Total and Added Sugars Consumption in Argentina: Their Contribution to Daily Energy Intake. Results from Latin American Study of Nutrition and Health (ELANS).

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Abstract

Aim: The aim of this study is to determine the intake of total sugars (TS) and added sugars (AS) in Argentina, based on the local data of the Latin American Study of Nutrition and Health (ELANS).

Method: This is a cross-sectional study of a representative sample of the urban Argentine population (n=1266). The sample was stratified by age group (15-65 years), gender, geographic region and socio-economic level (SEL). TS and AS intake were obtained by two 24-hour recalls (R24) and analysed using the Nutrition Data System for Research (NDS-R) Software 2013.

Results: On average, TS consumption in Argentina was 114.3 g/day, accounting for 39.8% of the total carbohydrate intake and 20.6% total energy (TE) intake. Overall, 77.2% of the total sugars intake consisted of AS (90.4 g/day), contributing to 30.4% of total carbohydrate intake and 15.9% TE. Men consume more TS and AS (in g/day), with no difference in the AS %TE between men and women. The consumption of sugars decreased with age, with adolescents consuming more AS and older adults more intrinsic sugars. The intake of AS was higher in low SEL.

Conclusions: In Argentina the intake of AS was 50% above the recommendations. Younger and socially vulnerable people are at higher risk of excessive intake.

Keywords: Argentina, dietary sugars, energy intake, ELANS, recommended daily intake.

Introduction

Sugars are naturally present in fruits, vegetables, and dairy products. Additionally, sugars may also be added to foods, both because of their sweetening power and their other functions needed in food technology.[1] The term "Total Sugars (TS)" refers to monosaccharides (glucose, fructose, galactose, etc.) and disaccharides (lactose, sucrose, maltose, etc.), and includes intrinsic sugars (incorporated in the structures of fruits and whole vegetables), milk sugars (lactose and galactose), and free sugars (FS). The term "FS" has been defined by the Technical Expert Advisory Group on Nutrition Monitoring from the World Health Organization (WHO) as the following: "Free sugars include monosaccharides and disaccharides added to foods and beverages by the manufacturer, cook or consumer, and sugars naturally present in honey, syrups, fruit juices and fruit juice concentrates".[2] Added sugars (AS) include white sugar, brown sugar, unrefined sugar, corn syrup, high-fructose corn syrup, maple syrup, liquid fructose, honey, dextrose and dextrin, among others.[3]

Currently, the effect of excessive sugar intake on health is an important matter of scientific and political debate. Many countries are considering public health regulations or measures to reduce sugar intake in the population.[4] Decreasing sugar intake is a good strategy to reduce excessive intake, which is pivotal in the fight against the current epidemic of chronic, non-communicable diseases.[4] To date, there is no evidence that the consumption of intrinsic sugars or milk extrinsic sugars have an adverse effect on health. Therefore, the WHO recommendations are focused on the intake of free sugars.[2]

It is strongly recommended that the intake of FS should be reduced to less than 10% of total calorie intake. A further reduction to below 5% of total caloric intake leads to additional beneficial effects on health.[2] These recommendations will be revised in 2020.[2]

For public health policies to be efficient and controllable, adequate knowledge of the current situation regarding total and AS intake in each country is necessary.[4] Unfortunately, data on AS intake are scarce and data on FS intake are practically non-existent.[5] Recently, the Latin American Study of Nutrition and Health (ELANS) has published the regional results for sugars intake in eight countries in the region; varying between 18.7-21.1%TE intake for TS, and between 10.3-16.4%TE for AS. Sugars intake in Argentina was found to be the highest in the study.[6]

The main aim of this study was to determine for the first time the intake of TS and AS of the Argentine population, based on the Argentinean data that are part of the ELANS study. Secondary aims were to 1) stratify the sugar content of the Argentine diet by gender, age, region of the country and Socio Economic Level; and 2) present, in a stratified manner, the percentages of the Argentinean population who meet the criteria for maximum FS intake recommended by the WHO.

Methods

The ELANS study was approved by by the Western Institutional Review Board (#20140605) and it is registered at Clinical Trials (#NCT02226627).

Written informed consent/ assent was obtained from all individuals before commencement of the study.

This survey evaluated food and nutrients intake and physical activity in eight Latin-American countries (Argentina, Brazil, Ecuador, Colombia, Costa Rica, Chile, Peru and Venezuela) through a household-based, multi-national cross-sectional survey. The current study was based on the dietary data from the local survey in Argentina approved by the Argentinian Medical Association Ethical Committee.

