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Trabajo Original

Otros

# Bad results obtained from the current public health policies and recommendations of hydration

## *Malos resultados obtenidos a partir de las actuales políticas de salud pública y recomendaciones de hidratación*

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## Abstract

**Introduction:** Achieving an adequate intake of water is crucial within a balanced diet. For that purpose, dietary guidelines for healthy eating and drinking are an important consideration and need to be updated and disseminated to the population.

**Aim:** We aimed to evaluate the liquid intake habits of a Mediterranean and Latin American population (Spain-Portugal and Mexico-Uruguay) and if they support the current recommendations of hydration by the EFSA.

**Methods:** A record of fluid intake was obtained from 1,168 participants from 4 countries above; and then compared with current consensus about hydration 1,600 mL/day (female) and 2,000 mL/day (male).

**Results:** The average fluid intake slightly surpassed the recommended: mean of 2,049 mL/day (2,223 mL in males, 1,938 mL in females). Portugal stood out due to its lower intake (mean of 1,365 mL/day). Water contributed the largest part to total fluid intake (37%) in all countries (mean of 1,365 mL/day). Hot beverages (18%) and milk and derivates (17%) follow water in highest consumption. The 20% of males and only 0.3% of females knew recommendations of hydration, while 63.3% of males and 62% of females followed them. Only 8.4% of people who follow the recommendations know them.

**Conclusion:** The people studied surpassed the recommendation, although the majority did not realize. Future research should examine actual beverage consumption patterns and evaluate if the current consensuses are correctly adapted to the population needs. Hydration's policies should be transmitted to the population for their knowledge and adequate compliance.

**Key words:**

Hydration. Water. Fluid intake. Health policy. Public health.

## Resumen

**Introducción:** el consumo adecuado de agua es crucial dentro de una dieta equilibrada. Para ello, las directrices dietéticas para una alimentación saludable e hidratación son una consideración importante y necesitan ser actualizadas y difundidas a toda la población.

**Objetivo:** el objetivo fue evaluar los hábitos de ingesta de líquidos de una población mediterránea y latinoamericana (España-Portugal y México-Uruguay) y si cumplen con las recomendaciones actuales de hidratación por parte de la EFSA.

**Métodos:** se obtuvo un registro de la ingesta de líquidos de 1.168 participantes de los 4 países ya mencionados; y luego se comparó con el consenso actual sobre hidratación 1.600 ml/día (mujeres) y 2.000 ml/día (hombres).

**Resultados:** la ingesta de líquidos promedio superó ligeramente la recomendada: media de 2.016 ml/día (2.149 ml en hombres, 1.884 ml en mujeres). Portugal destacó debido a su menor consumo (media de 1.365 ml/día). El agua aportó la mayor parte de la ingesta total de líquidos (37%) en todos los países (media de 1.365 ml/día). Las bebidas calientes (18%) y la leche y derivados (17%) siguieron al agua en mayor consumo. El 20% de los hombres y solo el 0,3% de las mujeres conocían las recomendaciones de hidratación, mientras que el 63,3% de los hombres y el 62% de las mujeres las seguía. Solo el 8,4% de la gente que las seguía conocía a la vez las recomendaciones.

**Conclusión:** las personas estudiadas superaron las recomendaciones, aunque la mayoría no las conocía. Investigaciones futuras deberían examinar los patrones actuales de consumo de bebidas y evaluar si los consensos actuales se adaptan correctamente a las necesidades de la población. Las políticas de hidratación deben ser transmitidas a la población para su conocimiento y cumplimiento adecuado.

**Palabras clave:**

Hidratación. Agua. Consumo de líquidos. Política sanitaria. Salud pública.

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## INTRODUCTION

Maintenance of fluid balance is essential to sustain human life. Water intake balances fluid losses to achieve adequate hydration of bodily tissues (1). It comes primarily from three sources: a) drinkable water (water and other drinks); b) the intrinsic water in food and its preparation, and c) the endogenous water produced during intermediary metabolism. Of these three sources, beverages not only represent the largest proportion of intake, but also can be modified more easily through the acquisition of healthy habits (2).

