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ABSTRACT

Introduction: water is a crucial component of human health useful for various bodily functions. Despite its importance, previous research has largely overlooked hydration in Latin America, focusing instead on regions with greater access to a variety of food sources.

Objective: hence, this study provides comprehensive data on water consumption patterns in this region and analyses the hydration profiles of urban Latin American populations, emphasizing the role of pure water in daily intake.

Materials and methods: involving 5977 participants from Argentina, Brazil, Costa Rica, Ecuador, and Peru, the study utilized a cross-sectional approach, examining total water intake (TWI) through two nonconsecutive 24-hour dietary recalls. This study focused on understanding the contribution of pure water to daily hydration and identifying disparities in water consumption patterns across different demographic conditions by measuring the TWI from beverages.

Results: the findings indicated significant variations in hydration profiles based on country, sex, and socioeconomic status. The median TWI was 3245.6 g/day, with a median water intake from beverages of 1982.9 g/d kcal, which represented 61 % of the participants' total water intake. A total of 63.8 % of the overall sample met the TWI recommendations. Our data indicate that 38.4 % of the water intake came from plain water, followed by coffee and tea (16.9 %), commercial sugar-sweetened beverages (13.7 %), and homemade SSB (11.7 %).

Conclusion: these findings contribute to a deeper understanding of nutritional behaviors and may serve as a basis for future studies and health interventions focused on improving hydration habits, with emphasis on pure water consumption, especially in urban areas in developing regions.

Keywords: Hydration profiles. Latin America. Total water intake (TWI). Nutritional behavior. ELANS.

RESUMEN

Introducción: el agua es un componente crucial para la salud humana, necesario para diversas funciones corporales. A pesar de su importancia, investigaciones previas han prestado poca atención a la hidratación en América Latina, enfocándose en cambio en regiones con mayor acceso a una variedad de fuentes alimentarias.

Objetivo: por ello, este estudio ofrece datos exhaustivos sobre los patrones de consumo de agua en esta región y analiza los perfiles de hidratación de poblaciones urbanas latinoamericanas, destacando el papel del agua pura en la ingesta diaria.

Materiales y métodos: con la participación de 5977 personas de Argentina, Brasil, Costa Rica, Ecuador y Perú, el estudio empleó un enfoque transversal para examinar la ingesta total de agua (ITA) a través de dos recordatorios dietéticos de 24 horas no consecutivos. El objetivo fue entender la contribución del agua pura a la hidratación diaria e identificar disparidades en los patrones de consumo de agua según diversas condiciones demográficas, midiendo la ITA proveniente de bebidas.

Resultados: los resultados indicaron variaciones significativas en los perfiles de hidratación en función del país, el sexo y el estatus socioeconómico. La mediana de la ITA fue de 3245,6 g/día, con una ingesta media de agua de bebidas de 1982,9 g/d, lo que representó el 61 % de la ingesta total de agua. El 63,8 % de la muestra total cumplió con las recomendaciones de ITA. Los datos revelaron que el 38,4 % de la ingesta de agua provino de agua pura, seguido de café y té (16,9 %), bebidas comerciales azucaradas (13,7 %) y bebidas azucaradas caseras (11,7 %).

Conclusión: estos hallazgos proporcionan una comprensión más profunda del comportamiento nutricional y pueden servir como base para futuros estudios e intervenciones de salud dirigidas a mejorar los hábitos de hidratación, con un enfoque en el consumo de agua pura, especialmente en áreas urbanas de regiones en desarrollo.

Palabras clave: Perfil de hidratación. Latinoamérica. Ingesta total de agua (ITA). Hábitos nutricionales. ELANS.

INTRODUCTION

Water is the main constituent of the human body. Comprising approximately 45 %-75 % of the human body weight depending on age and status, and it is essential for maintaining proper hydration in the body and plays an important role in various bodily functions. Insufficient water intake can cause dehydration and trigger symptoms such as fatigue, dizziness, and impaired cognitive function (1-3). High carelessness during hydration has been observed, even when this behavior may cause several physiological problems such as kidney damage, urinary infection, cardiovascular problems, metabolic diseases, and even other psychological factors (4-6).

On the other hand, adequate hydration can have additional benefits, such as helping to improve cognitive development in children and adolescents, as well as reducing stress, and improving concentration. Moreover, hydration is an important factor in the practice of physical activity, itself key component when predicting their future academic and nutritional status (7,8).

The interest in the quantity and quality of consumed beverages daily has been evaluated at several levels through distinct perspectives. Previous analyses have shown that 22 % of water intake comes from food (9). This value is potentially higher in Latin America because of the accessibility to a great variety of fruits and vegetables. However, data on the assessment of hydration in these countries are limited (10) as little or no importance has been given to water consumption, which may be a result of its low energetic/caloric input. In spite of this, promoting adequate hydration can help to control and prevent metabolic and psychological diseases.

Total water intake (TWI) results from the sum of all types of liquids from foods and beverages. However, the recommendations on water intake established by international organizations are based on different methodologies. Thus, the European Food Safety Authority (EFSA) reference values for TWI base their recommendations for adolescents and adults on the population´s median water intake and urinary osmolarity (11) and have been documented to be more conservative than the reference values set by the USA Institute of Medicine (IOM). In this regard, the IOM’s recommendations are the median water intakes observed in the National Health and Nutrition Examination Survey (NHANES) (12), and they are unlikely to overestimate the number of people who do not adhere to the recommendations. Considering that other references for TWI are not available in Latin American countries, it is more appropriate to use the adequate TWI established by the IOM (12) in agreement with the findings of other Latin American studies (13,14).

