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Fluid intake from beverages in Spanish adults; cross-sectional study

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Abstract

Introduction: Dietary questionnaires usually only assess the intake of drinks that provide calories, but do not accurately evaluate total fluid or water intake. The evaluation of the fluid consumption pattern of a population has been the main objective of only a very few studies.

Objective: To evaluate the total fluid intake from different types of beverages in Spanish adults.

Methods: A total of 1,262 adults aged 18-70 years were randomly recruited from all Spanish regions. The information about the quantity and quality of daily fluid intake from different types of beverages was collected using a 24h fluid-specific diary over 7 consecutive days.

Results: 50.4% of the study population had a fluid intake < 80% of the EFSA recommendations for total water intake. The odds of meeting the recommendations of total fluid intake were higher in women [OR: 2.48; 95% CI: 1.81-3.40], and in those with higher leisure-time physical activity (3-4 times/week [OR: 1.57; 95% CI: 1.01-2.46]; 5 times/week or more [OR: 1.97; 95% CI: 1.37-2.83]). Women consumed significantly more hot and sweet light beverages. However, men consumed significantly more sweet regular and alcoholic drinks. A significant higher percentage of young and normal/underweight subjects exceed the WHO recommendations for free sugars (> 10% total energy intake) from beverages alone.

Conclusion: Half of the adults studied do not meet the EFSA fluid intake recommendations. Water is the main fluid consumed. Differences in the pattern of fluid consumption were observed between ages and genders. A quarter of the population studied consumes from beverages alone already more sugar than recommended from the total diet.

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Key words: Fluid intake. Spain. Beverages. Water. Adult.

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INGESTA DE LÍQUIDOS A PARTIR DE BEBIDAS EN ADULTOS ESPAÑOLES; ESTUDIO TRANSVERSAL

Resumen

Introducción: Los cuestionarios dietéticos, solamente evalúan la ingesta de bebidas calóricas. Sin embargo, no evalúan adecuadamente la ingesta total de líquidos o de agua.

Objetivo: Evaluar la ingesta total de líquidos procedente de diferentes tipos de bebidas, en adultos españoles.

Métodos: 1.262 adultos (18-70 años) fueron seleccionados al azar en regiones españolas. La información sobre la cantidad y calidad de la ingesta diaria de líquidos se recogió mediante un registro de 24 horas específico para la evaluación de fluidos durante 7 días consecutivos.

Resultados: La ingesta de agua a partir de diferentes bebidas estaba por debajo de las recomendaciones de la EFSA en el 50,4% de la población. La probabilidad de cumplir las recomendaciones de la EFSA para la ingesta de agua fue mayor en mujeres [OR: 2.48, IC95%: 1.81-3.40], y participantes con mayor práctica de actividad física (3-4 veces/semana [OR: 1,5, IC95%: 1.01-2.46]; 5 o más veces/semana [OR: 1.97, IC95%: 1.37-2.83]). Las mujeres consumían más bebidas calientes y refrescos light. El consumo de refrescos regulares y de bebidas alcohólicas fue mayor en los hombres. Un mayor porcentaje de hombres, jóvenes y participantes con IMC < 30 kg/m² consumían azúcar procedente de bebidas, por encima de las recomendaciones de la OMS.

Discusión: La mitad de la población estudiada no cumple las recomendaciones de la EFSA para la ingesta de fluidos. El agua embotellada o del grifo es la principal bebida consumida. Existen diferencias en el consumo de bebidas en relación a la edad y género. Una cuarta parte de la población estudiada consume un exceso de azúcar procedente de las bebidas.

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Palabras clave: Ingesta de líquidos. España. Bebidas. Agua. Adultos.

Introduction

Water is a natural resource that is essential for life and for human daily nutrition¹. Total body water represents between 50% and 70% of total body weight^{2,3}, and is therefore the greatest component of the human body⁴. Body water is essential for the physiological processes of digestion, absorption, metabolism and elimination of non-digestible metabolic wastes, and also for the structure and function of the circulatory system. It also transports nutrients and other body substances, and directly helps to maintain body temperature⁵.