Although there are widespread guidelines in scientific literature and media for achieving optimal hydration status, there is no clear consensus about how much fluid an individual should consume (Table I) (1), neither sufficient research regarding the amount of water required to prevent disease or improve health (3). As a result, neither upper nor lower consumption thresholds have been clearly linked to a specific benefit or risk for humans (4).

Few countries have developed water requirements and those that do base them on weak population-level measures of water intake and urine osmolality (5). Recent official guidelines for total water intakes (water + beverages + food moisture) were published by the European Food Safety Authority (EFSA) in 2010 (6). These guidelines are the first ones to use both observed intakes and physiological parameters to set adequate intake. A desirable urine osmolarity of 500 mOsmol/L is proposed, and based on this value and on the osmotic load of a standard European diet, a urinary volume (1.6 L in females and 2.0 L in males) and associated total fluid intake [2.0 L/day (p 95 3.1 L) for females and 2.5 L/day (p 95 4.0 L) for males] are determined. This recommendation does not take into account extra fluid loss due to physical activity, which induces large variation in the adequate water intake.

It should be taken into account that the exact amount of water needed depends on: age, gender, weight, health, level of physical activity, foods eaten, medications, diseases and the weather (10).

Although considering the factors mentioned above, information and guidelines continue to be dissimilar. Are responsible for some, if not most, of the variation the differing assessment methodologies (11). As a consequence, and despite the importance of proper water intake, there is widespread confusion among the population and health professionals, in relation to total fluid intake and hydration status. This is partly due to a misinterpretation of existing recommendations (12).

In addition, the advice to drink at least eight glasses of water a day can be found throughout the popular press (magazines, TV, internet, etc.), but evidence is sparse and conflicting. One origin may be a 1945 recommendation by the Food and Nutrition Council that stated: "A suitable allowance of water for adults is 2.5 litres daily in most instances. An ordinary standard for diverse persons is 1 ml for each calorie of food. Most of this quantity is contained in prepared foods." If the last, crucial sentence is ignored, the statement could be interpreted as instruction to drink eight glasses of water a day (13).

Another endorsement may have come from a prominent nutritionist, Frederick Stare, who recommended, without references, the consumption of "around 6 to 8 glasses per 24 hours," which could be "in the form of coffee, tea, milk, soft drinks, beer, etc." The complete lack of evidence supporting the recommendation to drink six to eight glasses of water a day is exhaustively catalogued in an invited review by Heinz Valtin in the American Journal of Physiology (14). Despite this demystification, a significant number of advertisers and media news try to convince us otherwise (15).

Thus, governments, national and international organizations and institutions responsible for the establishment and implementation of nutrition guidelines and dissemination of information materials to the population, have the responsibility to include current and scientifically based information on the importance of hydration and total intake water to improve health and wellness (16).

## AIM

Firstly, we aimed to know the populations level of knowledge about the current recommendations for water intake and hydration. Secondly, we analyzed through which information channels they acquire this knowledge and the possibility of miscommunication and misunderstanding between the current policies and recommendations of hydration and the population. Thirdly, analyse if people are following that recommendation and get the minimum amount of hydration.

**Table I.** Summarizes the water intake recommendations of four international authorities

| | European Food Safety Authority, 2010 (6) | National Health and Medical Research Council, 2006 (7) | Institute of Medicine, 2004 (8) | World Health Organization, 2003 (9) |
|---|---|---|---|---|
| Men | 2.5 L | 3.4 L | 3.7 L | Sedentary: 2.9 L<br>Active: 4.5 L |
| Women | 2.0 L | 2.8 L | 2.7 L | Sedentary: 2.2 L<br>Active: 4.5 L |

*Reference values for total water intake (food + fluid), L/day.*

## MATERIAL AND METHODS

### OBSERVATIONAL RETROSPECTIVE COHORT STUDY

#### Sample

A total of 1,181 adults aged 18-65 years were randomly recruited from 4 different geographical territories, Spain, Portugal, Uruguay and Mexico. Information about the quantity and quality of daily fluid intake from different types of beverages was collected using a questionnaire. Data were collected by trained and formed nutritionists and dieticians, standardizing the data collection protocol and monitoring the study.