Given the evidence pointing to the crucial role of water intake and hydration play in human health and body weight, it is necessary to develop new studies that can confirm the population´s real hydration status. Therefore, this study sought to analyze TWI and the intake of different beverages, determining the associations with IOM recommendations. Using population-based data from the Latin American Study of Nutrition and Health (Estudio Latinoamericano de Nutricion y Salud ELANS), we conducted an analysis on a sample of male and female individuals aged between 15 and 65 years living in urban areas of Argentina, Brazil, Costa Rica, Ecuador and Peru using two nonconsecutive 24-h dietary recalls. This study aimed to determine trends in ingested beverages and thus promote water intake based on international recommendations. In this way, generating knowledge that allows the introduction of hydration processes in an orderly, planned manner and according to the necessary physiological requirements.

MATERIALS AND METHODS

Study design

The Latin American Study of Nutrition and Health (ELANS) is a household-based, multicenter, cross-sectional study of nutrition and health surveillance (14). This study aimed to evaluate the nutritional intake, physical activity levels, and anthropometric data of the participants. ELANS was simultaneously conducted in eight Latin American countries (Argentina, Brazil, Chile, Colombia, Costa Rica, Ecuador, Peru, and Venezuela). The fieldwork was conducted from September 2014 to July 2015. The Western Institutional Review Board (#20140605) approved the international ELANS protocol, which was registered in ClinicalTrials.gov (#NCT02226627). In addition, the Institutional Review Boards (IRBs) of each country also approved the protocol, which ensured that the study was performed in accordance with the ethical standards. All participants signed a written informed consent/assent before their participation in the survey. The confidentiality of the participants for the pooled data was maintained using numerical identification codes instead of names. All the data were transferred with secure file-sharing systems. The design and methodology of the ELANS study have been described in Fisberg et al., 2016 (14).

Sample

The sample for this study consisted of 5977 participants aged 15 to 65 years from an urban population living in 5 Latin American countries (Argentina, Brazil, Costa Rica, Ecuador, and Peru). The ELANS used a random complex, multistage process in which the data were stratified by geographical region, sex, age, and socioeconomic level (SEL). The sampling size was calculated with 95 % confidence intervals and a sample error of 3.49 %. Sampling weighting was applied for each country. SEL was assessed using a country-dependent questionnaire considering legislative requirements or established local standards. Details of the study design and protocol can be found in Fisberg et al., 2016 (14).

Anthropometric measurements

The anthropometric measurements considered for the present study were body weight and height and were obtained by trained interviewers according to standardized procedures (14). Body weight was measured using a calibrated electronic scale with an accuracy of 0.1 kg. Height was measured with a portable stadiometer with an accuracy of 0.1 cm. For body mass index (BMI = weight (kg) / height (m^2)), among the 15-19-year-old participants, BMI was classified according to age and sex using the cutoff points from the WHO z-score (15) as underweight (BMI for age ≤ 2 z-scores), normal weight (-2 to 1 z-scores), overweight (1 to 2 z-scores), or obese (≥ 2 SD); additionally, the BMI for adults and the elderly (older than 19 years) was categorized as underweight (< 18.5 kg/m^2), normal weight (18.5-24.9 kg/m^2), overweight (25-29.9 kg/m^2), or obese (≥ 30.0 kg/m^2) (14)-

Dietary assessment

Dietary intake was obtained by trained interviewers from two face-to-face 24-hour dietary recalls (R24H) following the Multiple Pass Method

(MSM) (16) on two nonconsecutive days. The R24H provided detailed information on all foods and beverages, including water and alcoholic beverages, recipes, and supplements consumed. Reported intakes were quantified using a photographic album containing the most common household utensils and size portions adapted to each country. This information was transformed into grams and milliliters of food by trained nutritionists, and the data obtained were converted into energy using the Nutrition Data System for Research software (NDS-R version 2013) (10). Trained dietitians in each country performed a standardization procedure for food matching using the NDS-R software, developed by the Nutrition Coordinating Center of the University of Minnesota.

Usual water intake and energy from foods and beverages was determined using the multiple source method (MSM) (http://msm.dife.de/), a web-based tool developed by the European Prospective Investigation into Cancer and Nutrition (EPIC) to estimate the usual intake of nutrients, foods (beverages) and energy consumed by the participants. The MSM technique is used to convert individual intakes from the R24H to usual intake distributions (17).

The beverage consumption records included information on the type of fluid consumed and the volume of the intake. Age and sex recommendations for adequate TWI according to the IOM were taken to assess compliance with the TWI. The reference values were 3.7 L/day for adult men and 2.7 L/day for adult women and 3.3 L/day for boys and 2.3 L for girls (3,12,18). Energy intake included total sugars, comprising both intrinsic and added sugars, as sweetened beverages contribute to this nutrient.

The types of beverages were classified into four groups according to the categories proposed by the USDA and their respective subgroups (19): 1. Milk and dairy; 2. Nonalcoholic beverages (which were separated into commercial and homemade beverages); 3. Alcoholic beverages; 4. Water (Table I). The TWI was defined as the sum of all the categories. The amount of water in the reported fluids was given in grams.

