



**Beverage Consumption Habits and
Association with Total Water and Energy
Intakes in the Spanish Population:
Findings of the ANIBES Study**

With the participation of:



NUMBER 8

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Introduction

Scientific literature recognizes that the adequate intake of beverages depends on each individual and the variation for water needs in response to different health status, metabolism, and environmental factors such as ambient temperature and humidity, as well as individual factors such as age, body size, and level of physical activity. Furthermore, water intake also depends on overall diet, including the water contained in food.

In general terms, about 80 % of the required daily intake has to be provided by different types of drinks, preferably including water; the rest is acquired through solid food.

The influence of the Mediterranean Diet is widespread in our country. This pattern of consumption also includes the hydration pattern of the population. Traditionally, this pattern included water as a main drink, along with daily but moderate intake of wine and beer with the principal meal, and the intake of a group of beverages elaborated with fresh vegetables (gazpacho, salmorejo, etc.). However, in the last decades, the adherence to the Mediterranean pattern has been decreasing, especially in children and young people.

Apart from the Spanish National Survey on Dietary Intake (ENIDE) conducted in 2011 among a representative adult population, we are unaware of other research investigating beverage intake among the Spanish population. According to the data from this study, the average beverage consumption was 1,646.5 mL/day, which reflects fluid intake below recommendations for the study population.

The ANIBES Study provides analyses of total water intakes from all sources of food and beverages among a nationally representative sample aged 9-75 years.

The aim of this research, within the ANIBES Study, has been to quantify the total water and beverage intake, and to explore associations between the types of beverage consumed and energy intake, consumption according to time of day and day of the week, the association between beverage variety and increased fluid intake, and compliance with the current reference values by sex and age.



Methodology used

The design, protocol and methodology of the ANIBES Study have been previously described in detail in Ruiz E. et al, 2015 and Varela-Moreiras G. et al, 2015.

Food and beverage intakes were assessed in a food and beverage diary over three days, which the participants in the study filled out over three consecutive days. Day and time of beverage consumption were also recorded in this diary.

The analysis focused on the total water intake of all food and drink, determined from food composition tables with several adaptations and updates. Metabolic water (water derived from oxidation of substrates) has not been included so as to focus the study on comparisons with dietary water requirements.

Beverages were combined into eight categories for further analysis:

- Hot beverages (iced teas in cans or bottles were considered caloric soft drinks).
- Milk (all types of milk without separation by fat percentage).
- Fruit and vegetable juices (including nectars, juice-milk blends, 100 % fruit juices, and some typical Spanish beverages such as horchata, gazpacho, salmorejo, and white garlic).
- Caloric soft drinks (including colas, tonic water, sodas, ginger ale, fruit flavored drinks, iced teas in cans or bottles, sports drinks such as isotonic drinks with mineral salts, and caffeinated energy drinks).
- Diet soft drinks (including the same beverages as in the caloric soft drinks group but with artificial sweetener).
- Alcoholic drinks. Two groups are distinguished:
 - Low-alcohol grade (mostly beer, wine, and cider).
 - High-alcohol grade (including brandies, liqueurs, tequila, vodka, whisky, etc.).
- Water (including tap water and bottled water).
- Other non-alcoholic beverages (including soy-based beverages, non-alcoholic beer and wine, and others).

To investigate daily trends, beverage consumption events were aggregated into six time periods, approximately corresponding to:

- Breakfast: up to 10:00 a.m.
- Mid-morning: 10:00 a.m. - 1:00 p.m.
- Lunch: 1:00 p.m. - 4:00 p.m.
- Mid-afternoon: 4:00 p.m. - 7:00 p.m.
- Dinner: 7:00 p.m. - 10:00 p.m.
- Other times

Total water intake was compared with the European Food Safety Authority (EFSA, 2010) Dietary Reference Values for the Adequate Intake of water for men and women from 14 years of age onward (2.5 L and 2.0 L/day, respectively), and for boys and girls from 9 to 13 years of age (2.1 L and 1.9 L/day, respectively).