It is assumed that the contribution of food to total water intake is approximately 20%, whereas fluids, including tap and bottled water and other types of beverages, provide 80%⁶. Fluids provide not only water but also minerals and other nutrients. For example, water, especially natural mineral water, may provide calcium, magnesium and sodium; tea provides flavonoids, antioxidants and a few micronutrients, and milk provides proteins, calcium and vitamins. In fact, some fluids can provide micronutrient levels comparable with those of some natural foods⁷. The excess or deficiency of these compounds provided by different types of beverages can determine the state of health or disease. For example, a meta-analysis in 2010 demonstrated that a high consumption of sugar-sweetened beverages is associated with the presence of type II diabetes and metabolic syndrome, in part because of their contribution to weight gain⁸.

Estimating the total fluid intake and real beverage pattern of a population is a real challenge to nutritional epidemiology. Dietary questionnaires are given to assess food intake but not to assess fluid consumption as a whole, because they usually focus only on the intake of solid foods and drinks providing calories. For this reason and because fluids are often consumed outside mealtimes, and are not perceived as a food, fluid intake tends to be underestimated⁹⁻¹². This may explain the important intra and inter-individual differences observed in the amount and pattern of fluid intake in different populations^{4,13-16}. For example, data collected by the same method showed that the main sources of fluid intake are water, sugar-sweetened beverages and hot drinks in Canadian¹⁶, Mexican^{17,18} and United Kingdom populations¹⁹, respectively. The main aim of the present study is to evaluate the total fluid and sugar intake provided by different types of beverages in Spain, to assess the percentage of individuals complying with the EFSA recommendations for total fluid intake and the WHO recommendations for sugars coming from total diet, and to assess the associated determinants of the total fluid intake in adult individuals.

Methods

Design and study population

The present study is a cross-sectional analysis of Spanish data, designed to assess the sources of fluid

consumption, from water to different types of beverages, and the association of this consumption with lifestyle and health. The study took place between March and May 2012, and 1,502 participants were randomly recruited from a database of voluntary individuals for population surveys after they had been stratified by age, gender, region (except Ceuta, Melilla and Canary Islands), habitat (rural or urban), educational and socioeconomic level.

Participants working in advertising, marketing, market research, media or manufacture, distribution and sale of different types of beverages, participants reporting a mean fluid intake below 0.4 L or higher than 6 L daily, and those participants that did not complete the fluid intake record were excluded (n = 240). So, the effective sample size for these analyses was 1,262 participants, all of whom provided informed consent.

Assessment of fluid intake

A fluid-specific record was provided to all participants so that they could collect information on their usual intake of fluids over 7 consecutive days. The data were collected at two different times: a first interview at home, when the record was delivered and explained, and a second visit after 7 days, when the completed questionnaire was collected after the interviewer had checked it with the participants. The record asked participants when they consumed fluids during the day, what beverages they consumed and in what volumes using standard portion sizes (one standard serving, cup, glass, can, bottle, etc). Sugar from beverages was calculated using updated Spanish food composition tables²⁰. The addition (by hand) of sugar to each beverage was also evaluated and participants were asked to state the number of teaspoons used. The total sugar provided by beverages was calculated as the sum of the amount contained in the beverage and added by the participant.

There were eleven possible responses to the question "moment of fluid consumption": Just after you wake up, at breakfast, during the morning, just before the lunch, at lunch, during the afternoon, just before dinner, at dinner, after dinner, just before going to bed, during the night. The intake of fluid *outside the main meals* at whatever time was regarded as being different from breakfast, lunch and dinner.

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 derivatives (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).

The percentage of individuals who did not follow the recommendations of the European Food Safety Agency (EFSA) for total water intake was calculated. 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 water²¹, since water is the preferred beverage to fulfil daily water needs according to a guidance system in the United States⁷.

Assessment of other variables and lifestyle factors

Leisure-time physical activity of more than thirty minutes a day was evaluated with a self-reported questionnaire. There were four possible responses: five times a week or more, between three and four times a week, between once and twice a week, and once every two weeks or less. In addition, variables such as marital status, socioeconomic characteristics, region, habitat (urban or rural) and education level were also assessed. The Institute of Medicine (IOM) equations were used to estimate the total energy expenditure of each individual²², so that the percentage of individuals consuming more than 10% of energy requirements as free sugar, as recommended by WHO, could also be calculated²³.

Assessment of body composition

Height in metres (m) and weight in kilograms (kg) were evaluated with a self-reported questionnaire. With these values, body mass index (BMI) was calculated in kg/m².

