tertiles of physical activity at school and during leisure time. In all cases, the consumption of non-alcoholic drinks increased with increasing physical activity (with more than 200 mL/day on average between extreme tertiles). Likewise, an age-related linear increasing trend of consumption of non-alcoholic beverages was observed.

Conclusions: The increase in non-alcoholic beverage consumption associated with physical activity by children and adolescents is highlighted.

Key words: hydration, beverages, physical activity, children, adolescents.

Validation of beverage intake methods *vs* hydration biomarkers

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Introduction: Fluid intake is difficult to monitor. Biomarkers of beverage intake are able to assess dietary intake/hydration status without the bias of self-reported dietary intake errors as well as intra-individual variability. Various markers have been proposed to assess hydration; however, to date there is a lack of universally accepted biomarkers that reflect changes in hydration status in response to changes in beverage intake.

Objective: The objective of this review was to discover the questionnaires on beverage intake available in the scientific literature to assess beverage intake and hydration status and their validation against hydration biomarkers.

Methods: A scientific literature search was conducted. Only two articles were selected, in which two different beverage intake questionnaires designed to document usual beverage intake were validated against the urine specific gravity biomarker (Usg). The questionnaires used were the water balance questionnaire (WBQ) and the beverage intake questionnaire (BEVQ) a quantitative food frequency questionnaire (FFQ).

Results: The WBQ reported no correlations ($r = -0.11$; $p = 0.40$) and BEVQ found a negative correlation ($r = -0.20$; $p < 0.05$). FFQ appears to measure better beverage intake than WBQ when compared with biomarkers. However, the WBQ seems to be a more complete method to evaluate the hydration balance of a given population.

Conclusions: Further research is needed to understand the meaning of the different correlations between intake estimates and biomarkers of beverage intake in distinct population groups and environments.

Association between hydration status and sodium intake amongst community-dwelling elderly people

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Introduction: Dehydration is a common condition in older people and does not manifest itself in a single form, making it more difficult to assess. The identification of the main factors associated with this condition is crucial.

Objective: The aim of this study was to describe the existence of an association between hydration status and sodium intake in community-dwelling elderly people.

Method: Data were collected from 74 community-dwelling elderly individuals (38% male, 70.2 ± 5.99 years) and 24-h urine samples were collected and screened for validity after a 24-h period (using 24-h urinary creatinine excretion in relation to body weight). Hydration status was assessed using urinary indicators (24-h urine specific gravity, urine osmolality and urinary volume) and sodium intake was assessed by 24-h urinary sodium excretion. Pearson correlations and multivariate regression analysis were performed to assess potential associations.

Results: The average urine volume was 1888.9 ± 654.85 mL, urine osmolality was 422.1 ± 153.86 mOsm/kg and 24-h urine specific gravity was 1.014 ± 0.005. Urine volume and osmolality showed a positive correlation with sodium intake ($p = 0.004$ and $p = 0.014$, respectively).

Conclusions: Our findings showed that community-dwelling elderly individuals with a higher level of sodium intake had higher 24-h urine volume and a higher 24-h urine osmolality. These findings suggest that a higher sodium intake is associated with a poorer hydration status in this elderly population since despite the fact that sodium intake activates the thirst mechanisms, the consequent fluid intake is insufficient to reduce urine osmolality.

Key words: hydration, sodium, community-dwelling, elderly.

Total water intake and beverage consumption in Maputo, Mozambique

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Introduction: Total water intake is seldom reported in dietary surveys, despite the existence of recommendations for water ingestion.

Objectives: To describe total water intake, comprising the water ingested through beverages (including plain water) and foods, in Maputo.

Method: Cross-sectional evaluation of a convenience sample of the adult general population (25-64 years) from Maputo (n = 100). A trained interviewer collected dietary intake data using a single 24-hour dietary recall, the Food Processor (ESHA Research, USA)® was used for the conversion into nutrients. Beverages were classified in 8 groups (plain water, milk, soft drinks, fruit-based drinks, fruit juices, tea, coffee and alcoholic beverages). The World Health Organization (WHO) recommendations were used to assess total water intake adequacy (2.9 L/day, men; 2.2 L/day, women).

Results: The mean total water intake was 2.1 [standard deviation (SD)], 1.0] L, in both sexes, with 20.0% of women and 10.0% of men meeting the recommendations. Foods contributed to 29% of total water intake. Plain water was the main contributor for water intake through beverages (60.6%), followed by tea (24.0%), soft drinks (4.3%), fruit-based drinks (3.6%), coffee (2.8%), milk (2.6%), alcoholic beverages (1.6%) and fruit juices (0.5%). Mean water-to-energy ratio was 0.9 (SD, 0.4) L/1000 kcal, short of the desirable ≥ 1.0 L/1000 kcal.

Conclusions: Most participants did not meet adequate water intake targets. It is important to promote an adequate hydration in Mozambique.

Key words: total water intake, beverages consumption, Mozambique, Africa.