In this study compliance with STROBE has been addressed. More details of this point can be found in a previous publication.[7]

The sample consisted of men and women, between 15- and 65–years-of-age, living in urban areas in the most densely populated regions. In Argentina, the urban population accounts for 91% of the total population.[8] The population was stratified into four age groups (15-19, 20-34, 35-49 and 50-65 years of age), as well as by gender (male or female), SEL (high, middle, or low) and geographic region (Pampa, Patagonia, Cuyo, North-east, North-west and the metropolitan area of Buenos Aires).The sample, consisting of 1,266 subjects, was recruited through multi-stage probability sampling for a result that was representative both at a country-wide and at a region-wide level. For more details on the study design see Fisberg et al.[9] The final sample was weighted based on the information available from the Population Census 2010 and the Extended Permanent Household Survey. Finally, the sample was adjusted for projections of the population to the year 2015.[8-10]

Two R24 were performed with each participant on non-consecutive days. They were conducted face-to-face by a trained interviewer using the Multiple Pass Method, a technique that was validated to standardize food data collection.[11] A visual guide was used for servings and foods to help the participant refer their intake quantities. Each R24 was analysed using the Nutrition Data System for Research (NDS-R) 2013, developed by the Nutrition Coordination Centre of the University of Minnesota (USA).[12] A process of food-matching for the standardization of the local foods was performed to be able to use the NDS-R. As a result of this process, 638 local foods and 195 recipes were standardized. For more details on the food standardization process see Kovalskys et al.[13] The NDS-R software analyses TS and AS intake, but not the intake of FS, according to the WHO definition. To calculate the content of FS, we also identified those foods that were included as “FS” in the WHO classification. The difference found between total AS (NDS-R), and total FS, was 2 g/day per subject (2,642 g for the total population; n=1266).

Usual daily intake of TS and AS was estimated using the online Multiple Source Method (MSM) tool, developed by the European Prospective Investigation into Cancer and Nutrition (EPIC).[14] TS and AS intake in grams and as %TE are presented as mean and SD, as well as in percentiles for our sample, which was stratified according to gender, age, SEL and geographical region. The percentage of individuals that adhered to the WHO’s sugar consumption recommendations was calculated by SEL. IBM SPSS Statistics 20 software was used for all statistical analyses. Comparisons by sex were performed by T test for independent samples with Levene's test on the equality

of the variances and a 95% confidence interval for the difference between the means. The one-way analysis of variance (ANOVA) was used to determine whether there were any statistically significant differences between the age and SEL groups.

Results

TS and AS intake according to age and gender is shown in Table 1. On average, TS consumption in Argentina was 114.3 g/day, accounting for 39.8% of the total carbohydrate intake and 20.6%TE. Overall, 77.2% of the TS intake consisted of AS (90.4 g/day), contributing to 30.4% of total carbohydrate intake and 15.9%TE. Men had a higher absolute sugars intake compared to women: 123.6 g/day vs. 105.5 g/day for TS and 100.9 g/day vs. 80.6 g/day for AS, respectively. Nevertheless, women consumed a greater % TE from TS compared to men: 21.4%TE vs. 19.7%TE. There was no statistically significant difference between men and women in the contribution of AS to %TE (15.6% for men vs. 16.0% for women, $p=0.334$).

Table 2 shows sugar intake according to SEL, age and gender. In general, it was found that the higher the SEL, the lower the TS and AS intake, both in grams per day and as part of %TE. AS intake was significantly different among SEL groups ($p<0.001$). In the group with the lowest SEL, AS intake was 98.6 g/day (17.0%TE) while in middle- and high SEL groups, AS intake was 84.0 g/d (14.9%TE) and 80.7 g/d (14.5%TE), respectively.

Figure 1 shows sugars intake in different geographic regions of Argentina. The highest intake levels of TS and AS, both in absolute and %TE, were observed in Patagonia and in the North-west of the country. TS and AS

consumption was led by men from Patagonia and women from the north-western region.

Figure 2 shows the distribution of the Argentinean population by SEL and gender according to the WHO recommendations (10%TE and 5%TE). In 78.8% of the Argentinean population, AS intake was higher than 10%TE. When considering the conditional WHO recommendation of 5%, this number rose to 94.4% of the population. It was possible to observe that 70.3% of the individuals with a higher SEL exceeded the recommendation of <10%TE as AS (WHO's strongest recommendation), while 83.7% of those with a lower SEL exceeded that limit. When considered the age group, it was noticed that among adolescents, 93.4% exceeded the limit of consuming 10%TE as AS, while 62.6% of the adults aged 50-65 exceeded this cut-off point.