Statistical analysis

All the data are presented either as means and 95% confidence intervals (CI) for continuous variables or numbers and percentages for dichotomous variables. We compared the distribution of the selected characteristics between groups using 2 tests for categorical variables or Student's t-tests or analysis of variance (ANOVA), as appropriate, for continuous variables. The Bonferroni post-hoc test was used to correct for multiple comparisons. The odds ratio for meeting the EFSA recommendations or not for water intake (dependent

variable) was assessed for several variables by logistic regression models adjusted for gender, age (years), body mass index (kg/m²), socioeconomic characteristics (lower and middle-low, middle, upper-middle and high), habitat (5,000-30,000 inhabitants, 30,000-200,000 inhabitants, more than 200,000 inhabitants), educational level (primary education, secondary education, high education) and leisure-time physical activity (once every 2 weeks or less, once or twice per week, 3-4 times/week and ≥ 5 times/week). All statistical tests were two-tailed and the significance level was set at $P < 0.05$. All analyses were performed using the SPSS software version 19.0 (SPSS Inc, Chicago, IL).

Results

A total of 1,262 participants (630 men and 632 women) took part with a mean age of 43 years and recruited from all over Spain (except Ceuta, Melilla and the Canary Islands). There were no significant differences in the proportion of individuals in different age categories, region, type of habitat and educational level between the study sample and the Spanish population as a whole. No gender differences were observed in the prevalence of age categories, type of habitat or education level. The baseline characteristics of participants are summarized in table I. The body-mass-index and the proportion of individuals with overweight or obesity was higher in men than in women. Most of the study population were of middle socioeconomic status and secondary educational level, and reported low leisure-time physical activity. Women were more sedentary than men.

The mean volume consumed of water (tap water, filtered tap water, natural mineral water, sparkling mineral water, flavoured water and fountain water) was 1,011 ml/day for the whole population (1,050 ml for women and 973 ml for men). Water intake from different types of beverages was below the EFSA recommendations (1,600 ml/d for women and 2,000 ml/d for men) in 50.4% of the whole population (41.6% of women and 59.2% of men). In total, 40.3% of the study population (31% of the women and 49.5% of the men) consumed < 90% of EFSA recommended for total fluid intake. 20.1% of the whole population (20.9% of the women and 19.4% of the men) consumed between 90 and 110% of the total EFSA recommendations, and 39.6% of whole population (48.1% of the women and 31.1% of the men) consumed > 110% of the EFSA recommendations ($P < 0.001$) (data not shown).

The odds of meeting the EFSA recommendations for water intake (table II) was higher in women [OR: 2.48; 95% CI: 1.81-3.40], and in participants with higher leisure-time physical activity (3-4 times a week [OR: 1.57; 95% CI: 1.01-2.46]; 5 times a week or more [OR: 1.97; 95% CI: 1.37-2.83]).

Table III shows the total daily fluid intake and the amount of each type of beverage consumed according

Table I
General characteristics of the study population

Baseline variables	All population (n = 1,262)	Women (n = 632)	Men (n = 630)	P value ^a
Age, years	43 (41.9, 43.5)	43 (41.5, 43.7)	43 (41.8, 43.7)	0.74
Age categories, % (n)				0.76
18 to 35 years	34 (431)	33 (212)	35 (219)	
36 to 50 years	35 (447)	37 (233)	34 (214)	
51 to 65 years	24 (305)	24 (149)	25 (156)	
66 to 70 years	6 (79)	6 (38)	6 (41)	
BMI, kg/m²	25.6 (25.4, 25.8)	25.1 (24.7, 25.4)	26.1 (25.8, 26.4)	<0.001
BMI classification, % (n)^b				<0.001
Under and normal weight	51 (638)	58 (367)	43 (271)	
Overweight	36 (453)	28 (177)	44 (276)	
Obesity	13 (171)	14 (88)	13 (83)	
Region, % (n)				0.99
Region 1 (Catalonia/Aragon)	12 (156)	12 (76)	13 (80)	
Region 2 (east)	18 (226)	18 (116)	17 (110)	
Region 3 (south)	20 (251)	19 (122)	20 (129)	
Region 4 (centre)	7 (87)	7 (45)	7 (42)	
Region 5 (north-centre)	8 (98)	8 (48)	8 (50)	
Region 6 (northwest)	9 (115)	10 (60)	9 (55)	
Barcelona and Madrid	26 (329)	26 (165)	26 (164)	
Habitat, % (n)				0.27
5,000 to 30,000 inhabitants	31 (389)	31 (197)	30 (192)	
30,000 a 200,000 inhabitants	36 (450)	37 (236)	34 (214)	
More than 200,000 inhabitants	33 (423)	32 (199)	36 (224)	
Socioeconomic level, % (n)				0.004
Lower and middle-low	31 (391)	34 (215)	28 (176)	
Middle	44 (552)	45 (281)	43 (271)	
Upper-middle and high	25 (319)	22 (136)	29 (183)	
Educational level, % (n)				0.06
Primary education	17 (217)	17 (104)	18 (113)	
Secondary education	64 (803)	67 (421)	61 (382)	
Higher education	19 (242)	17 (107)	21 (135)	
Leisure-time physical activity, % (n)				<0.001
1 time every 2 weeks or less	41 (521)	48 (301)	35 (220)	
1-2 times a week	20 (246)	16 (100)	23 (146)	
3-4 times a week	15 (191)	12 (78)	18 (113)	
5 times a week or more	24 (304)	24 (153)	24 (151)	