Statistical analysis

The data were analyzed using the Statistical Package for Social Science (SPSS) software (version 22.0). For categorical variables, the data are reported as frequencies (i.e., percentages), and comparisons were made through the chi-square test. For continuous variables, the Kolmogorov-Smirnov test was used to evaluate the normality of the distribution. Given that the TWI was not normally distributed, we performed nonparametric tests (e.g., Mann-Whitney or Kruskal-Wallis tests). The descriptive statistics are presented as the mean, median, standard deviation. A p-value < 0.05 was considered to indicate statistical significance.

RESULTS

The TWI from food and type of beverages consumed were analyzed for 5977 ELANS participants, including 52.7 % female individuals aged 15-65 years and from the urban population of five Latin American countries (Argentina, Brazil; Costa Rica, Ecuador; and Perú). Overall, 89 % of the participants were in the middle- and low-income brackets. More than one-third of the participants (37.1 %) were normal in weight, and 59.5 % were overweight or obese (Table II).

Overall, the mean energy intake from the five countries included in this study was 2045 kcal/day: the average was highest in Ecuador (2213 kcal/day), followed by that in Argentina (2181 kcal/day), that in Peru (2111 kcal/day), and that in Costa Rica (1886 kcal/day); the lowest average was in Brazil (1835 kcal/day). The median TWI in the overall sample was 3245.6 g/day. Residents from Argentina (4018.4 g/d), males (3619.3 g/d), and adults (3262.9 g/d) reported a significantly higher TWI. The median water intake from beverages was 1982.9 g/d, which represented 61 % of the participants' total fluid intake, ranging from 89.3 % in Brazil to 63.8 % in Ecuador. The energy intake from beverages for the overall sample represented 23.4 % of the total energy intake. This percentage varies significantly among countries and between sexes, as shown in Table II. The results for compliance with the TWI recommendations according to the sociodemographic characteristics of the sample are shown in table III. In general, 63.8 % of the overall sample, 68.1 % of the men, and 60.0 % of the women consumed adequate amounts of water, as did 59.1 % of the adolescents and 64.2 % of the adults. Additionally, participants in the middle SEL who were overweight or obese had higher compliance than did those in the other subgroups. Compliance with daily water intake recommendations also varies among countries, ranging from 42.8 % in Brazil to 84.4 % in Argentina.

Differences among sex and age by country are shown in figures I and II. A higher percentage of adolescent females were compliant (71.4 % vs 50.6 %, $p < 0.001$). In contrast, adult males had a higher percentage of compliance (69.9 % vs 59.3 %, $p < 0.001$).

The contribution of water from the different groups of beverages included 38.4 % of the total water intake from plain water, followed by coffee and tea (16.9 %), commercial sugar-sweetened beverages (13.7 %), and homemade SSB (11.7 %) (Table IV). The contribution of plain water to total water intake varies among countries, with Costa Rica (51.0 %) and Brazil (50.4 %) showing the highest percentage and Peru (22.4 %) the lowest. Other significant differences were observed among commercial sugar-sweetened beverages (SSB), where Argentina (14.9 %) reported the highest consumption and Costa Rica (11.4 %) the lowest, and from homemade SSB, Peru showed the highest percentage (31.7 %) and Brazil the lowest (0.7 %). Brazil had the highest percentage of water intake from alcoholic beverages (13.1 %), and Argentina had the highest intake of coffee and tea (29.3 %). The contribution of plain water to total water intake was higher for women (38.5 % vs 37.5 %) and adolescents (39.4 % vs 38.2 %) in the overall sample and in every country, except in Peru, where the percentage of plain water was higher for adults than for adolescents.

Due to the nutritional composition, each beverage group exhibited a different contribution to total energy intake (TEI). Commercial sugar-sweetened beverages had the highest contribution to TEI in all the countries except for Peru, where homemade sugar-sweetened beverages were the contributors. The highest contributors to energy from beverages were coffee and tea (16.9 %), commercial SSB (13.7 %), homemade SSB (11.7 %), dairy drinks and substitutes (5.7 %), and alcoholic beverages (7.2 %). The contribution of alcoholic beverages to TEI was higher in Brazil than in other regions and, in males and adults, for the overall sample and for every country. Other variations among countries, sexes, and age groups are detailed in table V.

DISCUSSION

In the last decade, there has been a significant increase in the analysis of total water intake (TWI) and the hydration profile within the population. This increase is driven by the recognition of the vital role these factors play in sustaining both physical and mental functions. However, the consumption of sugar-sweetened beverages has been linked to a range of health issues, including obesity and a heightened risk of noncommunicable diseases. Consequently, having access to comprehensive data on fluid intake is invaluable for the formulation of effective public health policies and the development of health programs (13,20,21).

Multiple methods have been employed to assess water intake, including smart bottles and wrist-based sensor systems, but practical limitations have prompted the development of more accurate techniques, such as wireless surface electromyography (sEMG) (22). Neverthless, the R24H repeated in cross-sectional studies has been considered a valuable approach to collecting data on fluid intake, including tap water (23). However, this method has limitations, as it has been observed that as age increases, the population tends to underreport the consumption of sugary beverages (21). Also, the R24H was primarily designed to assess food intake and does not adequately account for fluid consumption outside of meals. In this context, underestimations of up to 500 ml/day have been previously reported (24). This study revealed an apparent underreporting situation, particularly among individuals with low body weight who had lower fluid consumption and those with normal weight and obesity who had higher TWI values.

