Temporal trends of excessive consumption of soda and artificial juice in adults of a county of the Brazilian western Amazon (2007-2016)

Abstract
Due to the association between the consumption of sugar-sweetened beverage and various diseases and non-contagious damages, this consumption has been discouraged. The objective of this study was to analyze the temporal trend of excessive consumption of soda and artificial juice in adults of a county of the Brazilian Western Amazon. For this, a time series ecological study was carried out using the microdata from the Surveillance System of Risk Factors and Protection for Chronic Diseases by Telephone Inquiry (Vigitel). The trend analysis was performed using estimates from the Annual Percentage Change (APC) of the prevalence of excessive consumption of soda and general artificial juice and by sex in the period from 2007 to 2016 by means of Poisson regression in the software Join point. A total of 19,030 men and women aged 18 years and over were interviewed between 2007 and 2016. It was observed the downward trend in the period from 2010 to 2016, with APC of -11.1 (95% CI = -15.9 to -5.9). When stratified by sex, the downward trend for both sexes was observed, in the male sex the CP was -6.1 (95% CI = -9.7 to -2.3), and for females the APC was -8.5 (95% CI = -12.5 to -4.4).

Introduction
The Western dietary pattern consisting of large amounts of refined carbohydrates, sugar-sweetened beverage and unhealthy fats is among the leading causes of obesity and cardiometabolic diseases in the world. Nutrition care costs attributable to obesity and overweight are over $600 billion per year, and the trend is to increase as the prevalence of overweight and obesity is increasing significantly. The World Health Organization projects that by 2025, about 2.2 billion adults are overweight and more than 700 million are obese. Between 2000 and 2013, the overall prevalence of overweight and obesity increased 25% among adults and 50% among children. By 2013, more than 2 billion people were overweight, and of these, over 674 million were obese. In 2010, it was estimated that overweight and obesity were responsible for causing 3.4 million deaths worldwide. Among the various factors associated with overweight and obesity, the consumption of sugar-sweetened beverage deserves attention, because in the recent years, this consumption has increased in both high-income and low- and middle-income countries. This increase is worrisome because besides the association with overweight, the consumption of sugar-sweetened beverage is associated with cardiovascular diseases, some types of cancer, type 2 diabetes, quality and duration of sleep, non-alcoholic fatty liver disease. In Brazil, the National Food Survey observed that, in adults, the increase in the size of the portion of soft drinks was associated with overweight (PR = 1.19, 95% CI, 1.10-1.27) regardless of age, sex, income and total energy ingestion. Data from the Surveillance System for Risk Factors and Protection for Chronic Diseases by Telephone Inquiry (Vigitel) of 2016, point out the city of Rio Branco as the Brazilian capital with higher prevalences of overweight and obesity in adults. Therefore, the objective of this study was to analyze the temporal trend of excessive consumption of soda and artificial juice in adults from Rio Branco, Western Brazilian Amazon, from 2007 to 2016.

Materials and methods
A time-series ecological study was carried out using the microdata from the Surveillance System of Risk Factors and Protection for Chronic Diseases by Telephone Inquiry (Vigitel) for the county of Rio Branco, Acre, from 2007 to 2016. Rio Branco, capital of the State of Acre, is located in the western Brazilian Amazon at 9° 58’29” south and at 67° 48’36” west, at an altitude of 153 meters above the sea level. The capital has 348,354 inhabitants (45.9% of the state’s population), spread over an area of 9,962 km² (6.5% of the territory of the State), with about 90% residing in the urban area. The sample consisted of 19,030 men and women aged 18 years or more between the years 2007 to 2016, having at least 1,500 participants each year. The prevalence of excessive consumption of soda and artificial juice was used as an outcome. The excessive consumption was defined as consumption on five or more days in the week, referring to the seven days prior to the survey. The trend analysis was performed with estimates of the Annual Percentage Change (APC) and the Average Annual Percentage Change (AAPC) of the prevalence of excessive consumption of soft drink and artificial juice and by sex between 2007 and 2016 by means of Poisson regression, using the Joinpoint statistical program (http://surveillance.cancer.gov/joinpoint/). The technique uses the proportions to identify joinpoints over the period, capable of describing a significant change in the trend through APC. The APC allows determining the magnitude of the change of the frequencies in a determined period of time. It assumes that the change occurs with a constant percentage in time, similar from year to year. As the biological phenomena do not always behave uniformly, the analysis of segments may better represent the phenomenon observed. In the APC concept of the segment, the join points correspond to k-1 segments. The summary measure of the various CPAs is the AAPC which corresponds to the average annual percentage change.
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situations where only one APC comprises the entire period studied, the AAPC corresponds to APC. The tests of significance to choose the best model were based on the Monte Carlo permutation method, taking into account p value <0.05. To minimize the effect of possible autocorrelations, the option “fit an autocorrelated errors model based on the data” was available in the software. Informed consent was obtained with the interviewees. The surveys were conducted by the Brazilian Ministry of Health and approved by the National Ethics Commission in Research.