Data expressed as means (95% CI) or percentages (n). Abbreviations: BMI, body mass index. ^aP values for comparisons between groups were tested by Student's t-test or χ^2 as appropriate.

^bBMI (kg/m²) was divided into the following categories: underweight and normal weight (BMI < 24.9 kg/m²), overweight (BMI between 25-30 kg/m²), and obesity (BMI > 30.0 kg/m²).

to gender. Women consumed significantly more hot and sweet light beverages than men. Consumption of sweet regular beverages and alcoholic drinks was significantly higher in men than in women. No significant differences were observed for total fluid intake or water intake between genders.

Total fluid intake and beverage consumption according to age ranges are shown in table IV. Younger participants (18-35 years) consumed fewer hot beverages, more fruit juices and more sweet regular beverages than others age categories (P < 0.05). Participants aged between 51-65 years consumed significantly more alcoholic drinks than younger participants. There were no significant differences in total fluid intake or water intake between age categories.

The total daily intake of different types of beverage and when they were consumed (during the main meals/outside the main meals) are described in table V. No significant differences were observed in the times at which water and juices were consumed throughout the study population for either women or men.

The consumption of hot beverages, sweet regular beverages, and alcoholic drinks was significantly higher during the main meals than at other times of the day. During the main meals –for the whole population and women, but not for men–, the intake of sweet light beverages, and milk and derivatives was significantly greater than at other times. In both genders, total fluid intake was significantly higher during the main meals.

Table II
Association (Odds ratio) between compliance with EFSA recommendations for total daily fluid intake and several socio-demographic variables

Variables	All population (n = 1,262)	Women (n = 632)	Men (n = 630)
Gender ^a	2.48 (1.81-3.40)	-	-
Age	0.99 (0.98-1.00)	0.99 (0.98, 1.01)	0.99 (0.97-1.01)
BMI	0.99 (0.96-1.03)	1.00 (0.96-1.05)	1.05 (0.98-1.12)
Habitat			
5,000 to 30,000 inhabitants	1 (ref)	1 (ref)	1 (ref)
30,000 to 200,000 inhabitants	1.30 (0.91-1.85)	1.31 (0.84-2.04)	1.35 (0.73-2.49)
More than 200,000 inhabitants	0.71 (0.48-1.05)	0.63 (0.38-1.05)	0.83 (0.43-1.60)
Socioeconomic level			
Lower and middle-low	1 (ref)	1 (ref)	1 (ref)
Middle	1.12 (0.76-1.64)	1.04 (0.65-1.67)	1.16 (0.59-2.29)
Upper-middle and high	1.22 (0.75-1.99)	1.33 (0.73-2.44)	1.01 (0.43-2.40)
Educational level			
Primary education	1 (ref)	1 (ref)	1 (ref)
Secondary education	0.92 (0.57-1.15)	0.97 (0.53-1.78)	0.90 (0.41-1.98)
Higher education	1.06 (0.56-1.99)	1.38 (0.62-3.09)	0.81 (0.28-2.34)
Leisure-time physical activity			
1 time every 2 weeks or less	1 (ref)	1 (ref)	1 (ref)
1-2 times a week	0.91 (0.57-1.43)	0.98 (0.55-1.74)	0.85 (0.39-1.86)
3-4 times a week	1.58 (1.01-2.46)	1.24 (0.68-2.25)	2.13 (1.05-4.32)
5 times a week	1.97 (1.37-2.86)	1.85 (1.18-2.89)	2.28 (1.19-4.36)

Data expressed as ORs (95% CI). ^aGender was coded as 0 for men and 1 for women.