Furthermore, the approach taken by Nordic and German-speaking countries has also been taken into account in this study, where the water intake is considered inadequate when it is less than 1 gram per kilocalorie of energy requirement.

Therefore, three different approaches have been used to define water intake adequacy to provide a more comprehensive estimate of the proportion of participants who consume low amounts of water:

- A classification based on the adequate intake value, defined by the EFSA criteria.
- A ratio between total water intake (water from food and beverages in grams) and energy intake in kcal with a value higher than 1.
- The combination of both criteria aforementioned.



Intake vs. reference values

Data show that more than 75 % of the participants in the study did not meet the recommendations for adequate water consumption proposed by the EFSA, which suggest that intake for adults should be 2.5 L/day for men and 2.0 L/day for women. Men consumed approximately 33 % less than the established recommendations and women nearly 21 % less.

In grams, total water intake was $1,625 \pm 14.2$ g/day ($1,664 \pm 21.1$ g/day for men and $1,585 \pm 18.8$ g/day for women).

Most of the categories of beverages have been consumed in similar amounts by participants of both genders. However, it should be noted that men consumed two times more alcoholic beverages than women.

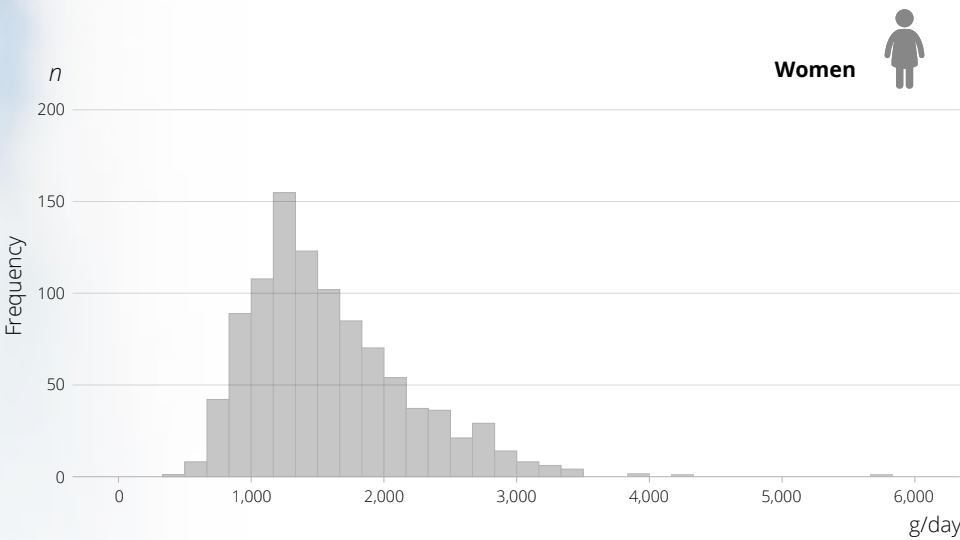
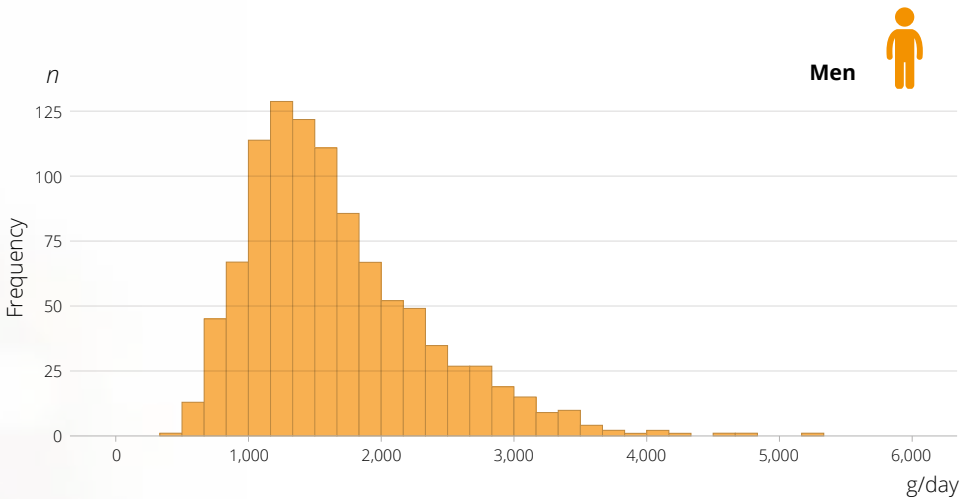
Taking into account that the mean total energy intake in the ANIBES Study was 1,809 kcal/day, the relative contribution from beverages was 12 % (13 % for men, 12 % for women). Furthermore, 68 % of the total water intake came from beverages and 32 % from food.