Results

A total of 19,030 men and women aged 18 or over were interviewed between 2007 and 2016 (Table 1). The prevalence of excessive consumption of soda and artificial juice in 2007 was 32.9%, and in 2016 it was 16.7% (variation of -49.2%). When stratified by sex, the prevalence in men was 36.5% in 2007 to 18.0% in 2016 (-50.7%), and in women it was 29.6% in 2007 to 15.6% in 2016 (-47.3%, Table 2). Figure 1 shows the temporal trends of total prevalence and stratified by sex. When analyzing the trend of excessive consumption of soda and artificial juice (Figure 1) (Table 2), there is a downward trend in the period from 2010 to 2016, with APC of -11.1 (95% CI = -15.9 to -5.9). When stratified by sex, there is a downward trend for the entire period studied in both sexes. For males the APC was -6.1 (95% CI = -9.7 to -2.3), and for the female PCA was -8.5 (95% CI = -12.5 a -4.4).

Table 1 Excessive consumption of soda and artificial juice (%) by sex. Rio Branco - AC, 2007 to 2016

<table>
<thead>
<tr>
<th>Year</th>
<th>Total</th>
<th>Male</th>
<th>Female</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>%</td>
<td>CI95%</td>
</tr>
<tr>
<td>2007</td>
<td></td>
<td>32.9</td>
<td>29.2-36.7</td>
</tr>
<tr>
<td>2008</td>
<td></td>
<td>29.5</td>
<td>24.8-34.3</td>
</tr>
<tr>
<td>2009</td>
<td></td>
<td>32.1</td>
<td>27.8-36.5</td>
</tr>
<tr>
<td>2010</td>
<td></td>
<td>35.5</td>
<td>30.2-40.9</td>
</tr>
<tr>
<td>2011</td>
<td></td>
<td>30.3</td>
<td>25.7-34.9</td>
</tr>
<tr>
<td>2012</td>
<td>1662</td>
<td>29.0</td>
<td>25.7-32.3</td>
</tr>
<tr>
<td>2013</td>
<td>1971</td>
<td>24.6</td>
<td>21.5-27.6</td>
</tr>
<tr>
<td>2014</td>
<td>1517</td>
<td>18.6</td>
<td>14.9-22.2</td>
</tr>
<tr>
<td>2016</td>
<td>1806</td>
<td>16.7</td>
<td>14.6-18.9</td>
</tr>
</tbody>
</table>

Table 2 Distribution of the Annual Percentage Change (APC) of excessive consumption of soda and artificial juice by sex. Rio Branco - AC, 2007 to 2016

<table>
<thead>
<tr>
<th>Period</th>
<th>Total</th>
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<th>Female</th>
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<tbody>
<tr>
<td>2007-2010</td>
<td>32.9 (29.2-36.7)</td>
<td>16.7 (14.6-18.9)</td>
<td>-49.2</td>
</tr>
<tr>
<td>2010-2016</td>
<td>-11.1</td>
<td>-15.9 a -5.9</td>
<td></td>
</tr>
</tbody>
</table>

Sex

<table>
<thead>
<tr>
<th>Period</th>
<th>Total</th>
<th>Male</th>
<th>Female</th>
</tr>
</thead>
<tbody>
<tr>
<td>2007-2016</td>
<td>36.5 (30.6-42.5)</td>
<td>18.0 (14.6-21.3)</td>
<td>-50.7</td>
</tr>
<tr>
<td>2007-2016</td>
<td>29.6 (25.0-34.3)</td>
<td>15.6 (12.8-18.5)</td>
<td>-47.3</td>
</tr>
</tbody>
</table>
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In our study, there was an expressive decrease in the excessive consumption of soda and artificial juice in Rio Branco, Acre, for adults of both sexes. Despite this downward trend, the prevalence of soft drink consumption on five or more days in the week is still high.

Discussion

In our study, there was an expressive decrease in the excessive consumption of soda and artificial juice in Rio Branco, Acre, for adults of both sexes. Despite this downward trend, the prevalence of soft drink consumption on five or more days in the week is still high.

While assessments of the impact of tax on health and economic indicators are underway, modeling studies have suggested that the effect will be largely beneficial. In addition to reducing the consumption of sugar-sweetened beverage, the tax generates revenue that can contribute to programs that improve the health or socioeconomic development of the public. However, although the World Health Organization has recommended a 20% increase in the taxation of sugar-sweetened beverage, Brazil has not yet adopted this measure. The main limitation of our study is the impossibility of stratification by age, schooling, economic income and BMI. Our results are limited to stratification by sex. Besides that, some limitations regarding the methodology of the Vigitel survey should be considered in the interpretations of the results. Vigitel is based on self-reported information and may be subject to underestimation or overestimation. However, Vigitel’s food and beverage consumption indicators were validated by Monteiro et al., which concluded good reproducibility and adequate validity for the consumption of soft drinks and artificial juices. Vigitel excludes individuals residing in households without fixed telephony coverage, which could result in sub-sampling. In order to minimize this bias, the effect of the Vigitel design was used.

Conclusion

In our study, there was an expressive decrease in the excessive consumption of soda and artificial juice in Rio Branco, Acre, for adults of both sexes. Despite this downward trend, the prevalence of soft drink consumption on five or more days in the week is still high.

Acknowledgements

None.

Conflict of interest

The author declares that there is no conflict of interest.

References

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