Table III
Total daily consumption of different types of beverage (ml/day) in all population and stratified by gender

Variables	All population (n = 1,262)	Women (n = 632)	Men (n = 630)	P value ^a
Water	1011 (973, 1049)	1050 (997, 1103)	973 (918, 1027)	0.05
Hot beverages	305 (290, 320)	349 (327, 371)	261 (242, 279)	<0.001
Milk and derivates	103 (92, 114)	94 (83, 106)	111 (93, 129)	0.14
Juices	94 (84, 104)	88 (77, 99)	101 (85, 117)	0.20
Sweet regular beverages	152 (136, 167)	128 (111, 145)	176 (150, 201)	0.003
Sweet light beverages	38 (28, 48)	50 (35, 64)	26 (12, 40)	0.02
Alcoholic drinks	195 (176, 215)	103 (86, 121)	288 (255, 320)	<0.001
Beer and wine	179 (161, 197)	93 (76, 109)	265 (234, 297)	<0.001
Spirit drinks	16 (13, 19)	10 (6, 14)	22 (17, 27)	<0.001
Total daily fluid volume	1901 (1856, 1946)	1865 (1804, 1927)	1937 (1872, 2003)	0.12

Data expressed as means (95% CI). ^aP values for comparisons between gender were tested by Student's t-test.

When stratified by BMI, obese participants consumed more hot beverages and less milk and milk derivates than participants from the other BMI categories ($P < 0.05$). Overweight individuals consumed more alcoholic drinks than those with obesity or normal weight ($P < 0.05$) (data not shown).

The whole population consumed a total of 46.7 g/d (187 kcal/d) of sugar added by hand and contained in beverages, men consumed 52 g/d (208 kcal) and women 41.2 g/d (165 kcal) ($P < 0.001$).

The consumption of calories from sweet regular beverages (48.5 kcal in women; 67.4 kcal in men) and alcoholic drinks (13.4 kcal in women; 32.9 kcal in men) was significantly higher in males than females. No significant differences between genders were found for the other beverages (data not shown).

Table VI shows the percentage of participants who consumed more sugar than is recommended by WHO²⁴ only from beverages (less than 10% of the estimated energy requirements). Younger participants and people with normal or underweight more frequently consume sugar over the recommendations ($P < 0.001$) than old individuals or people with overweight. Compared to men, a higher percentage of women consumed sugar above the recommendations ($P = 0.08$).

Discussion

The main objective of the present pioneering study is to estimate the total fluid intake and the real fluid pattern of a large sample of Spanish individuals. We re-

Table IV
Total daily consumption of different types of beverages (ml/day) stratified by age range

Variables	18-35 years (n = 431)	36-50 years (n = 447)	51-65 years (n = 305)	66-70 years (n = 79)	P value ^a
Water	1037 (972, 1102)	1019 (953, 1084)	958 (884, 1032)	1036 (867, 1204)	0.46
Hot beverages	224 (202, 247) ^b	330 (305, 356) ^c	370 (340, 399) ^c	352 (297, 407) ^c	<0.001
Milk and derivates	141 (117, 165) ^b	89 (73, 104) ^c	76 (60, 93) ^c	76 (42, 110) ^c	<0.001
Juices	117 (101, 134) ^b	96 (76, 115)	64 (50, 79) ^c	76 (45, 107)	0.001
Sweet regular beverages	233 (199, 266) ^b	144 (121, 168) ^{c,d}	71 (49, 92) ^{c,e}	79 (30, 104) ^c	<0.001
Sweet light beverages	53 (35, 71)	38 (25, 52)	23 (0, 49)	8 (0, 17)	0.07
Alcoholic drinks	140 (116, 164) ^b	200 (168, 231)	271 (220, 322) ^c	181 (120, 242)	<0.001
Beer and wine	113 (92, 135) ^b	189 (159, 220) ^c	257 (207, 306) ^c	179 (118, 197)	<0.001
Spirit drinks	26 (19, 33) ^b	10 (6, 14) ^c	14 (8, 20) ^c	2 (0, 5) ^c	<0.001
Total daily fluid volume	1948 (1867, 2028)	1919 (1843, 1994)	1836 (1749, 1923)	1798 (1626, 1970)	0.18

Data expressed as means (95% CI). ^aP values for comparisons between groups were tested by bivariate analysis of variance (ANOVA) followed by post hoc tests with the Bonferroni correction. P < 0.05 for differences between letters (^b versus ^c and ^d versus ^e).