Discussion

Sugar intake in Argentina had so far only been indirectly measured, using commercialization data[15] that tended to overestimate consumption. To the best of our knowledge, this is the first time that sugar intake (total and added) is evaluated in Argentina, using methods to measure direct consumption in adolescents and adults (15-65–years-of-age), living in urban areas, stratified by gender, age, geographic region and SEL of a representative weighted sample.

We found that sugar intake (g/day and %TE) is high in the Argentinean population and was inversely related to age and SEL and varied according to the geographic region.

In Europe, mean consumption of AS accounts for 7.3-11.4% of the total calorie intake in adults.[4] In North America, this number increases to between 10-14% of the total calorie intake.[3, 16] Recently, the first data on dietary intake were published for eight countries in Latin America showing that mean AS intake in these countries accounted for 13.2%TE consumption. [6]In this study, we confirmed that in Argentina the intake of AS exceeded the current recommendations, accounting for a mean of 15.9%TE intake, which is twice the amount consumed in countries such as Spain.[17]

All previous publications have noticed that men consumed more TS and AS than women (expressed in g/day or in total calories).[3, 4, 18] Nevertheless, when calculated as percentage of total calorie intake, AS intake was higher in women, probably because the TE intake is higher in men.[3, 4, 18] The same trend is observed in the US and Europe.[3] In Argentina, there was a higher AS intake in men than in women but unlike the rest of the world there was no statistically significant difference between men and women in the contribution of AS to %TE

In Argentina, the %TE from AS was higher in the age group of 15-19-year-olds (17.5%) and decreased with age,, similar to the findings in the literature for other countries. As reported in other countries, the contribution of intrinsic sugars (whole fruits and vegetables) to the TE intake is higher in the older age groups.[17, 18] Unlike in Spain, where only adolescents reach 10% of total daily calories from AS,[17, 18] in Argentina all age groups exceeded this cut-off point. In Latin America, a similar trend toward a decrease in AS intake (and %TE) with increasing age was found, with a mean of 13.9%TE intake consisting of AS in adolescents, against 12.1% in older adults.[6] Data from the US has

shown a linear decrease in calorie intake from AS with age, both in men and in women. A linear decrease in %TE consisting of AS was also reported.[3] The results of different studies conducted in European countries found that a higher intake of AS was observed in adolescence, ranging from 12.4-18.6%TE consumption.. It is noteworthy that for the majority of the analysed countries, AS intake was higher than 10% in children and adolescents and lower than 10% in older adults.[5]

The %TE from AS increased linearly with the SEL among the countries evaluated by ELANS, only in Argentina an inverse relationship was observed[6]. Data from the National Health and Nutrition Examination Survey in the US (2005-2010) also showed the same trend.[3] It is noteworthy that this trend toward the consumption of higher amounts of sugars in lower-income populations was observed just for AS but not for TS (21.0%TE, 20.3%TE and 20.1%TE in the population for low, middle and high SEL, respectively). These findings would reflect a higher intake of intrinsic sugars (fruits and vegetables) and/or milk sugars in higher-income populations.[19] In Argentina, this may be explained by the fact that fruits and vegetables are usually expensive and therefore difficult to obtain in the recommended amounts by people with a lower income.

The exception to this inverse relationship between AS consumption and SEL is observed only in adolescents (15 to 19 years), where those with higher SEL consume significantly more AS. This may be due to the fact that, while in many parts of the world discretionary food and beverages are relatively inexpensive, in Argentina they are quite expensive and therefore access is restricted.

In four out of the six geographic regions into which the country was divided, mean %TE from TS was 20% (range, 19.5-20.4%) and mean %TE from AS was around 15% (range, 14.5-15.6%).

TS and AS intake were higher in two regions: Patagonia (23.1%TE from TS and 18.6%TE from AS) and North-west (23.9%TE from TS and 19.3%TE from AS), the latter of which was the region with the highest sugar intake in the country.

Sugar cane in the North-west of Argentina is a crop with a strong cultural identity and key to the regional economy of Tucuman, Salta, and Jujuy (three north-western provinces), accounting for 98% of the total production of the country. Many of the regional foods are characterized by high sugar content. Future research relating sugars intake to food sources may allow for a better understanding of this association (data in progress).