This figure is close to that proposed by some international authorities such as EFSA or WHO, who recommended that no more than 10 % of the daily calorie intake should come from beverages. The EFSA also recommended that between 70 % and 80 % of fluid should be provided by beverages and the remaining 20 %-30 % from food.

On average, the percentage of total beverage consumption from water over the three-day study period was 46 % for women and 41 % for men. Water was the most frequently consumed beverage, followed by milk, for both genders.

Among men, the most consumed beverages (after water and milk) were, in decreasing order, alcoholic drinks, caloric soft drinks, and hot beverages, with similar percentages (11 %, 11% and 10 %, respectively). For women, the most consumed beverages after water and milk were hot beverages (12 %), caloric soft drinks (8 %), and alcohol (5 %). Fruit and vegetable juices and diet soft drinks were consumed in lower amounts by both genders.

Frequency distribution of total water intake (g/day) over three consecutive days



Contribution of food and beverages to total water and energy intake

Total Weight Consumed	Total*	Men*	Women*
Sample (n individuals)	2,007	1,011	996
All food and drink (g/day)	2,071.5 ± 15.8	2,136.3 ± 23.8	2,005.7 ± 20.7
Food only (%)	45.0 ± 0.3	45.5 ± 0.4	44.6 ± 0.4
Beverages only (%)	55.0 ± 0.3	54.5 ± 0.4	55.4 ± 0.4
Water	24.8 ± 0.4	23.3 ± 0.5	26.3 ± 0.5
Milk	10.0 ± 0.2	9.5 ± 0.2	10.6 ± 0.2
Hot beverages	6.1 ± 0.1	5.5 ± 0.2	6.6 ± 0.2
Caloric soft drinks	5.1 ± 0.2	5.8 ± 0.3	4.4 ± 0.2
Alcohol	4.6 ± 0.2	6.2 ± 0.3	3.0 ± 0.2
Fruit & Vegetable Juices	2.4 ± 0.1	2.6 ± 0.2	2.2 ± 0.1
Diet soft drinks	1.8 ± 0.1	1.4 ± 0.1	2.1 ± 0.2
Other non-alcoholic beverages	0.2 ± 0.0	0.3 ± 0.1	0.2 ± 0.0

* Mean ± standard error

Contribution to Total Energy Intake	Total*	Men*	Women*
Sample (n individuals)	2,007	1,011	996
All food and drink (kcal/day)	1,809.0 ± 11.1	1,955.7 ± 16.4	1,660.1 ± 13.5
Food only (%)	87.8 ± 0.1	87.2 ± 0.2	88.4 ± 0.2
Beverages only (%)	12.2 ± 0.1	12.8 ± 0.2	11.6 ± 0.2
Milk	5.6 ± 0.1	5.1 ± 0.1	6.0 ± 0.1
Alcohol	2.7 ± 0.1	3.5 ± 0.2	1.9 ± 0.1
Caloric soft drinks	2.2 ± 0.1	2.4 ± 0.1	2.0 ± 0.1
Fruit & Vegetable Juices	1.3 ± 0.1	1.4 ± 0.1	1.2 ± 0.1
Hot beverages	0.4 ± 0.0	0.4 ± 0.0	0.5 ± 0.0
Diet soft drinks	0.0 ± 0.0	0.0 ± 0.0	0.0 ± 0.0
Other non-alcoholic beverages	0.0 ± 0.0	0.0 ± 0.0	0.0 ± 0.0
Water	-	-	-

