

Understanding Fluid Consumption Patterns to Improve Healthy Hydration

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Water is quantitatively by far the No. 1 nutrient in our diet. Of course, this can vary, depending on the amount and the quality of food and drink one consumes, but approximately 50% of what we eat and drink every day is water (CIQUAL, Table CIQUAL 2008, composition nutritionnelle des aliments, 2008, Centre d'Information sur la Qualité des Aliments, <http://www.afssa.fr/TableCIQUAL/>; US Department of Agriculture, Agricultural Research Service, 2005, USDA National Nutrient Database for Standard Reference, Release 18. Nutrient Data Laboratory Home Page, <http://www.nal.usda.gov/fnic/foodcomp>; NUTTAB, 2006, Food Standards Australia New Zealand [FSANZ], <http://www.foodstandards.gov.au/monitoringandsurveillance/nuttab2006/>). It is also the No. 1 component of the human body by mass. This varies from one person to another, depending on individual characteristics such as body weight, ratio between lean and adipose tissues, and physiological state (pregnancy, etc), but approximately 60% of the adult body is composed of water. [Nutr Rev 2005;63(6 pt 2):S40–S54]. Finally, no biological reaction or function in the body would be possible without water. In other words, life is not possible without water. This makes the quantity and the quality of the fluids we have to drink every day quite an important issue both nutritionally and physiologically. From this perspective, it is interesting to discuss available recommendations for water intake and their reliability. This is very challenging, because no study is available on the long-term health effects of the

quantity and/or the quality of fluids ingested. Nutr Today. 2010;45(6S):S22–S26

Recording Fluid Intake Deserves More Attention and Effort

Current recommendations for the adequate intake (AI) of water are based on national consumption surveys from which a mean (or a median) value is derived for different categories of people. This approach is of great interest because it gives precise values and official references in which people can place reasonable confidence. However, there are numerous situations for which such references do not exist: in particular, physiological stages (children, elderly, and pregnant and lactating women) and countries where total fluid intake surveys do not exist. Moreover, this approach does not ensure that physiological needs are adequately covered. As illustrated in the Table, a simple comparison of well-known recommendations on fluid intake reveals large discrepancies.

The differences between surveys, between and within countries, are also well illustrated in Figure 1 by data collected by the European Food Safety Agency. Total fluid intake varies from a minimum of 720 mL/d in Hungary to a maximum of 2621 mL/d in Denmark. Reasons for these differences are diverse and may involve the contribution of food to water intake or climatological differences.

Methodological aspects of these surveys also deserve consideration. Historically, recording food intake has gained attention because of the importance of dietary nutrient deficiencies or excesses and their consequences for health. However, recording fluid intake has gained

Table. Summary of Recommended Fluid Intakes From Different Authorities and Organizations

Countries	Sources	Fluid Intake Recommendations, mL/d
United Kingdom	The British Dietetic Association (Food Facts)	1500–2500
	The British Nutrition Foundation	1500–2000
	www.waterforhealth.org.uk	2000
France	AFSSA (PNNS, “manger, bouger”)	1500
Mexico	Instituto Nacional de Salud Publica	2000
Canada and United States	DRI (Adequate Intake for Water)	3000 for men
		2200 for women
Australia and New Zealand	Nutrient Reference Values ^a	2600 for men
		2100 for women
Worldwide	World Health Organization	1500

^aBased on median population intakes in Australia.

interest only recently. Recording fluid intake is a difficult challenge because of the variability of one’s consumption across days, the large number of times that water is consumed within a single day, and because of the numerous types of beverages that contribute to water intake. Indeed, most surveys are dedicated to recording food intake and analyzing nutrient intake and calories using a diary designed for this purpose, but most food diaries do not give an opportunity to record fluid intake separate from food ingestion. Consequently, these surveys underestimate fluid intake, particularly consumption between meals.

A comparison between food and nutritional surveys available in France and a fluid intake survey using a diary specifically designed for this purpose was conducted by Danone Eaux France, in collaboration with TNS-SOFRES, in 2006. A representative population sample revealed a difference of about 500 mL between the surveys. Indeed, available French surveys^{1,2} concluded that an average fluid intake for French adults was 1300 to 1400 mL/d, whereas our data exhibit an average consumption of 1850 mL/d. Of these 500 mL, 350 mL was due to water intake.