Table V
Total daily intake of different types of beverages (ml/day) by moment of consumption

Variables	All population (n = 1,262)			Women (n = 632)			Men (n = 630)		
	During the main meal	Outside the main meal	P value ^a	During the main meal	Outside the main meal	P value ^a	During the main meal	Outside the main meal	P value ^a
Water	503 (481, 525)	508 (479, 536)	0.78	513 (484, 543)	536 (495, 577)	0.37	492 (460, 525)	480 (440, 520)	0.60
Hot beverages	173 (164, 182)	131 (121, 141)	<0.001	186 (174, 198)	163 (147, 179)	0.01	160 (147, 173)	100 (88, 111)	<0.001
Milk and derivates	59 (52, 65)	44 (36, 52)	0.003	55 (46, 63)	39 (32, 47)	0.005	62 (52, 72)	48 (34, 62)	0.09
Juices	48 (42, 55)	45 (39, 51)	0.44	43 (35, 51)	45 (37, 52)	0.71	54 (43, 66)	46 (37, 55)	0.18
Sweet regular beverages	103 (91, 114)	49 (42, 56)	<0.001	90 (75, 105)	38 (31, 45)	<0.001	116 (97, 134)	60 (47, 72)	<0.001
Sweet light beverages	25 (18, 31)	12 (7, 18)	<0.001	34 (23, 45)	15 (9, 20)	<0.001	15 (9, 21)	10 (1, 20)	0.24
Alcoholic drinks	108 (96, 120)	87 (76, 98)	0.001	60 (49, 72)	43 (34, 52)	0.002	156 (136, 177)	131 (112, 150)	0.03
Beer and wine	106 (95, 118)	72 (62, 82)	<0.001	59 (47, 70)	33 (25, 41)	<0.001	154 (134, 175)	111 (93, 128)	<0.001
Spirit drinks	1 (1, 2)	14 (11, 17)	<0.001	1 (0, 2)	9 (5, 12)	<0.001	2 (0, 3)	20 (15, 24)	<0.001
Total daily fluid volume	1022 (1000, 1044)	879 (844, 914)	<0.001	984 (955, 1013)	881 (832, 929)	<0.001	1059 (1027, 1092)	877 (826, 928)	<0.001

Data expressed as mean (95% CI). ^aP values for comparisons between during and outside meals were tested by Student's t-test.

Table VI
Participants exceeding the WHO recommendation of < 10% energy from free sugar, from beverages consumption

	n	%	P value ^a
Gender			
Women (n = 632)	185	29.3	0.08
Men (n = 630)	156	24.9	
Age, categories			
18-35 years old (n = 431)	164	38.1	<0.001
36-50 years old (n = 447)	122	27.3	
51-65 years old (n = 305)	47	15.4	
66-70 years old (n = 79)	9	11.4	
BMI, categories			
Under and normal weight (n = 638)	204	32	<0.001
Overweight (n = 453)	101	22.3	
Obesity (n = 171)	37	21.6	

^aP values for comparisons between groups were tested by Student's t-test or χ^2 as appropriate. * Sugar recommendations: < 10% of the daily energy intake²³.

port for the first time that approximately half of the adult population do not cover the total water intake recommended by the EFSA²¹.

Our results are in agreement with the data collected by the EFSA⁹ evaluating fluid consumption in 13 European countries and which show that only Denmark and Germany consumed a mean of at least two liters of water per individual from all types of beverages. Our findings also add new knowledge to the current scientific literature made by other research^{9,13,24}, showing that a considerable proportion of Spanish adults do not have a healthy fluid consumption pattern.

Interestingly, in our study compliance with recommendations for total fluid intake was mainly associated with physical activity and with being a woman, but not with education, socioeconomic status or type of habitat (rural or urban). The higher compliance with recommendations for total fluid intake by people who practice physical activity is partly due to the fact that they tend to drink more as they have increased fluid demands^{25,26}. The social determinants of the consumption

of water and other types of beverage may explain why women tend to comply more with recommendations for total fluid intake. In fact, women tend to have a better lifestyle pattern²⁷ and, in general, adults with a healthier dietary pattern usually have a healthier fluid pattern,²⁸ which leads to greater water consumption²⁸.