* Mean ± standard error

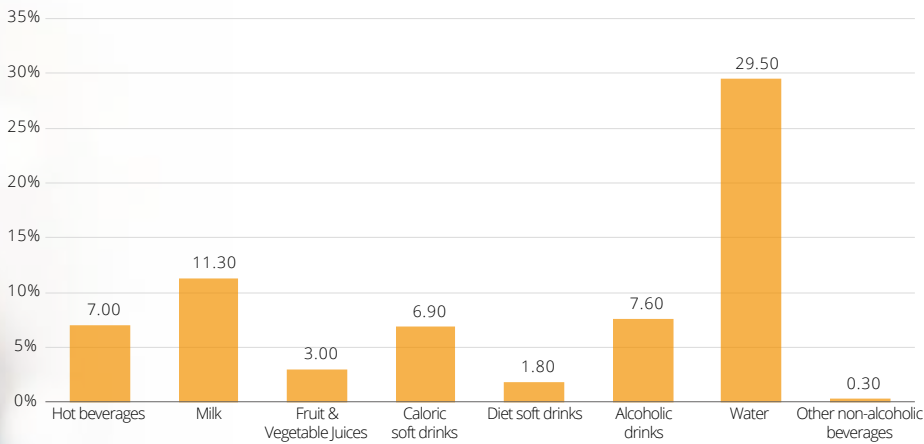
Contribution to Water Intake	Total*	Men*	Women*
Sample (n individuals)	2,007	1,011	996
All food and drink (g/day)	1,625.1 ± 14.2	1,664.2 ± 21.2	1,585.5 ± 18.9
Food only (%)	32.2 ± 0.3	32.4 ± 0.3	32.1 ± 0.4
Beverages only (%)	67.8 ± 0.3	67.6 ± 0.3	67.9 ± 0.4
Water	31.2 ± 0.4	29.5 ± 0.6	32.9 ± 0.6
Milk	11.8 ± 0.2	11.3 ± 0.3	12.3 ± 0.3
Hot beverages	7.7 ± 0.2	7.0 ± 0.2	8.3 ± 0.3
Caloric soft drinks	6.1 ± 0.2	6.9 ± 0.4	5.2 ± 0.3
Alcohol	5.7 ± 0.2	7.6 ± 0.4	3.7 ± 0.2
Fruit & Vegetable Juices	2.8 ± 0.1	3.0 ± 0.2	2.5 ± 0.2
Diet soft drinks	2.3 ± 0.1	1.8 ± 0.2	2.7 ± 0.2
Other non-alcoholic beverages	0.3 ± 0.0	0.3 ± 0.1	0.2 ± 0.0

* Mean ± standard error

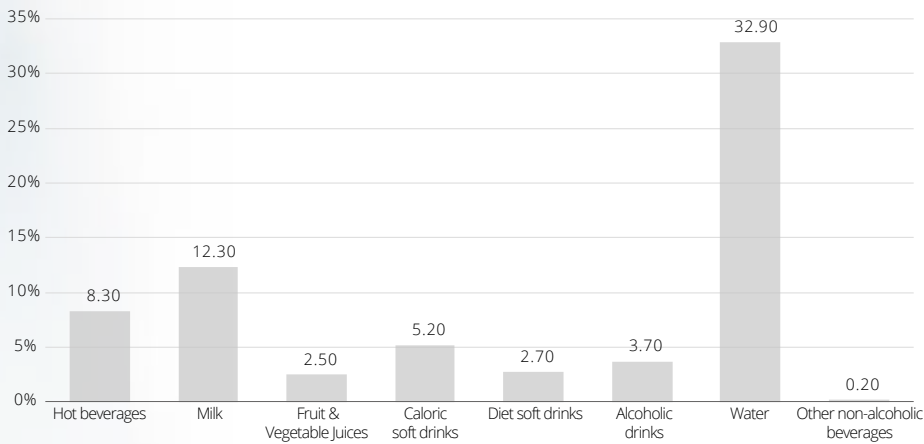
Beverages consumed (%) over a three-day period



Men



Women



Water intake by age group

In general, the contribution of water intake from food in the ANIBES Study increased with age, from 434 g/day among younger participants (13-17 years) to 584 g/day among older adults (65-75 years). This finding is likely owing to lower consumption of fruits and vegetables, which are rich in water, for the youngest participants.