The evaluation of the population's hydration profile, encompassing both pure water and water from beverages, aligns with findings from other research in different populations (13,15,20,25). The analysis of the TWI in the population belonging to the ELANS Study, revealed a median intake of water from beverages of 1984.4 g/day, with significant variations among countries. Similar medians of approximately 1980 g/day were observed in other cross-sectional surveys conducted in Latin American, European, and Asian countries, with notable disparities between nations. For instance, Japan reported the lowest TWI at 1500 g/day, while Germany had the highest TWI at 2470 g/day. Additionally, it was determined that at least 50% of both women and men did not meet the recommended fluid intake. These variations are often attributed to data collection in different seasons, with countries experiencing hotter summers expected to have higher fluid consumption. In this context, it is essential to consider other factors influencing liquid intake, such as weather, daily physical activity and dietary habits. (24,26) Factors such as age, sex, physical activity, drug consumption in some cases, energy intake, and environmental factors such as temperature and humidity may affect water needs, as mentioned by Laja et al. Therefore, personalized TWI recommendations should be considered if feasible (5).

The median TWI exhibited significant differences between sex and age groups, being significantly lower in women than in men, consistent with findings from various global studies (5,21,24,27,28).

This underscores the role of social and academic factors, including education, in fluid consumption, as developed countries tend to exhibit healthier lifestyles, particularly among women (29). In recent years, it has been shown that up to 89.7 % of young people do not meet the daily recommendations for fluid intake (30), which is reflected in the results found the study. In addition, the results obtained can be taken as a pre-pandemic baseline considering that during the pandemic, the interruption in normal academic routines, such as the suspension of face-to-face classes, caused changes in fluid intake behavior, in particular an increase in alcohol consumption among adolescent and young adult students (31).

Pure water accounted for 36 % of the TWI, while the other fluid intake came from nonalcoholic beverages, followed by alcoholic beverages and milk and dairy products. Similar patterns in terms of the contribution of pure water to the TWI and the consumption of other beverages were observed in studies conducted among the adult population, consistent with the present study (13,25,27). Notably, alcoholic beverages contribute energetically but not to hydration, suggesting that they are consumed (5). The patterns found reflect similarities with observations from studies conducted among adult populations, where the contribution of pure water to the TWI was 33 %. Furthermore, the consumption of other beverages closely paralleled the findings obtained in the present study (13,27,32).

When categorizing the sample by BMI, it was observed that subjects with a normal weight and those with overweight or obesity had similar TWIs, unlike the findings of previous research showing that water consumption is greater in adults with higher BMIs, which may be due to the limited amount of data (25). For decades, the sources of TWI and their associations with nutritional status have been researched. Notably, water consumption tends to be relatively low compared to the substantial contributions of other sources, including alcoholic and nonalcoholic beverages, which have been empirically linked to adverse health outcomes. The importance of dairy beverages as valuable sources of essential nutrients is highlighted in the studies conducted by Daniels and Popkin (2010) and O'Connor et al. (2014) (27,33).

A systematic review by Mukelbauer et al. noted that overweight and obese people tend to consume more water than their normal-weight counterparts do; however, it is important to note that Mukelbauer et al.'s review did not explicitly look at TWI (34). The elevated intake of plain water reported among overweight and obese individuals suggests a potential strategy for managing weight through increased fluid intake, as supported by previous research (32). Although Laja et al. also reported inverse associations between water consumption and body weight, body fat mass and waist circumference (5), the analysis of water consumption from pure water and other beverages is important. In our study, the youngest individuals exhibited the lowest level of fluid consumption, and those with a normal weight profile exhibited the highest levels of fluid consumption. Interestingly, the greatest contribution to energy intake from beverages was observed among participants with normal body weights. Furthermore, our study revealed notable disparities in both water and energy consumption patterns across different countries. Specifically, the median energy intake from beverages was calculated at 280.3 kcal/day, particularly in Latin American countries where the consumption of soft-sweetened beverages (SSB) and juices is notably high, representing a significant contribution to TWI (26), and underscoring the fact that the consumption of SSB significantly contributes to overall energy intake, consistent with prior research (21,35).

Fluid intake recommendations should be tailored to an individual's body mass. Typically, individuals with a normal weight tend to better meet their daily fluid needs, particularly women. Various authors have indicated that there is no substantial relationship between body mass index (BMI) and fluid consumption. However, there is evidence to suggest that BMI can influence factors such as body weight, body fat, and waist circumference normalization (5,28). Moreover, research has shown that substituting other beverages with water may promote weight loss in populations dealing with overweight and obesity (36). The meta-analysis by Chen et al. (2024) suggests that while water intake may not significantly affect adiposity in overweight and obese individuals (37). This aligns with our study, where overweight and obese subjects consume more water. However, replacing sugar-sweetened beverages with water could provide modest benefits for weight loss.

Adherence to adequate water intake from beverages, as per the recommendations set by the Institute of Medicine (IOM), exhibits notable variations between countries. Notably, half of the adolescents and less than half of the adult males met the recommendations, whereas half of the adolescent and adult females did. It becomes clear that the TWI shows a decreasing trend with advancing age. Furthermore, in international studies conducted across diverse regions, comparing fluid intake with recommendations, women consistently exhibit a greater likelihood of meeting adequate intake levels (24,38,39).

Fernández et al. highlighted a higher dairy consumption among children, probably due to constant encouragement from parents, and as people age, dairy consumption tends to decrease, giving way to hot beverages such as tea and coffee, as well as sugar-sweetened beverages. Despite these changes reported, we highlight that a significant percentage of adolescents do not meet the daily requirements of TWI, so we emphasize the importance of promoting proper hydration, given its influence on nutritional status (40).