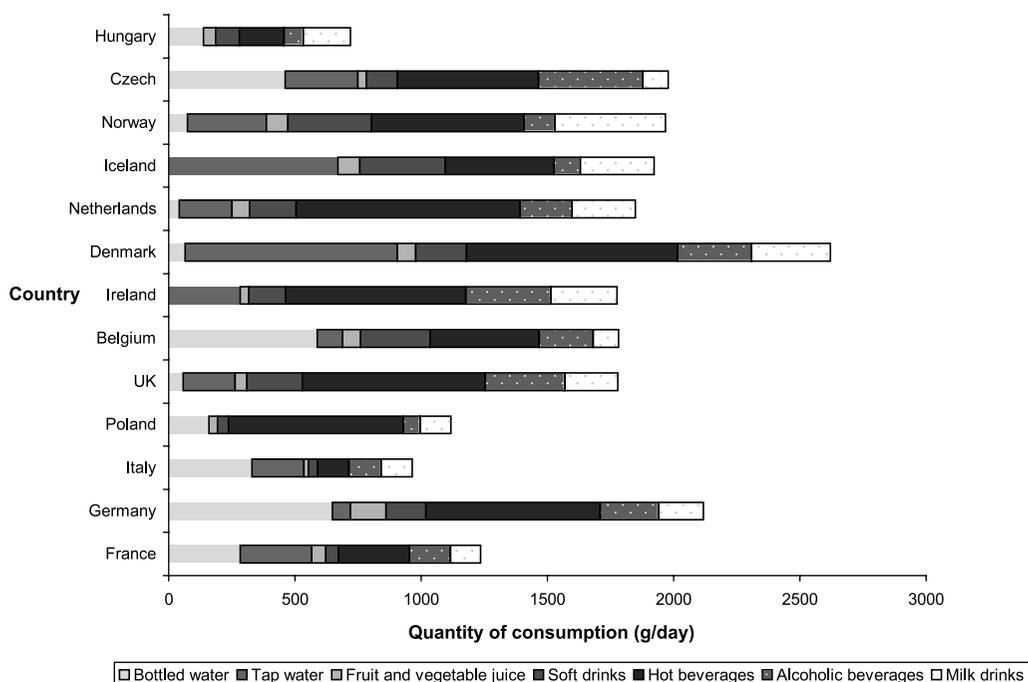


Figure 1. Concise European Food Consumption database. <http://www.efsa.europa.eu/en/datex/datexfooddb.htm>.

Surveys reporting fluid consumption data are also generally characterized by a large variability in the total amount of fluid consumed per day. Thus, total fluid intake varies from a few hundred milliliters up to several liters per day. A similar variation is also reported by the American Dietary Reference Intakes³ and does not seem to be country dependent. Thus, it is reasonable to question the meaning of an AI of 1.5 L/d, when people in reality consume anything from 500 mL/d to 5 L/d. Because of such methodological issues, the classic approach to measuring fluid intake is not likely to provide a true picture of population fluid intake. Therefore, we question setting fluid recommendations based on national survey data.

Impact of Fluid Composition on Total Fluid Intake

The study of fluid consumption patterns according to measured amounts also gives interesting results. Based on internal data, collected using identical methodology in France in 2006 and in Mexico in 2007, we have shown a significant relationship between the quality of fluids and the total quantity consumed. Indeed, there is a significant positive relationship between daily water intake and the total amount of fluid consumed per day. On the contrary, there is a negative relationship between total fluid intake and the daily intake of hot beverages, caffeinated sweetened beverages, and fruit