The water contribution from beverages declined from $1,202 \pm 21.6$ g/day among adults (18-64 years) to $1,002 \pm 44.0$ g/day among older adults.

For adolescents, the mean consumption of caloric soft drinks was 167 ± 19.1 g/day for men and 139 ± 15.9 g/day for women (equivalent to about three cans per week for each). This consumption was lower among adults, with 114 ± 6.3 g/day for men and 82.1 ± 4.6 g/day for women. Consumption of alcoholic drinks for adult men and women averaged 160 ± 9.0 g/day and 71 ± 4.8 g/day, respectively. As for the older participants (65-75 years), it was 143 ± 19.0 g/day for men and 53 ± 9.8 g/day for women.

Total water intake and beverage consumption (g/day) by sex and age group

Men*						
		9-12 (B)	13-17 (C)	18-64 (D)	65-75 (E)	P ¹
Sample (n individuals)	1,156	125	136	796	99	
Total Water intake from food & beverage (g/day)	1,638 ± 19.40	1,440 ± 45.47 (a)	1,398 ± 43.29 (b)	1,717 ± 24.69	1,585 ± 57.75	<0.001
Water from food (g/day)	503.90 ± 6.07	443.62 ± 13.72 (a,c)	433.60 ± 13.96 (b,d)	515.60 ± 7.41 (e)	583.72 ± 24.81	<0.001
Water from beverages (g/day)	1,134 ± 16.74	997.58 ± 39.33 (a)	964.44 ± 36.31 (b)	1,201 ± 21.61 (e)	1,001 ± 44.03	<0.001
Total beverages consumption (g/day)	1,181 ± 16.94	1,058 ± 40.39 (a)	1,026 ± 37.54 (b)	1,244 ± 21.86 (e)	1,035 ± 44.79	<0.001
Hot beverages (g/day)	107.14 ± 3.60	41.20 ± 4.26 (a,c)	54.43 ± 7.37 (b,d)	120.95 ± 4.55	151.82 ± 12.91	<0.001
Milk (g/day)	204.48 ± 4.52	309.73 ± 12.00 (a,c)	274.67 ± 16.00 (b,d)	175.69 ± 4.94	206.64 ± 15.24	<0.001
Fruit & Vegetable Juices (g/day)	58.22 ± 3.15	91.56 ± 11.83 (a,c)	87.67 ± 11.31 (b,d)	50.94 ± 3.51	34.25 ± 7.74	<0.001
Caloric soft drinks (g/day)	112.76 ± 5.25	113.02 ± 14.76 (c)	166.97 ± 19.06 (b,d)	114.19 ± 6.32 (e)	26.43 ± 6.57	<0.001
Diet soft drinks (g/day)	28.81 ± 2.70	12.09 ± 3.17 (a,c)	21.65 ± 6.41 (b)	35.25 ± 3.68 (d)	7.98 ± 3.13	0.003
Alcohol (g/day)	122.36 ± 6.72	-	1.14 ± 1.14 (b,d)	159.66 ± 9.05	143.45 ± 19.00	<0.001
Water (g/day)	542.12 ± 14.81	491.0 ± 35.99	419.88 ± 33.19 (b)	582.15 ± 19.15	452.69 ± 40.51	<0.001
Other non-alcoholic beverages (g/day)	5.11 ± 1.11	-	-	5.90 ± 1.49	12.26 ± 5.05	0.034

P¹ value obtained through ANOVA test; (a) BD; (b) CD; (c) BE; (d) CE; (f) HI; (g) HJ; (h) GI; (i) GJ; (j) IJ = Significant
* Mean ± standard error