The insights gleaned from this study underscore the critical need for a balanced and mindful approach to fluid consumption. This emphasizes the crucial importance of promoting increased pure water consumption to potentially mitigate dehydration-associated risks within the population.

CONCLUSIONS

Significant disparities in total fluid intake from beverages and water are readily observed across diverse countries, age cohorts, and nutritional conditions. Remarkably, these disparities do not exhibit any notable correlation with sex or socioeconomic determinants. Substantially, both adult and adolescent populations are susceptible to insufficient water intake related to the recommended water intake levels prescribed by the Institute of Medicine (IOM).

After analyzing the discrepancies based on sex, it becomes apparent that men, regardless of age group, fall shorter than their female counterparts in regard to reaching the recommended water intake. This emphasizes the urgency for further research to explore the potential health implications of inadequate TWI, as it elevates the risk of dehydration.

Recognizing the significance of having comprehensive fluid intake data gathered from population surveys, it becomes apparent that this information is invaluable for the formulation of evidence-based public health policies. In addition, this study provides a basis for the development of specific health programs designed to address these multifaceted concerns. Considering these findings, it is essential to establish region-specific initiatives and strategies within Latin America aimed at promoting water intake through appropriate hydration programs and promoting strong and ongoing hydration education campaigns. In doing so, Latin American nations can effectively address not only the pressing issues of overweightness and obesity and their metabolic consequences but also the prevailing challenges associated with sugary drink consumption and inadequate intake of pure water in the urban population.

Strengths and limitations

This research has both strengths and limitations that warrant consideration when interpreting its outcomes. Among its strengths, the use of a 24-hour recall method for food intake data collection is notable, as this approach is generally regarded as more precise than the food frequency questionnaires typically employed in studies with similar objectives. Moreover, the study benefits from a substantial sample size, which enables more accurate mean value calculations, the identification of potential outliers that could distort data in smaller samples, and a reduction in the margin of error.

However, certain limitations must be recognized. First, the data were collected before the onset of the SARS-CoV-2 pandemic, which could mean that the study results reflect a different state of total water intake. Along with the post pandemic periods, the pandemic may have further altered water consumption patterns through economic and social factors.

Second, the study's geographical scope was confined to urban areas within five Latin American countries, which excludes rural regions and other nations within the region. Consequently, the findings should not be broadly generalized to encompass all Latin American areas.

In addition, this study focused mainly on analyzing the hydration profile, covering both pure water and water derived from beverages. This approach does not improve the assessment of water intake from other food sources, as has been explored in other related studies.

Moreover, the study did not consider potential climatic variations in the countries under investigation, which could have influenced the results. Furthermore, the assessment of total water and fluid intake, conducted using the 24-hour recall method, may be associated with both insufficient and excessive consumption of various beverage types. Future research should contemplate the utilization of alternative assessment instruments, such as a 7-day fluid record, which is renowned for its heightened sensitivity in capturing fluid intake patterns.

Last, it is worth noting that Bardosono et al. have raised concerns regarding potential errors in calculating water intake based on the R24H method. While this method typically provides adequate estimations of energy and macronutrient intake, it tends to significantly underestimate absolute beverage intake in adolescents and adults when compared to a 7-day dietary record.

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Table I. Beverage classification according to the United States Department of Agriculture (USDA)

Group	Subgroup
Milk and dairy	Milk Flavored milk Dairy drinks and substitutes Yogurt
Nonalcoholic beverages	Commercial diet beverages Home-made beverages without sugar Sweetened commercial beverages Sweetened homemade beverages Coffee and tea
Alcoholic beverages	
Water	Plain water Flavored or enhanced water

USDA

Table II. The demographic characteristics included total water intake, water intake from beverages, and percentage of energy intake from beverages relative to total energy intake

			Total water intake (g/d)			Water intake from beverages (g/d)			Percentage of energy from beverages to total energy intake (%)		
Variables	***n***	**%**	**Mean (DS)**	**Median (P25-P75)**	***p*-value***	**Mean (DS)**	**Median (P25-P75)**	***p*-value***	**Mean (DS)**	**Median (P25-P75)**	***p*-value***
Total	5977	100	3513.8 (2773.1)	3245.6 (2470.5-4192.3)		2572.6 (2707.8)	1982.9 (1284.1-2888.4)		27.1 (19.4)	23.4 (14.5-35.4)	
Country											
Argentina	1266	21.2	4376.1 (5179.8)	4018.4 (3208.9-5009.2)	< 0.001	3559.3 (5154.7)	3202.7 (2410.7-4135.6)	< 0.001	29.7 (19.0)	26.4 (19.2-38.4)	< 0.001
Brazil	2000	33.5	2922.9 (1578.4)	2067.5 (1894.1-3491.2)		2162.8 (1478.4)	1847.1 (1214.7-2671.2)		26.3 (22.4)	21.2 (12.3-34.0)	
Costa Rica	798	13.3	3465.3 (1488.7)	3141.2 (2540.5-4043.2)		2497.9 (1307.1)	2192.3 (1677.0-2996.8)		23.4 (17.8)	21.2 (11.4-31.9)	
Ecuador	800	13.4	3619.9 (1501.8)	3413.1 (2844.7-4080.3)		2395.8 (1348.4)	2180.3 (1752.7-2760.2)		21.7 (15.8)	19.2 (12.5-27.3)	
Peru	1113	18.6	3556.3	3312.0 (2700.1-		2369.6	2129.9 (1634.4-		31.5 (15.5)	29.1 (20.3-40.2)	

