Travel time and dietary intake in Latin American cities - A multilevel analysis.


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Rationale

• Latin american cities have a diverse urban profile, which can define the spatial relationships between home and workplaces.

• Longer travel times have been observed due to increased urbanization and vehicle motorization rates, and may affect activities in daily life such as physical activity and dietary intake.
Rationale

• More time spent travelling can translate into less time for buying food and cooking, leading to a greater consumption of lower time cost meals (e.g. pre-prepared foods) and ultra-processed foods.

• There are some studies showing a positive association between active commuting and lower risk of obesity, diabetes, and metabolic syndrome.

• There is limited empirical evidence on how travel time affects diet, and even less is known about it in Latin American cities.
Research questions:

1) Whether travel time at the city-level is associated with individual diet indicators and

2) If this association varies according to the city size?
Methods

Sample
SALURBAL harmonized data - Countries with available data on travel time, diet indicators and covariates (BR, CO, CL, MX, PE)

Exposure (L1_UX – Urban extent metropolitan area, Quistberg, 2018)

- **Urban average travel time** – measures the average automobile travel time during peak hour (in minutes);
- **Urban travel delay** - the average travel time delay due to congestion in the street network (in minutes);
- **Urban travel delay index** - Measures the increase in travel times due to congestion in the street network (Index ranges from zero to infinity)

Outcome (individual)
Vegetable and Sugar-sweetened beverages consumption
(Days per week - Rare: <= 1; Medium: 2-4 and Frequent: 5-7)
Methods

Confoundings

Individual: age, sex, education, car ownership;

City-level: city size, population density, intersection density;
adjusted gas price, presence of mass transportation options (Subway or BRT);
social environment index.
Methods

• Analytical methods:
  • Ordinal multilevel models for each outcome
    Individuals nested within cities
    Random effect at the city level

• Model building:

Model 1: exposure + sex + age
Model 2: exposure + sex + age + education
Model 3: exposure + sex + age + education, car ownership
Model 4: M3 + citysize + popden + intden + gasprice + transport option
Model 5: M4 + socio environment index

Models - 3 tertiles based on the city size (M1-M3 were the same and M4 and M5 without city size)
Results - Descriptives

Table 1. Number of cities and individuals per country.

<table>
<thead>
<tr>
<th>Country</th>
<th>BR</th>
<th>CL</th>
<th>CO</th>
<th>MX</th>
<th>PE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of cities (n=181)</td>
<td>27</td>
<td>21</td>
<td>35</td>
<td>91</td>
<td>23</td>
</tr>
<tr>
<td>Number of individuals*</td>
<td>93,113</td>
<td>3,140</td>
<td>62,230</td>
<td>72,789</td>
<td>11,929</td>
</tr>
</tbody>
</table>

*Note: Surveys complete samples;

Analytic sample: 57,170 (Vegetable consumption) 42,117 (SSB consumption)
## Results - Descriptives

Table 2. City-level characteristics by Vegetable consumption groups.

<table>
<thead>
<tr>
<th>City level characteristics</th>
<th>Vegetable consumption (in Days per week)</th>
<th></th>
<th></th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Frequent (5-7)</td>
<td>Medium (2-4)</td>
<td>Rare (&lt;=1)</td>
<td></td>
</tr>
<tr>
<td>Average travel time in traffic (min)</td>
<td>30.0</td>
<td>28.9</td>
<td>26.1</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Average travel delay time in traffic (min)</td>
<td>5.6</td>
<td>6.2</td>
<td>6.2</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Travel delay index</td>
<td>0.23</td>
<td>0.27</td>
<td>0.28</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>City size</td>
<td>46523.3</td>
<td>41039.3</td>
<td>30914.2</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Population density</td>
<td>7775.4</td>
<td>8632.8</td>
<td>9839.4</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Intersection density (NA=42)</td>
<td>13.0</td>
<td>12.9</td>
<td>12.4</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Adjusted gas price (NA=533)</td>
<td>0.03</td>
<td>0.03</td>
<td>0.03</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Presence of mass transit, %</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>44.7</td>
<td>37.0</td>
<td>18.3</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Yes</td>
<td>50.7</td>
<td>35.8</td>
<td>13.5</td>
<td></td>
</tr>
<tr>
<td>Social environment index (z-score)*</td>
<td>0.19</td>
<td>0.06</td>
<td>-0.02</td>
<td>&lt; 0.001</td>
</tr>
</tbody>
</table>
### Results - Descriptives

**Table 3.** City-level characteristics by *Sugar Sweetened Beverages* consumption groups.

<table>
<thead>
<tr>
<th>City level characteristics</th>
<th>Sugar Sweetened beverages consumption (in Days per week)</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Frequent (5-7)</td>
<td>Medium (2-4)</td>
<td>Rare (≤1)</td>
<td>p-value</td>
</tr>
<tr>
<td>Average travel time in traffic (min)</td>
<td>30.7</td>
<td>29.6</td>
<td>29.9</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Average travel delay time in traffic (min)</td>
<td>5.2</td>
<td>5.1</td>
<td>5.3</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Travel delay index</td>
<td>0.22</td>
<td>0.22</td>
<td>0.23</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>City size</td>
<td>51942.9</td>
<td>47454.9</td>
<td>48567.4</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Population density</td>
<td>8292.7</td>
<td>8073.3</td>
<td>8184.4</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Intersection density (NA=42)</td>
<td>15.6</td>
<td>14.3</td>
<td>14.8</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Adjusted gas price (NA=533)</td>
<td>0.036</td>
<td>0.037</td>
<td>0.038</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Presence of mass transit, %</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>44.2</td>
<td>30.8</td>
<td>25.0</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Yes</td>
<td>49.2</td>
<td>26.2</td>
<td>24.5</td>
<td></td>
</tr>
<tr>
<td>Social environment index (z-score)*</td>
<td>0.06</td>
<td>-0.0005</td>
<td>0.02</td>
<td>&lt; 0.001</td>
</tr>
</tbody>
</table>

* Higher score indicates better social environment
Results - models

Notes:
Odds for Rarity of consumption;
Average travel time / delay time variable: 10 min increase. Delay index: 0.1 increase.

Figure 1: Adjusted association between Average travel time, Delay Time and Delay Index and Vegetable consumption in Latinamerican cities. SALURBAL Project.
Results - models

Figure 2: Adjusted association between Average travel time, Delay Time and Delay Index and SSB consumption in Latinamerican cities. SALURBAL Project.

Notes:
Odds for Rarity of consumption
Average travel time / delay time variable: 10 min increase. Delay index: 0.1 increase
Summary Results

• Our results suggest there is an inverse association between travel time (average travel time, average delay time and travel delay index) and the frequency of vegetable consumption and a direct association with the frequency of SSB consumption - specially in bigger cities.

• Relevance of interventions in urban mobility systems for healthy diets.
Strengths

- Harmonized data for five countries;
- Big sample size;
- Possibility to explore a novel hypothesis.

Limitations

- Lack of temporality between exposure and outcome measures (travel time data does not precede diet data);
- Heterogeneity of exposure across individuals in the same city.
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