Total water intake and beverage consumption (g/day) by sex and age group

		Women*				
		9-12 (G)	13-17 (H)	18-64 (I)	65-75 (J)	P ¹
Sample (n individuals)	1,125	87	74	857	107	
Total Water intake from food & beverage (g/day)	1,559 ± 17.53	1,334 ± 46.58 (h)	1,235 ± 40.07 (f,g)	1,608 ± 20.97	1,579 ± 48.94	<0.001
Water from food (g/day)	476.31 ± 5.67	440.18 ± 19.42	403.67 ± 17.83 (g,i)	475.75 ± 6.45 (j)	560.47 ± 19.59	<0.001
Water from beverages (g/day)	1,083 ± 15.55	894.37 ± 40.30 (h)	831.84 ± 33.16 (f)	1,132 ± 18.72	1,019.31 ± 42.33	<0.001
Total beverages consumption (g/day)	1,121 ± 15.65	943.92 ± 41.27 (i)	881.93 ± 33.59	1,169 ± 18.85	1,050 ± 42.78	<0.001
Hot beverages (g/day)	123.93 ± 3.96	41.85 ± 6.12 (h,i)	37.15 ± 6.81 (f,g)	134.00 ± 4.33	170.00 ± 19.02	<0.001
Milk (g/day)	202.55 ± 3.85	249.77 ± 14.51 (h)	201.86 ± 15.43	196.82 ± 4.28	210.45 ± 14.12	0.003
Fruit & Vegetable Juices (g/day)	45.05 ± 2.42	91.76 ± 12.08 (h,i)	93.35 ± 17.17 (f,g)	37.46 ± 2.27	34.42 ± 6.66	<0.001
Caloric soft drinks (g/day)	79.17 ± 3.86	67.32 ± 11.1	138.94 ± 15.91 (g)	82.15 ± 4.59 (j)	23.66 ± 6.18	<0.001
Diet soft drinks (g/day)	40.26 ± 3.56	20.90 ± 6.48	18.56 ± 9.28	46.88 ± 4.48	17.91 ± 6.16	0.011
Alcohol (g/day)	59.03 ± 3.88	-	2.93 ± 2.34	70.64 ± 4.85	52.82 ± 9.78	<0.001
Water (g/day)	568.75 ± 14.17	472.31 ± 39.27	389.14 ± 34.77 (f)	597.92 ± 17.03	537.72 ± 40.88	<0.001
Other non-alcoholic beverages (g/day)	2.90 ± 0.55	-	-	3.34 ± 0.67	3.52 ± 2.14	0.195

P¹ value obtained through ANOVA test; (a) BD; (b) CD; (c) BE; (d) CE; (f) HI; (g) HJ; (h) GI; (i) GJ; (j) IJ = Significant
 * Mean ± standard error