Association of urinary biomarkers of cellular oxidation with urine volume osmolality in Guatemalan preschoolers

Selected for oral communications

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Introduction: Much has been described about hydration and biomarkers of cellular oxidation, but information regarding the relationship between these markers in urine is lacking.

Objectives: Our aim was to find any possible association between urine osmolality (UOsm), volume and biomarkers of oxidation.

Methods: Seventy-eight 24-hour urine samples were collected from 2 semi-urban and 1 rural dayccare centres subsidised by the Secretaria de Obras Sociales de la Esposa del Presidente (SOSEP) in Quetzaltenango, Guatemala. We measured volumes and took an aliquot to determine Uosm using a Vogel Löser 850 osmometer and an aliquot to measure 15-isoprostane F2t and 8-Hydroxydeoxyguanosine (8-OHdG) as biomarkers of cellular oxidation.

Results: Median values [95%CI] for urine volume (mL) were 460[136-575], for Uosm (mOsm/kg) 484[464-538], for isoprostanes (ng/mL) 2.4 [1.9-2.8] and for 8OHdG (ng/mL) 5.7 [6.3-9.8]. No differences regarding sex or setting were found. Significant inverse correlations for urine volume with isoprostane concentration ($r = -0.603$, $p < 0.001$) and 8OHdG concentration ($r = -0.433$, $p < 0.001$) were found as well as for

UOsm with these two biomarkers (r = 0.337, p = 0.003 and r = 0.620, p < 0.001), respectively. When oxidation biomarkers were adjusted for creatinine, the strength of the associations declined or lost significance. This confirms that the production of these two all-tissue oxidation biomarkers is not related to that of creatinine.

Conclusions: Our results suggest that a better hydration status reduces free radical generation or propagation down to the cellular level.

Key words: urine osmolality, 8OHdG, isoprostanes, preschool-children, Guatemala.

Hydration status of preschool children with a largely common weekday meal in western Guatemala

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Introduction: There is increasing evidence that even mild dehydration affects overall health. Urine osmolality (UOsm) is one of the most feasible and accurate methods to determine hydration status.

Objectives: To report on the distribution of urine osmolality (UOsm) and volume in a group of preschool children from Quetzaltenango, Guatemala.

Methods: Three samples of 24-h urine were collected from 78 children from semi-urban and rural day care centres in Quetzaltenango Guatemala. All samples were stored at 0-4°C or -80°C to determine Uosm using Vogel Löser 815, and GonotecOsmomat 030 osmometers. Statistics for whole samples were run by subject and only for those that fit the Remer criteria for 24-h urine collection compliance.

Results: Median [95% CI] in mOsm/kg were 473 [476 - 518] by collection (n = 232), and 475 [473 - 526] by subject (n = 78). No significant differences were found between sexes or setting; the r value for age (mo) *vs.* 24-h urine volume was 0.579 (p = <0.001). When samples meeting the Remer Creatinine Criterion were analysed, median [95% CI] were 495 [490 - 541] by collection (n = 134), and 495 [491 - 558] by subject, meeting the criterion at least once (n = 60), respectively: (p = 0.029) *vs.* all-subjects.

Conclusions: UOsm for preschool children in Guatemala is lower than reported elsewhere. A significantly higher Uosm was found in subjects that meet the Remer Creatinine Criterion.

Key words: urine osmolality, creatinine, preschool-children, Guatemala.

Nursing care for an immobilized patient

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Introduction: A 72-year-old patient with hypertension, Diabetes Mellitus 2, cerebral infarction, insomnia and urinary incontinence was hospitalized due to a surgical intervention for grade 4 Ductal carcinoma with chemo-radiotherapy treatment. After the intervention she started experiencing difficulty standing up and presented grade 4 vascular ulcers in both legs. At this point, she began her follow-up, which lasted seventeen months and took place at her home. As she was in a socially vulnerable situation, each home visit lasted at least 60 min and met several demands and needs, such as curing ulcers, nutritional education, regular control of vital signs, emotional help and support with self-care.

Objective: To help the patient to achieve physical and emotional autonomy and overall healing. Specific diagnoses: acute pain in both legs, damage to cutaneous integrity in both legs, risk of falling, social isolation, urinary and faecal incontinence, insomnia.

Methods: Clinical case including home visits 3 times per week with continuous follow-up of the patient.

Results: All types of analgesia were ceased. The vascular ulcers were cured. An improvement of leg damage related to traumatisms was observed. The patient returned to her normal life after seventeen months of home isolation due to her physical handicap, which resulted in emotional imbalance.

Conclusions: The patient regained the autonomy and independence she had prior to her medical situation. After losing 15 kg, her blood pressure improved and she had better diabetic control.

Key words: nursing, immobilized.

Beverage consumption and total water intake compared to the recommendations in a Spanish adult population

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Introduction: A wide variety of recommendations exists for total water intake (TWI). Only a few studies have examined how consumption patterns, including beverage type and variety, are related to TWI.