One of the possible reasons that could explain the higher sugar intake of Argentineans when compared with other countries of the region is their cultural customs. As an example, the "mate", a typical infusion which is mostly consumed with table sugar, thus representing a substantial part of the contribution of AS in the Argentinean diet (manuscript in progress).

High AS intake is associated with a poor quality of diet as it leads to a decrease in the intake of essential micronutrients,[20] an increase in body weight,[21, 22] development of obesity and the subsequent risk of chronic and non-communicable diseases,[2, 23] cardio-metabolic risk factors, and mortality.[24] Another worrisome impact on health is the association of AS intake and dental

caries.[25-27] Considering all of the above, a decrease in AS intake would be a good strategy to improve the health of the population.

In this article, we present for the first time an estimate of the AS intake. for the Argentinean population between 15- and 65-years-of-age. The results that were recently reported for Latin America showed that approximately 69.3% of the Latin American population exceeds in AS the cut-off point recommended by the WHO for FS intake.[6] It's important to point out that, the difference found between AS and FS is minimal in the case of Argentina.

While in countries such as Spain only one in four people exceeds the WHO recommendation regarding the consumption of AS,[18] in Argentina, 78.8% of the population exceeds WHO's cut-off point of 10% of their caloric intake as AS. In North-west and Patagonia, nine out of 10 people exceed the recommendation of 10%. Considering the recommendations of the Scientific Advisory Committee on Nutrition of the UK and the conditional recommendation of the WHO, about not to exceed 5% of the caloric intake from FS and 94.4% of the study population exceeds this recommendation.

Unfortunately, due to the lack of previous studies it is impossible to define a trend in sugar consumption over time. The results of this study may therefore be considered a basis on which to build future research.

The present study has some limitations. The content of FS or AS in food products may be under- or over-estimated. Estimates of AS or FS are based on the information provided by food manufacturers. This information may be difficult to obtain and to keep updated, as the composition of the food products available on the market are continually changing, due to frequent

reformulations.[5, 15] Additionally, in Argentina it is not mandatory to disclose sugar contents on the label. To resolve this inconvenience, information on sugar content of the foods was obtained through the list of ingredients and consultation with the manufacturers. Overall, 638 foods were standardized, and 195 recipes were created to facilitate data entry in the NDS-software.[13]

The definition of "AS" and the method to calculate them also differ between databases. Therefore, it is extremely difficult for consumers to understand how to adhere to a diet that meets the WHO recommendations for sugar intake (less than 10% of the calories from FS) without a previous agreement on the definitions of TS, AS, and FS.[28]

The present study also has several strengths. There is no flawless method to assess dietary intake, as different methods may be appropriate for specific purposes. For instance, self reported dietary intake data have been found to be associated with underreporting of the intake of TE and different macro and micro-nutrients.[5] On the other hand, R24 only require short-term memory, are less expensive, and less prone to change reporting of food intake behaviour than food records. Additionally, as a high educational level is not required to perform the R24, they may be used in different populations.[1] Indeed, it is the method of choice to quantify “absolute intake" in large population studies.[1, 5]

A strength of this study is the use of a two-day food intake record, as an accurate technology for the data collection on the individual intake of sugars (both total and added) in foods and beverages.

In conclusion, the Argentinean population consumed 114.3 g/day of TS and 90.4 g/day of AS, being the country with the highest consumption of sugars in the region. No difference was found in the %TE intake as AS between men and women. The consumption of sugars (total and added) decreased with age, with adolescents consuming larger amounts of added sugars and older adults consuming more intrinsic sugars. The regions of the country that lead the consumption of sugars were the Patagonian region and the North-west region. The intake of AS was inversely proportional to the SEL of the population. In Argentina the intake of AS exceeded 50% the current recommendations.

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Conflicts of Interest

Brian M. Cavagnari has received consulting fees from several biotechnological, pharmaceutical and food and beverage companies. He has also received consulting fees and financing for research studies, from governmental sources and non-profit entities. None of the afore mentioned entities had any role in the present study. The rest of the authors have no conflict of interest to declare as well.

Authorship

IK conceived and designed the study; IK and VG coordinated the study; IK and VG performed the local implementation of the study. All authors analysed, interpreted the data and drafted the manuscript. AG, IK and VG did the statistical analysis. All authors read the manuscript, revising it critically for important intellectual content, and approved this submitted version. The authors also state that the content has not been published elsewhere.

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