The EFSA recommends that men should have a total water intake of 2.5 L every day and women 2 L. This water can come from food but also from different types of beverage. As foods usually contribute about 20% of water intake, the EFSA recommendations for total fluid intake in men is 2 L/day and women 1.6 L/day of beverages, of which preferably water (17), since water is the preferred beverage to fulfil daily water needs according to a guidance system in the United States (18).

The questionnaire was designed to investigate mainly the sources of information used by participants to learn about hydration policies and recommendations (EFSA recommendations), and whether the source of knowledge generates miscommunication and misunderstanding in the population. Therefore, it was conducted individually to the participants to assess what impact information channels have on populations' hydration knowledge.

The following information on demographics factors was collected: age, sex, level of education and nationality. They were asked to express in millilitres or litres and in glasses whether they knew their age and gender fluid intake recommendations or not, and how much of that amount should be in form of water.

Data of which drinks did they consume every day more frequently was also compiled. The questionnaire items on beverages included: water (tap water, filtered tap water, natural mineral water, sparkling natural mineral water, flavoured water, water from a fountain); hot beverages (coffee, white coffee, espresso with a drop of milk, cappuccino, tea, beverages made from cereals, other infusions and hot beverages); milk and milk derivates (milk, milkshakes, milkshakes with juice, liquid yogurt, other milk drinks); juices (home-made juice, bottled juice, nectars, nectar without added sugar, other fruit drinks); sweet regular beverages: carbonated soft drinks (cola, orange, lemon, bitter, tonic water, other flavours) non-carbonated soft-drinks (orange, lemon, sports drinks, energy drinks, regular iced tea, other flavours), other sugared soft drinks; sweet light beverages: diet carbonated soft drinks (cola, orange, lemon, other flavours), diet non-carbonated soft drinks (orange, lemon, diet iced tea), other diet soft drinks; and alcoholic drinks (beer, alcohol-free beer, lemon beer, wine, wine with soda, alcoholic mixed drinks, other alcoholic drinks).

Finally, we investigated from which source of information they received the correct hydration recommendations: at home, medical and scientific journals, internet, academic training, social networks, books, TV, radio or medical centres.

Minor modifications to wording and customs were made for Uruguay and Mexico's surveys, in favour of a better unification of the answers in the database.

#### INCLUSION CRITERIA

- Men and women, ages 18-65 years old.
- Sufficient level of understanding to conceive their participation in the study.
- Acceptance and voluntary participation after signing an informed consent.

#### EXCLUSION CRITERIA

- Nonage.
- Participants reporting a mean fluid intake below 0.1 L.
- Participants that did not complete the fluid intake record correctly.

#### STATISTICAL ANALYSIS

Questionnaire responses were analysed using the Statistical Package for the Social Sciences (SPSS) version 21. Frequency, percentage and other descriptive statistics were used to describe and summarise data.

Parametric statistical tests, such as t-student, ANOVA and non-parametric, were used to analyze the differences between the means of two groups of quantitative variables, with a p value $< 0.05$ considered significant and a 95% confidence interval.

## RESULTS

### RESPONSE RATE

A total of 1,181 surveys were returned (response rate 100%). Twenty surveys were excluded due to respondent's nonage or incongruent answers. Thus, a total of 1,161 participants (439 men and 718 women) were taken in consideration with a mean age of 37.9 ± 16.1 years and recruited from Spain, Portugal, Uruguay and Mexico. There were no significant differences between country and gender ($p = 0.240$) but there were significant differences when analyzed by age ($p < 0.05$, Kruskal-Wallis).

There were no significant differences either in the proportion of individuals in different education level by gender ($p = 0.393$) neither by total intake of liquid ($p = 0.292$). Most of the study population had a university studies educational level. The baseline characteristics of participants are summarized in table II.