			(1275.5)	4135.5)		(1113.3)	2876.6)					
Sex												
Male	28.29	47.3	3955.5 (3735.1)	3619.3 (2793.3-4665.9)	< 0.001	2924.8 (3687.3)	2540.3 3532.1)	(1845.8-	< 0.001	29.2 (21.2)	25.3 (15.1-38.0)	< 0.001
Female	31.48	52.7	3117.9 (1316.1)	2937.7 (2232.4-3764.9)		2257.0 (1222.6)	2039.5 2792.9)	(1466.3-		25.1 (17.3)	21.9 (14.0-33.1)	
Age group												
15 to 17.9	445	7.5	3224.2 (1185.2)	3095.6 (2392.0-3920.4)	< 0.050	2279.7 (1055.5)	2106.0 2857.4)	(1559.9-	< 0.050	26.0 (14.1)	24.1 (15.4-34.5)	0.235
18 to 65	5532	92.5	3537.7 (2861.4)	3262.9 (2478.9-4214.0)		2596.6 (2797.4)	2271.3 3184.0)	(1619.0-		27.1 (19.7)	23.4 (14.4-35.4)	
Socioeconomic level												
Low	2726	45.6	3500.6 (3746.2)	3195.3 (2387.1-4133.7)	0.350	2578.7 (3700.8)	2188.0 3168.2)	(1558.0-	0.984	26.8 (21.0)	22.5 (13.5-35.0)	0.165
Middle	2580	43.2	3507.3 (1572.5)	3265.7 (2500.0-4216.0)		2567.3 (1450.4)	2305.9 3143.3)	(1662.2-		27.0 (18.1)	23.8 (14.8-35.4)	

High	671	11.2	3597.7 (1406.1)	3351.1 (2607.9-4307.9)		2572.5 (1264.7)	2292.0 (1678.9-3141.4)		28.4 (16.7)	25.3 (16.5-36.8)	
Body mass index											
Underweight	203	3.4	3136.9 (1246.3)	3032.1 (2148.9-3919.7)	0.231	2153.6 (1131.0)	2029.3 (1350.3-2725.4)	0.148	25.0 (17.3)	21.5 (13.3-33.0)	0.211
Normal weight	2211	37.1	3555.0 (4061.2)	3256.4 (2461.4-4215.4)		2595.2 (4008.2)	2250.5 (1616.0-3122.0)		27.4 (19.3)	24.0 (15.0-35.6)	
Overweight/ Obese	3547	59.5	3510.9 (1606.7)	3252.8 (2485.7-4206.3)		2586.2 (1505.1)	2286.4 (1638.2-3195.7)		26.9 (19.6)	22.9 (14.2-35.2)	

*Mann-Whitney and Kruskal-Wallis tests for comparisons between groups. BMI: body mass index. BMI was classified based on WHO specifications.

Table III. Water intake recommendation compliance by sociodemographic characteristics of the sample (N (%))

Variables	**Inadequate consumption**	**Adequate consumption**	***p*-value***
Overall sample	2161 (36.2)	3817 (63.8)	
Sex			
Male	902 (31.8)	1927 (68.1)	< 0.001
Female	1259 (39.9)	1889 (60.0)	
Age group			
15-17.9 years	182 (40.9)	263 (59.1)	< 0.050
18-65 years	1979 (35.7)	35537 (64.2)	
Country			
Argentina	197 (15.6)	1068 (84.4)	
Brazil	1145 (57.2)	855 (42.8)	
Costa Rica	297 (37.2)	501 (62.7)	< 0.001
Ecuador	199 (24.9)	601 (75.1)	
Peru	323 (29.0)	790 (71.0)	
Socioeconomic level			
Low	1032 (37.9)	1694 (62.1)	
Middle	921 (35.7)	1659 (64.3)	< 0.010
High	208 (31.0)	463 (69.0)	
Body mass index			

Underweight	89 (43.8)	114 (56.2)	
Normal weight	814 (36.8)	1397 (63.2)	< 0.050
Overweight/Obesity	626.5 (35.1)	1149 (64.9)	

BMI: body mass index. BMI was classified based on WHO specifications. *p-values were determined through the chi^2 test. A value of $p < 0.05$ was considered to indicate statistical significance.