In the present study, fluid consumption was assessed with a 24 h fluid-specific diary over 7 consecutive days. Not only did it assess the type and amount of fluid ingested, but also the times at which beverages were consumed and the amount of sugar added by hand to drinks. The same methodology was used in a French study, and both studies found that water consumption represented more than 50% of the total daily fluid intake in all age groups and in both genders²⁹. This is important because plain water is regarded as the healthiest option for hydration, and increasing water consumption is a recommended strategy for reducing energy intake³⁰.

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^{4,14,16}. However, in our study, the percentage of women who met the EFSA recommendations was higher than the percentage of men (58.4% of women, but only 40.8% of men).

Several of our findings about the pattern of fluid consumption in our population deserve comment. Men generally consumed more of all type of beverages with some exceptions: for example, total water (tap water or mineral water), hot beverages and sweet light beverages, all without or few calories. These findings have also been observed in other populations²⁸, which suggests that women are more aware of the need to consume fewer calories in the form of drinks to avoid overweight or obesity^{31,32}. Age is also an important determinant of the general fluid pattern. As in other studies^{13,29,33}, the mean total fluid intake in our study progressively decreased as age increased. This can probably be explained by a decrease in the perception of thirst with age^{26,34}, but social determinants cannot be discounted. The type of fluid consumed also changed with age. The intake of milk, juices, and sweet beverages (regular or light) decreased with age, whereas the intake of hot beverages increased. The decrease in the mean milk intake observed in our population may be partly due to the fact that the percentage of individuals with lactase deficiency is higher in elderly people^{35,36}.

As reported in other studies in adults and seniors^{29,37}, more beverages were consumed during the main meals than at other times of the day. For example, Bellisle²⁹ reported that fluids were consumed more at breakfast, dinner and lunch than at other secondary meals. In our study only spirits were consumed more outside the main meals, and water was consumed in similar amounts.

Beverages can account for a substantial share of daily calories. Most of these calories come from sweet regular beverages, alcohol drinks, milk and milk derivatives, and juices¹⁶. Approximately 27% of our study population consumed more sugar than recommended

by the WHO (> 10% of the total daily calories) only from the sugar in beverages (intrinsic or added)²³. These results are alarming if it is taken into account that other studies show that an excessive consumption of calories from sugar has unhealthy effects^{8,38,39}.

Several potential limitations of our study deserve comment. The main limitation is that our population is probably not representative of the general Spanish population because individuals were randomly recruited from a database of volunteers for population surveys. Despite this, the final distribution of the individuals studied among age groups, gender, region of Spain and educational categories is very similar to the real distribution of the population in Spain. The second limitation has to do with the cross-sectional design of the study, which means that no conclusions about cause/effect relationships can be drawn. Third, the fact that anthropometric measures were self-reported and not measured may produce some systematic bias. Finally, the 24 h fluid-specific diary over 7 consecutive days must be validated in the future with gold standard methods, so that total fluid intake can be reliably assessed.

One of the strengths of this study is that it uses a 24 h fluid-specific diary over 7 consecutive days that allows to assess the total fluid intake and real fluid pattern. Also, the population was randomly recruited using the quota-based sample method from a database of volunteers for population surveys, which led to a large representative sample of Spanish adults in relation to the stratum considered⁴⁰. Moreover, this report is the first specific description of total fluid intake in Spanish adults.

Total beverage consumption and types of beverage consumed showed some differences between genders and age groups. Approximately half of the Spanish population does not meet the EFSA recommendations for total fluid intake. Water is the main beverage consumed, but a significant amount of dietary calories are provided by other beverages. A quarter of the studied population consume more sugar from beverages than is recommended by the WHO (> 10% of total daily calories)²³. There is enough evidence to prove that replacing sweet drinks by water has beneficial effects on health^{30,41} so it is imperative to promote the consumption of water, especially in children, parents and educators, and also elderly people, and limit the intake of sugar from beverages in Spain. Longitudinal studies should be carried out in various populations to determine the chronic contribution of fluid consumption to health.

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Conflict of interests

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