The mean volume of water consumed (tap water, filtered tap water, natural mineral water, sparkling mineral water, flavoured

**Table II.** Information on demographics factors, by country and sex

| | Spain (n = 620) | | Portugal (n = 199) | | Uruguay (n = 132) | | Mexico (n = 210) | | Total (n = 1161) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Male n = 253 | Female n = 363 | Male n = 77 | Female n = 122 | Male n = 36 | Female n = 96 | Male n = 73 | Female n = 137 | Male n = 439 | Female n = 718 | Both sexes |
| Age (M ± SD) | 35.1 ± 15.4 | 34.5 ± 15.4 | 49.8± 14.2 | 46.3 ± 12.9 | 38.8 ± 15.1 | 43.5 ± 19.6 | 30.3 ± 13 | 38.0 ± 14.5 | 37.2 ± 16 | 38.4 ± 16.1 | 37.9 ± 16.1 |
| Sex (%) | 40.8 | 58.5 | 38.7 | 61.3 | 27.3 | 72.7 | 34.8 | 65.2 | 37.8 | 61.8 | 99.7* |
| Primary studies (n, %) | 16 (6.3) | 25 (6.9) | 1 (1.3) | 2 (1.6) | 4 (11.1) | 11 (11.5) | 4 (5.5) | 11 (8) | 25 (5.7) | 49 (6.8) | 74 (6.4) |
| Secondary studies (n, %) | 99 (39.1) | 109 (30) | 30 (39) | 48 (39.3) | 12 (33.3) | 31 (32.3) | 19 (26) | 48 (35) | 160 (36.4) | 236 (32.9) | 397 (34.2) |
| University studies (n, %) | 132 (52.2) | 225 (62) | 45 (58.4) | 68 (55.7) | 20 (55.6) | 52 (54.2) | 49 (67.1) | 72 (52.6) | 246 (56) | 417 (58.1) | 666 (57.4) |
| Doctorate (n, %) | 5 (2) | 4 (1.1) | 1 (1.3) | 4 (3.3) | 0 (0) | 2 (2.1) | 1 (1.4) | 6 (4.4) | 7 (1.6) | 16 (2.2) | 23 (2) |

*Data expressed as mean (M) ± standard deviation (SD) or sample size (n) – percentage (%).*
**Missing data about the sex of 4 Spanish participants.*

water and fountain water) was 1,403.5 mL/day for the whole population (1,497.5 mL for men and 1,309.5 mL for women).

The percentage of individuals who did not follow the recommendations of the European Food Safety Agency (EFSA) for total water intake was calculated, along with the percentage of the sample who thought they knew those recommendations (Table III). There was a statistically significant difference ($p = 0.002$) between the total water intake and the follow up of recommendations.

The mean quantity of water intake from different types of beverages was above the EFSA recommendations (2,000 mL/day for men and 1,600 mL/day for women), 2,222.9 mL/day for men and 1,938.1 mL/day for women. There is statistically significant difference ($p < 0.001$) between the total water intake and the sex. The odds of meeting the EFSA recommendations for total fluid intake were higher in men [$p < 0.05$; 95% CI: 0.194-0.121].

Added to this, statistically significant difference ($p = 0.023$) were found between Latin-American and European participants and their total fluid intake.

There were statistically significant differences between the knowledge of the recommendations ($p = 0.006$), but not if they got right the EFSA recommendations ($p = 0.752$) with the continent of residency (Latin-Americans and Europeans). On the contrary, the follow up of the recommendations showed significant differences ($p < 0.001$).

Concerning this total daily fluid intake and the type of beverage consumed, hot beverages (47.4%) and milk and derivates (45.8%) are consumed significantly more than juices (25.5%) and alcoholic drinks especially in Spain (22%). Sweet soft drinks have lower percentages of consumption (16.3% for carbonated, 9% for diet carbonated, 3.1% for non-carbonated and 1.4% for diet non-carbonated). More detail about the type of beverages consumed, according to country, is found in table IV.

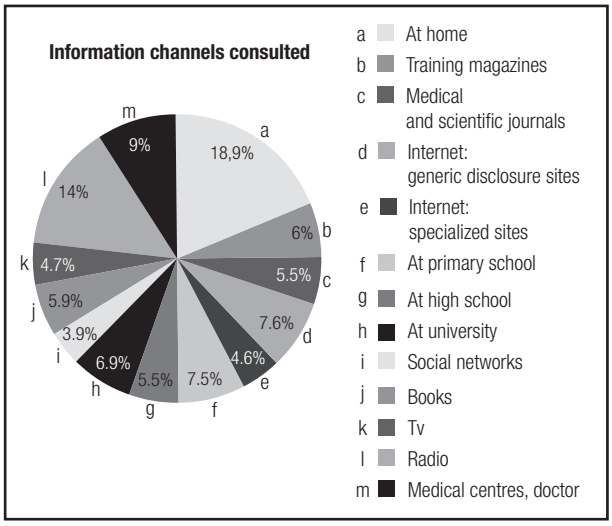


**Figure 1.**

Information channels through which the sample learned about the recommendations of hydration.