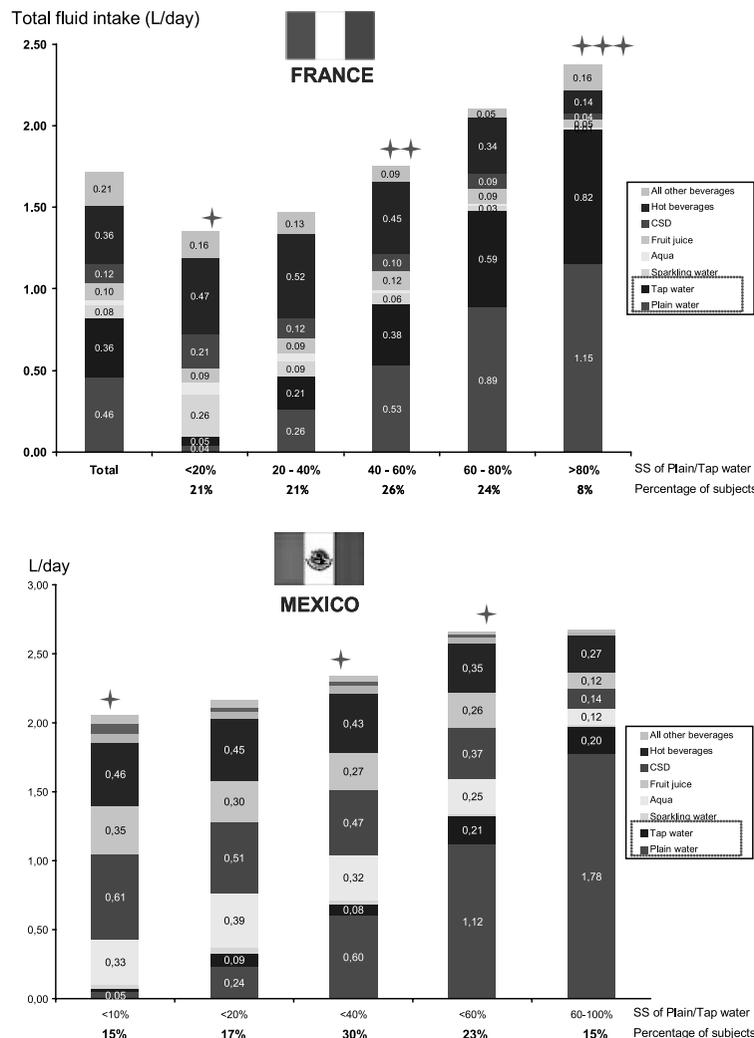


Figure 2. Fluid intake patterns of the French and Mexican adult populations according to stomach share of plain water. Source: Danone Waters fluid intake surveys in France, 2006, and in Mexico, 2007.

juices. In other words, people who drink more water consume a greater total volume of fluid in the form of fewer beverage types. In the reverse scenario, those who consume less water (by volume) actually consume a greater variety of beverages than those who drink more water. These findings are well illustrated in Figure 2.

Two hypotheses explain this apparent relationship between the quality and the quantity of fluids. Specifically, the total amount of fluid consumed is influenced by (a) individual characteristics such as education and social environment or (b) the composition of the fluids. Confirming one of these hypotheses appears to be of great importance, as this could be a way to improve the fluid intake of those who drink very little, thus reducing their caloric intake from beverages and total calorie intake. In turn, this may chronically influence obesity and concomitant diseases.⁴⁻⁶

Is This Fluid Consumption Pattern Flexible?

Our research team conducted a consumer study to evaluate whether it would be possible to increase total fluid intake of those who ordinarily consume small amounts each day, by increasing their water intake. This study was conducted in France during January and February 2009. It included 266 adults, aged 25 to 55 years (50% male, 50% aged between 25 and 40 years, and 50% aged between 41 and 55 years). The study

was conducted in the subjects' own homes, to improve the reliability of the study and to improve compliance in completing fluid diaries. Data were collected in 4 French cities: Lille, Lyon, Montpellier, and Rennes. Participants declared themselves to be healthy and not taking any medications. They were finally selected on the basis of their fluid intake, recorded through a specific fluid diary. People selected for the study had to drink less than 1.2 L/d (all beverage types), with maximum intakes for specific fluids set at 300 mL/d for water, sparkling water or both, and alcoholic beverages, respectively. It was established that people were not resistant to Volvic, a natural mineral water that is widely available in France.

The study lasted 5 consecutive weeks (Figure 3). During week 1, subjects simply recorded their normal fluid intake in a diary. In week 2, we asked them to drink at least one 0.5-L bottle of water on the first 2 days, at least two 0.5-L bottles of water on days 3 and 4, and at least three 0.5-L bottles of water, that is, a total of 1.5 L of water per day, on days 5 and 6. Products were supplied to each of the participants' homes in sufficient quantities. During week 3, the water bottles were supplied to the participants, but they were no longer given instructions. Their fluid intake was tracked in a diary on all weeks. In weeks 4 and 5, we tracked their water intake with no products supplied and with no instructions.