Objectives: The aim of this study was to evaluate TWI, compare it with different water intake recommendations, and find out the most consumed beverages.

Methods: Studied subjects were 466 Spanish adults aged 18-50 (260 women and 206 men). Beverage intake was obtained from a 3-day food record (including one weekend day). Dial software was used to calculate TWI and g/day of different beverages (water, milk, soft drinks, juices, wine, beer and other alcoholic drinks).

Results: The mean TWI (all food and beverage sources included) was 2030 ± 734 g/day; 93.5% and 74.5% of the population did not meet the adequate intakes of IOM and EFSA respectively. The most consumed beverage was water (99.6% of the subjects consumed water), followed by milk (83.3%), soft drinks (50.9%), juices (49.4%), wine (40.6%) and beer (35%). The mean total beverage intake was 1496 ± 680 g/day.

Conclusion: A high percentage of this population does not meet the recommendations. Increasing beverage intake is advisable. More nutritional and hydration education is needed.

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Key words: water intake, beverage.

Nutritional significance of three locally produced non-alcoholic drinks from Nigeria

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Introduction: Fruits are an important source of both digestible and indigestible carbohydrates, minerals and vitamins, especially vitamin C and β-carotene. Non-alcoholic beverages are usually prepared from fruits or plant seeds, and they serve as refreshing drinks. In Nigeria, large quantities of fruits are produced and wasted due to post-harvest losses. To guarantee a regular supply of these fruits during the four seasons, they need to be processed and preserved in a form that can extend their shelf life.

Objectives: This study was carried out to prepare and determine the nutrient content and physico-chemical characteristics of three locally produced juices (Pineapple, Apple and Kunnu).

Methods: Samples of fruits and millet (for Kunnu) were purchased from Sango market in Ibadan, cleaned, processed into juices by extraction and sieving methods and packaged for further analysis. The samples were analysed for proximate and ascorbic acid composition using standard methods of AOAC.

Results: 100 g portion of the drinks contained 68.29-72.20 g moisture, 0.61-4.50 g protein, 9.85-12.98 g total soluble sugar, and 5.80-21.33 mg ascorbic acid. The pH range was 3.46-5.52, titratable acidity 0.52-4.54, and specific gravity 1.04-1.06.

Conclusions: The values obtained from the analyses of the beverages were within the range for commercial juices, and hence, they are recommended as refreshing drinks.

Key words: fruits, non-alcoholic beverages refreshing drinks.

Sanitary surveillance of drinking water, health and safety warrants in hydration

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Introduction: The basic support of hydration is water, which quenches thirst and is easily found. It can be consumed on its own as tap or bottled water or as a part of hydrating liquid foods (soft drinks, broths, infusions).

Tap water is the most commonly consumed, since it is affordable and readily available. Having been treated, it does not contain harmful substances or any microorganisms, thanks to health control and water surveillance, designed to prevent health risks.

The water supply in Seville and its metropolitan area draws on four reservoirs (395 Hm3), located in mountain areas with low industrial concentration, low agricultural activity and low populations, and is thus of very good quality.

Objectives: To study legal compliance with drinking water regulations in this supply area.

Methods: Taking analytical reports recorded in the SINAC (Spanish National Drinking Water Information System), the number of analyses performed in a year in supply infrastructures (water treatment plants, tanks, and distribution networks) was studied and compared with the legal regulations in order to verify compliance.

Results: Water potability is guaranteed and thus its consumption is safe.

Conclusions: The characteristics of the tested water are similar or even better in quality than three brands of bottled water.

Key words: supply, potability, surveillance, health quality.

An update on caffeine and fluid balance: a meta-analysis

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Introduction: Despite its popularity and numerous benefits for physical and mental performance, caffeine is generally

recognized as having a diuretic action. For situations where fluid balance is essential, it is often recommended that caffeine be used with caution or simply avoided, as failure to maintain body fluid balance is associated with a wide range of physical and mental decrements in performance.

Objectives: A meta-analytic method was used to determine caffeine's diuretic effect.

Methods: Twelve publications met the selection criteria, providing a total of 19 effect sizes (ESs) for analysis.

Results: Collectively, the results found a moderate ES for caffeine, 0.52 ± 0.84 (95% CI, 0.12-0.93). This corresponds to an absolute change in urine volume of 83 ± 191 mL (95% CI, -8-175 mL). Further analyses confirmed physical activity as a strong moderator, as diuretic action is reduced with exercise ($p < 0.05$).

Conclusions: The current results suggest that caffeine is mildly diuretic in most cases, and in practice, such a marginal effect on urine volume is minimal and would not negatively affect fluid balance. The practical implications for athletes and occupational workers include the fact that there is no reason to avoid moderate coffee consumption. However, rehydration with caffeinated drinks during rest should be avoided.

Key words: hypohydration, dehydration, diuresis, rehydration.

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