**Table III.** Data about the knowledge and follow up of hydration recommendations, by country and sex

| | | Spain (n = 620) | | Portugal (n = 199) | | Uruguay (n = 132) | | Mexico (n =2 10) | | Total (n = 1161) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Male n = 253 | Female n = 363 | Male n =7 7 | Female n = 122 | Male n = 36 | Female n = 96 | Male n =7 3 | Female n = 137 | Male n = 439 | Female n = 718 | Both sexes |
| Mean quantity fluid (mL) | - | 2432.5 | 2049.9 | 1369.5 | 1410.2 | 2616.7 | 2135.4 | 2202.6 | 1973.5 | 2222.9 | 1938.1 | 2049.1 |
| | - | 1608.7 | 1372.3 | 1013 | 1018.4 | 1675 | 1386.5 | 1535.6 | 1348.6 | 1497.5 | 1309.5 | 1384.3 |
| Think they know recommendations (n, %) | Yes | 100 (39.5) | 161 (44.4) | 24 (31.2) | 53 (43.4) | 21 (58.3) | 60 (62.5) | 26 (35.6) | 66 (48.2) | 171 (39) | 340 (47.4) | 512 (44.1) |
| | No | 152 (60.1) | 195 (53.7) | 53 (68.6) | 69 (56.6) | 15 (41.7) | 35 (36.5) | 47 (64.4) | 71 (51.8) | 267 (60.8) | 370 (51.5) | 640 (55.1) |
| Got right EFSA recommendations (n, %) | Right | 53 (21) | 0 (0) | 5 (6.5) | 0 (0) | 14 (38.9) | 0 (0) | 16 (21.9) | 2 (1.5) | 88 (20) | 2 (0.3) | 90 (7.8) |
| | Wrong | 48 (19) | 158 (43.5) | 19 (24.7) | 50 (41) | 7 (19.4) | 60 (62.5) | 11 (15.1) | 63 (46) | 85 (19.4) | 331 (46.1) | 417 (35.9) |
| Follow EFSA recommendations (n, %) | Yes | 186 (73.5) | 252 (69.4) | 16 (20.8) | 29 (23.8) | 29 (80.6) | 62 (64.6) | 47 (64.4) | 102 (74.5) | 278 (63.3) | 445 (62) | 723 (62.3) |
| | No | 67 (26.5) | 111 (30.6) | 61 (79.2) | 93 (76.2) | 7 (19.4) | 34 (35.4) | 26 (35.6) | 35 (25.5) | 161 (36.7) | 273 (38) | 434 (37.4) |
| If followed, did they know the recommendations? (n, %) | Knew | 36 (60) | 0 (0) | 3 (5) | 0 (0) | 12 (20) | 0 (0) | 9 (15) | 1 (100) | 60 (98.4) | 1 (1.6) | 61 (8.4) |
| | Did not know | 39 (75) | 112 (53.6) | 2 (3.9) | 10 (4.8) | 5 (9.6) | 37 (17.7) | 6 (11.5) | 50 (23.9) | 52 (19.9) | 209 (80.1) | 261 (36.1) |