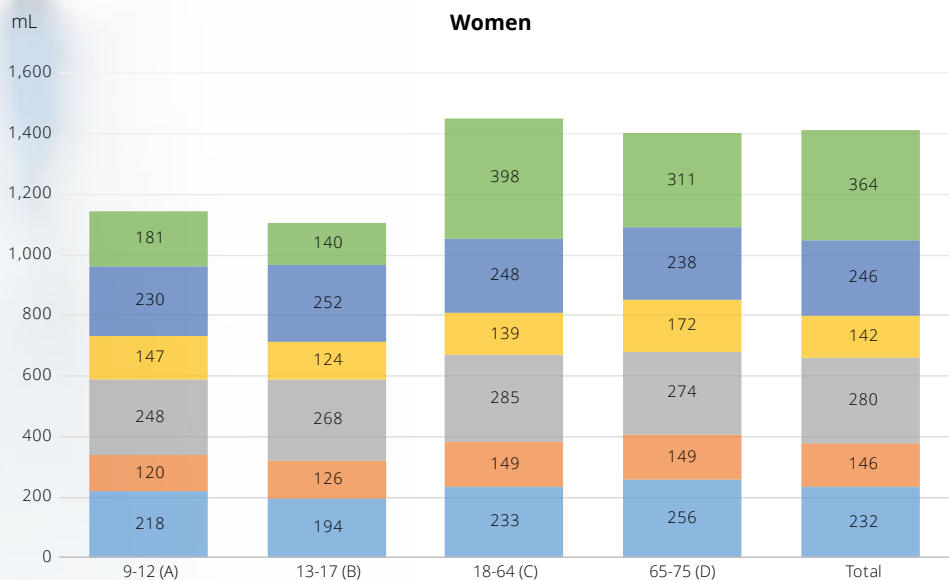
Differences throughout the day

Beverage consumption pattern of the ANIBES population is uneven throughout the day, concentrated at lunchtime, with no significant differences between different age and gender groups. Only one exception was seen in this sense, as the group of adult males consumed a higher amount of beverages during lunch.

Although a large variation was not found, these findings reflect certain cultural trends of consumption that appear to be attributable to a higher intake of alcoholic beverages on weekends, among both genders.



Beverage consumption according to time of day by age and gender



- Breakfast <10:00

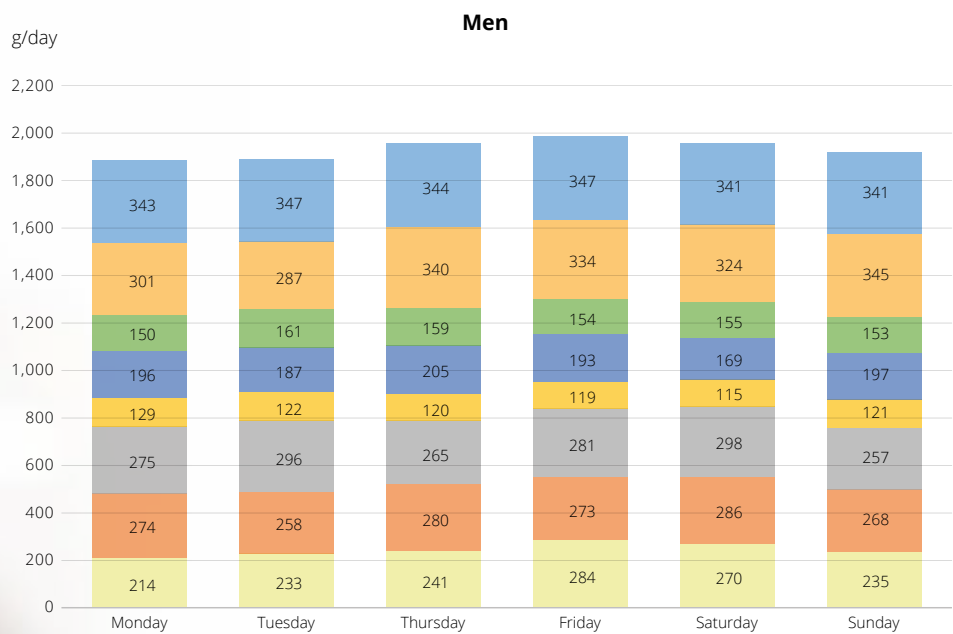
● Mid-morning 10:00 to 13:00

● Lunch 13:00 to 16:00
- Snack 16:00 to 19:00

● Dinner 19:00 to 22:00

● Other moments

Amount and types of beverages consumed (g/day) according to day of the week



- Water
- Hot Beverages
- Other non-alcoholic beverages
- Diet Soft Drinks
- Milk
- Fruit & Vegetables Juices
- Caloric Soft Drinks
- Alcohol



Strengths

The careful design, protocol, and methodology used in the ANIBES Study are some of the strengths of this wide research. In this sense, this extensive study demonstrated that well-conducted national surveys have the potential to yield rich contextual value data.

Furthermore, surveys like this one can be used as a reference to make improvements and implement different programs that enable to promote an adequate diet and hydration among the population.

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The final protocol of the ANIBES scientific study was previously approved by the Clinical Research Ethics Committee of the Autonomous Region of Madrid (Spain).