Table IV. Percent contribution (%) of beverage groups to water intake

	Plain water	Flavored or enhanced water	Milk	Flavored milk	Dairy drinks and substitutes	Yogurt	100 % juice	Commercial not SSB	Homemade not SSB	Commercial SSB	Homemade SSB	Coffee and tea	Alcoholic beverages
Overall sample	38.4	2.2	3.0	0.8	1.2	0.7	1.3	0.4	2.5	13.7	11.7	16.9	7.2
Male	37.5	2.4	2.8	0.7	1.1	0.6	1.3	0.4	2.2	14.5	12.1	14.5	10.0
Female	39.8	2.0	3.3	0.9	1.3	0.9	1.2	0.4	3.0	12.1	10.6	19.9	4.5
Adolescents	39.4	1.6	3.4	1.6	1.6	1.1	1.7	0.1	2.5	19.5	13.7	13.1	0.7
Adults	38.2	2.2	3.0	0.7	1.1	0.7	1.2	0.4	2.5	13.2	11.8	17.3	7.6
Argentina	*24.8*	*5.4*	*1.0*	*0.9*	*0.2*	*0.8*	*0.4*	*1.1*	*3.4*	*14.9*	*12.3*	*29.3*	*5.4*
Male	22.8	5.4	0.7	1.0	0.3	0.7	0.3	1.2	2.4	17.0	16.5	23.5	8.2
Female	28.1	5.1	1.3	0.7	0.1	0.9	0.4	1.0	4.4	12.1	7.4	36.1	2.3
Adolescents	26.1	3.4	1.1	2.7	0.1	1.7	0.3	0.1	3.6	21.7	16.5	21.2	1.5
Adults	25.7	5.3	1.0	0.8	0.2	0.7	0.3	1.1	3.3	14.0	11.7	30.3	5.5
Brazil	50.4	0.3	5.2	0.3	0.3	0.7	1.8	0.1	4.1	14.6	0.7	8.3	13.1
Male	47.9	0.3	4.9	0.2	0.4	0.5	1.9	0.1	3.9	15.6	0.6	7.6	15.8
Female	50.8	0.2	5.8	0.4	0.3	0.9	1.9	0.1	4.5	14.1	0.8	9.4	10.7
Adolescents	51.5	0.1	6.9	0.4	1.1	1.1	3.2	0.2	5.4	22.9	0.7	6.0	0.5
Adults	49.5	0.3	5.2	0.3	0.3	0.7	1.8	0.1	4.1	14.3	0.7	8.5	14.1
Costa Rica	51.0	0.1	3.9	0.3	0.3	0.3	0.3	0.2	0.7	11.4	8.0	18.7	4.7
Male	50.4	0.1	3.8	0.2	0.3	0.2	0.3	0.1	0.5	11.9	8.7	16.5	7.1
Female	53.6	0.1	4.0	0.3	0.3	0.4	0.4	0.3	0.9	10.5	6.8	21.0	1.5
Adolescents	54.8	0.0	4.2	0.6	0.2	0.2	0.1	0.0	0.8	18.6	7.1	13.3	0.2
Adults	51.5	0.1	3.9	0.2	0.3	0.3	0.3	0.2	0.7	10.6	8.0	18.9	5.0
Ecuador	49.8	2.2	4.7	0.2	1.2	0.7	4.1	0.0	0.1	13.3	11.8	6.6	5.1

Male	48.4	2.7	4.2	0.1	1.0	0.7	4.6	0.1	0.1	15.3	10.0	5.5	7.4
Female	51.6	1.5	5.3	0.3	1.5	0.8	3.5	0.0	0.1	10.9	14.0	8.0	2.5
Adolescents	55.1	1.6	4.5	0.0	0.6	1.0	0.0	5.2	0.2	14.2	10.3	6.6	0.7
Adults	49.4	2.3	4.7	0.2	1.3	0.7	4.0	0.1	0.1	13.2	11.9	6.6	5.5
Peru	22.4	1.7	0.8	2.3	4.8	0.9	0.5	0.0	1.7	11.6	31.7	16.1	5.4
Male	22.1	2.3	0.7	1.6	4.3	0.8	0.5	0.0	2.0	12.5	31.1	14.0	8.2
Female	22.8	0.9	1.0	3.1	5.3	1.2	0.5	0.0	1.4	10.6	32.6	18.6	2.0
Adolescents	20.0	2.3	1.0	3.2	6.1	1.1	0.4	0.0	0.6	16.7	33.1	15.3	0.2
Adults	22.6	1.6	0.8	2.2	4.7	0.9	0.5	0.0	1.8	11.2	31.6	16.2	5.8

SSB: sugar-sweetened beverages.

Table V. Percent contribution (%) of beverage groups to total energy intake

	Plain water	Flavored or enhanced water	Milk	Flavored milk	Dairy drinks and substitutes	Yogurt	100 % juice	Commercial not SSB	Homemade not SSB	Commercial SSB	Homemade SSB	Coffee and tea	Alcoholic beverages
Overall sample	0.0	1.4	11.3	4.5	3.8	3.4	2.9	0.0	1.2	29.9	14.3	10.5	16.7
Male	0.0	1.5	9.6	3.7	3.3	2.6	2.8	0.0	1.0	31.1	13.8	8.7	21.9
Female	0.0	1.3	13.1	5.3	4.3	4.3	3.0	0.0	1.5	28.7	14.8	12.4	11.3
Adolescents	0.0	1.2	11.2	7.5	4.3	4.5	3.2	0.0	1.2	38.3	15.9	10.7	2.0
Adults	0.0	1.5	11.3	4.2	3.7	3.3	2.9	0.0	1.2	29.3	14.2	10.5	17.8
Argentina	0.0	4.4	3.8	4.3	1.4	4.5	1.0	0.1	0.5	31.2	5.5	26.8	16.6
Male	0.0	3.9	2.5	4.3	1.6	3.5	0.7	0.1	0.3	33.0	5.7	21.0	23.4
Female	0.0	4.8	5.2	4.3	1.2	5.6	1.4	0.1	0.7	29.4	5.2	33.0	9.3
Adolescents	0.0	2.8	3.5	10.9	0.6	7.7	0.6	0.0	0.4	39.1	7.2	23.7	3.6
Adults	0.0	4.5	3.8	3.8	1.4	4.3	1.0	0.1	0.5	30.7	5.3	27.0	17.5
Brazil	0.0	0.2	19.1	4.9	1.2	3.0	4.3	0.0	2.9	36.3	0.8	0.7	26.6
Male	0.0	0.3	16.4	4.2	1.1	2.0	4.2	0.0	2.5	36.6	0.6	0.7	31.6
Female	0.0	0.1	21.8	5.6	1.2	4.1	4.5	0.0	3.3	36.0	1.0	0.7	21.7
Adolescents	0.0	0.0	21.2	8.6	3.8	3.9	6.0	0.0	3.6	48.4	0.9	0.5	3.1
Adults	0.0	0.2	18.	4.6	1.0	3.0	4.2	0.0	2.8	35.6	0.8	0.7	28.1