*Data expressed as mean (M) or sample size (n) – percentage (%).*

**Table IV.** Count of beverages consumed, according to country

| n (%) | Spain | Portugal | Mexico | Uruguay | Total |
|---|---|---|---|---|---|
| | n = 620 | n = 199 | n = 210 | n = 132 | n = 1161 |
| Water | 620 (100) | 199 (100) | 210 (100) | 132 (100) | 1161 (100) |
| Hot beverages | 381 (61.5) | 9 (4.5) | 106 (50.5) | 54 (40.9) | 550 (47.4) |
| Milk and derivates | 453 (73.1) | 2 (1) | 77 (36.7) | NS | 532 (45.8) |
| Juices | 259 (41.8) | NS | 37 (17.6) | NS | 296 (25.5) |
| Carbonated soft drinks | 121 (19.5) | NS | 68 (32.4) | NS | 189 (16.3) |
| Non-carbonated soft drinks | 29 (4.7) | NS | 7 (3.3) | NS | 36 (3.1) |
| Diet carbonated soft drinks | 86 (13.9) | NS | 18 (8.6) | NS | 104 (9) |
| Diet non-carbonated soft drinks | 9 (1.5) | NS | 7 (3.3) | NS | 16 (1.4) |
| Alcoholic drinks | 226 (36.5) | 4 (2) | 25 (11.9) | NS | 255 (22) |

*NS: Not specified.*

There was no statistically significant difference ($p > 0.05$) between any of the information channels consulted and their total water intake, expect for people who learned about hydration.

## DISCUSSION

Maintenance of fluid and electrolyte balance is essential to healthy living as dehydration and fluid overload are associated with morbidity and mortality (19).

The lack of consistency in the evidence concerning hydration status and fluid intake requirements published to date is mainly due to the different methodologies used and also due to the complex and dynamic human fluid–electrolyte regulatory system that defies description as it changes constantly (20). Many studies often rely on self-reported fluid consumption, which at times, has been shown to be inconsistent and inaccurate (19). That is why an attempt should be made to standardise methods for future studies. There is currently no consensus on a 'gold standard' for hydration status markers. This indicates the need to define the best so-called field method to assess hydration status in a population of supposedly healthy people or patients (20).

The scientific and medical communities have made recommendations regarding daily water intake to fulfil water requirements in infants, children and adults of both sexes (20). However, these guidelines are based on limited evidence. In view of this, the EFSA recommends a daily fluid intake of 2.5 L for men and 2.0 L for women to maintain urinary osmolarity of 500 mOsmol/L (19). Because plasma osmolality directly reflects intracellular osmolality, it supposedly constitutes a good marker to assess acute hydration changes (20), even though no evidence incontrovertibly demonstrates that any concentration measurement, including plasma osmolality, accurately represents total body water gain and loss during daily activities (21).

None of the review articles read (22-28) provided an incontrovertible argument for the superiority of a single hydration index for use in all situations and populations.

One of the main objectives of the present study was to estimate the total fluid intake and the real fluid pattern of a large sample of individuals. We report that approximately the 37.4% of adult population do not follow the total water intake recommendations by the EFSA.

Our results are in agreement with the data collected by the EFSA evaluating fluid consumption in 13 European countries and which show that only Denmark and Germany consumed a mean of at least two litres of water per individual from all types of beverages (29).

Total fluid intake in our study was non-significantly higher in men than in women. This is in agreement with other studies evaluating fluid intake in other populations (30-32). However, in our study, the percentage of men who met the EFSA recommendations was similar to the percentage of women (63.3% of men, 62% of women).

Determining the amount of fluid necessary to maintain hydration is one concern when trying to discern recommendations on fluid intake; determining fluid intake necessary to treat or decrease risk of certain diseases or disorders is another (9).

An incremental formula by which water requirements could be more precisely estimated for populations, groups of people, and perhaps even individuals would need to consider requirements under sedentary conditions at temperate environment with adjustments for altitude, heat, humidity, activity level, clothing, and other factors. While such a formula does not currently exist, development of such a formula could provide a point from which to more closely estimate requirements (9).

## CONCLUSION

The populations' level of knowledge about the current recommendations for water intake and hydration were mainly wrong. According with the bad results, it´s show that probably the current politicises are not enough.

The population´s intake was above EFSA recommendations, but that are not clear in specific populations, situations or conditions. None of the current consensus specify clearly water consumption, not fluids, and they don´t give any maximum limit.

It is important for public health purposes to estimate, as exactly as possible, the water requirements of a population.

The evidence is largely associative and lacks consistency to draw firm conclusions, and the number of randomized trials is limited.

Given these challenges, further work is required to get these important issues to establish recommendations of water intake.

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