Results of week 1 showed that the average total fluid consumption was 710 mL/d. Male and female fluid intake was similar, 734 versus 756 mL/d, respectively. Of the 710 mL consumed per day, 271 mL came from hot beverages and 242 mL from water. The remainder of

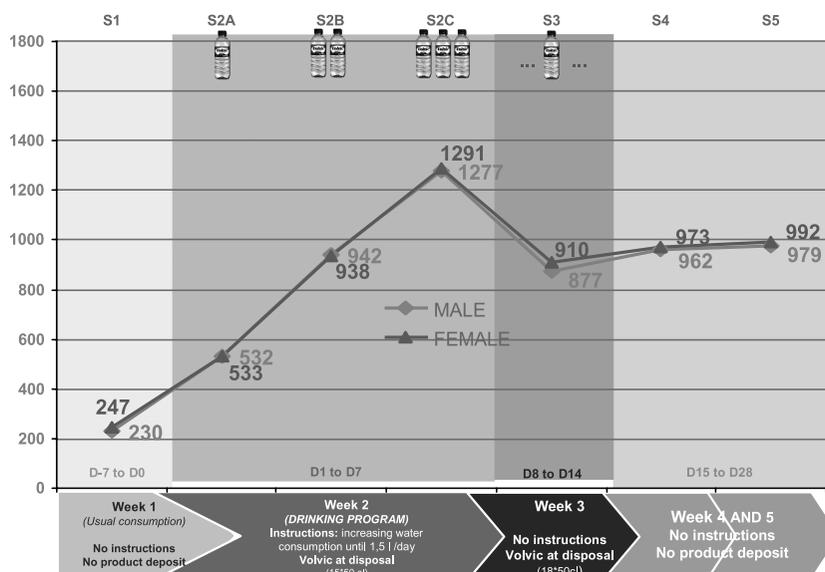


Figure 3. Water consumption of French men and women over the 5 weeks of the study. See text for methodological details.

their consumption involved other fluid categories (alcohol, fruit juices, caffeinated sweetened beverage, milk, and hot chocolate made with milk).

During week 2, water consumption increased sharply as participants closely followed the instructions. For men, the total fluid intake at day 6 reached 1760 mL, of which 1277 mL came from water; women reached 1710 mL, of which 1291 mL came from water. There was a small adjustment in the consumption of other fluids, but the effect on total intake was almost exclusively due to the increase in water consumption. These results are very interesting, as they show that, in a short period, it is possible to increase total fluid intake markedly, through water consumption: about a liter on top of the basal fluid intake for both men and women.

Water intake data recorded during weeks 3, 4, and 5 were not significantly different and show that in week 3 people dipped slightly in water consumption; women changed from 1291 mL/d to 910 mL/d, whereas men changed from 1277 mL/d to 877 mL/d. The water consumption volumes remained almost the same during weeks 4 and 5. For women, this was 973 and 992 mL/d during weeks 4 and 5. For men, this was 962 and 979 mL/d during weeks 4 and 5. These results were achieved, despite the fact that water bottles were no longer supplied during weeks 4 and 5. The overall results for water intake in this study are summarized in Figure 3.

This study, even though it was preliminary and took place over a few weeks, clearly indicates opportunities to modify the behavior of those who consume small amounts to increase their total intake of fluid through an increase in water intake. This study also suggests that the composition of beverages is a major factor driving the total volume of fluid consumed.

Conclusions

Despite the usefulness of recommendations for fluid intake, they can be challenged because they are mainly based on national food intake surveys that likely underestimate the real fluid intake of people. To raise the awareness of the organizations that issue AI recommendations or give advice on this methodological issue, more attention should be paid to fluid intake records. Designing research instruments that record only fluid intake also deserves more attention, in that such instruments provide a significantly different understanding of consumption patterns. For example, such instruments might identify those who underconsume fluid as an at-risk subgroup in each population.

Our French and Mexican data demonstrate the negative impact of beverages and the positive impact of water on total fluid intake. The French consumer

pilot study (Figure 3) shows the possibility of increasing the total fluid intake of those who drink very small amounts, by increasing their water consumption. This gives a promising perspective to help those people to better meet the AI in a healthy way. Further investigation will help us better understand the mechanisms regulating chronic fluid intake across months and years. Further, the potential of water to substitute for caloric beverages also needs to be investigated. This is of great importance, particularly in children living in countries where the intake of calories, including those from beverages, must be reduced to slow the growing incidence of obesity.

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