			9										
Costa Rica	0.0	0.2	14.4	2.6	1.4	1.4	0.7	0.0	0.9	31.1	27.9	7.7	11.8
Male	0.0	0.2	12.7	2.2	1.1	0.8	0.6	0.0	0.8	29.6	28.8	6.3	17.0
Female	0.0	0.2	16.4	3.0	1.9	2.2	0.9	0.1	0.9	33.0	26.7	9.3	5.4
Adolescents	0.0	0.0	14.6	4.6	0.9	0.9	0.1	0.0	0.4	44.2	22.6	11.3	0.4
Adults	0.0	0.2	14.3	2.4	1.5	1.5	0.8	0.0	0.9	29.9	28.4	7.3	12.8
Ecuador	0.0	0.8	16.2	1.1	4.8	4.0	9.4	0.0	0.1	31.3	20.2	2.6	9.4
Male	0.0	1.2	13.4	0.7	3.3	3.7	10.1	0.0	0.1	35.7	15.6	2.5	13.7
Female	0.0	0.5	19.3	1.6	6.4	4.4	8.6	0.0	0.1	26.5	25.3	2.7	4.6
Adolescents	0.0	1.4	16.1	0.4	2.2	6.0	12.2	0.0	0.4	39.0	18.6	1.9	1.8
Adults	0.0	0.8	16.2	1.2	4.9	3.9	9.2	0.0	0.1	30.8	20.4	2.7	9.9
Peru	0.0	1.1	3.6	6.8	11.0	3.6	0.8	0.0	0.4	17.6	33.7	13.2	8.2
Male	0.0	1.7	3.1	4.9	9.9	2.8	0.7	0.0	0.3	19.1	33.1	11.9	12.6
Female	0.0	0.6	4.2	8.8	12.1	4.4	0.8	0.0	0.4	16.1	34.2	14.5	4.0
Adolescents	0.0	1.5	3.4	8.2	10.8	3.8	0.6	0.0	0.3	23.5	34.3	13.4	0.3
Adults	0.0	1.1	3.7	6.7	11.0	3.6	0.8	0.0	0.4	17.0	33.6	13.2	9.0

SSB: sugar-sweetened beverages.

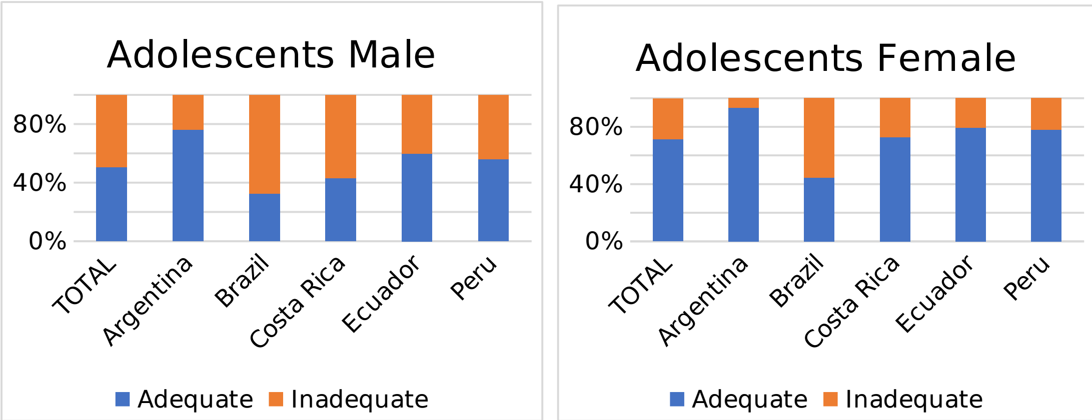

Figure 1. Distribution of those < 18 years old who compliance the water intake.

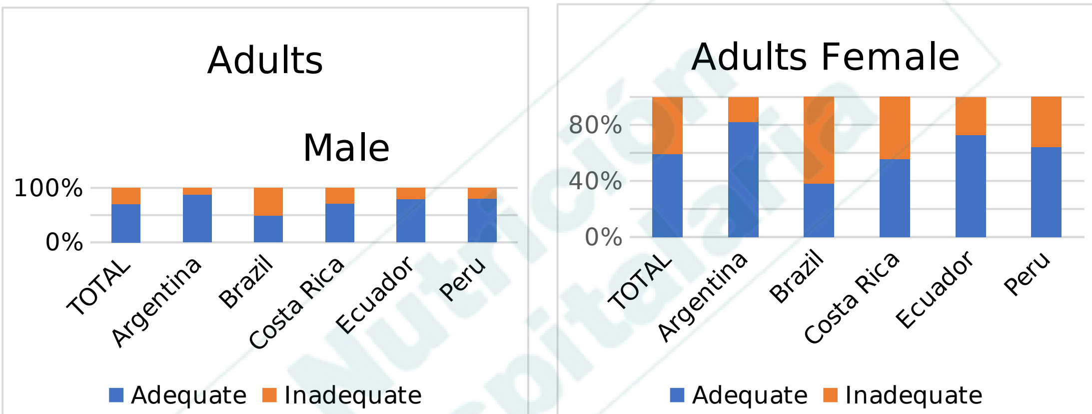

Figure 2. Distribution of those > 18 years old who compliance water intake.