Tas1r3 and Ucn2 transcript levels in peripheral blood cells are associated with sugary and fatty food consumption and with excess of fat accumulation in children

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Introduction

New types of robust biomarkers of dietary exposure and function are needed to implement strategies for obesity prevention in children. Of special interest are those biomarkers of consumption of food rich in simple sugars and fat, as their intake has been associated with obesity development. Peripheral blood cells (PBCs) represent a new promising tool for identifying novel transcript-based biomarkers. We studied the potential associations between the expression levels of Tas1r3 and Ucn2 genes in PBCs and the frequency of sugary, fatty, and junk food consumption.

Subjects and Methods

Design, setting and participants: 463 children from the IDEFICS cohort selected to include similar number of boys and girls, with normal-weight and overweight, belonging to eight European countries.

Main outcome measures: Anthropometric parameters (measured at baseline and in a subset of 193 children after two years), food consumption frequency (estimated by the Children’s Eating Habits Questionnaire) and expression levels of genes in PBCs (analyzed by RT-qPCR).

Selected candidate genes:
- Taste receptor type 1 member 3 (Tas1r3), which codifies for a sweet taste receptor (TAS1R3).
- Uroctin II (Ucn2): the protein encoded by this gene is a member of the corticotrin-releasing factor family of peptides, with an important role in the control of food intake.

Results

Association studies between gene expression in PBCs and anthropometric parameters

The expression levels of Tas1r3 in PBCs of children (divided into three categories according to percentiles) were significantly associated with the two-year variation of some anthropometric parameters.

Conclusion

Transcript levels of Tas1r3 and Ucn2 in PBCs may be considered as potential biomarkers of consumption of sugary, fatty, or junk food, to complement data of food intake questionnaires.

Table 1. Frequencies of consumption of sugary, fatty and junk food expressed in times per week, corresponding to the 25th and 75th percentiles in the study population. The types of foods included in each category is indicated.

<table>
<thead>
<tr>
<th>Food category</th>
<th>Frequency consumption</th>
<th>Types of food</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sugary food</td>
<td>25th</td>
<td>Fruit juices, sweetened drinks, sugar added cereals, sweetened milk, sweetened yoghurt, and four types of snacks, like chocolate bars, candies, cakes, or ice cream</td>
</tr>
<tr>
<td></td>
<td>75th</td>
<td>Fruit juices, sweetened drinks, sugar added cereals, sweetened milk, sweetened yoghurt, and four types of snacks, like chocolate bars, candies, cakes, or ice cream</td>
</tr>
<tr>
<td>Fatty food</td>
<td>25th</td>
<td>Fried potatoes, fried fish, fried meat, or scrambled eggs</td>
</tr>
<tr>
<td></td>
<td>75th</td>
<td>Fried potatoes, fried fish, fried meat, or scrambled eggs</td>
</tr>
<tr>
<td>Junk food</td>
<td>25th</td>
<td>Sweetened drinks, chocolate or nut based spreads, and three types of snacks, like crisps, chocolate bars, or cakes</td>
</tr>
<tr>
<td></td>
<td>75th</td>
<td>Sweetened drinks, chocolate or nut based spreads, and three types of snacks, like crisps, chocolate bars, or cakes</td>
</tr>
</tbody>
</table>

Table 2. Anthropometric parameters and food intake consumption of fatty, sugary, and junk food of the study population spread according to expression analysis levels (<25th, 25-75th, and >75th percentiles) of Tas1r3 (Taste receptor type 1 member 3) and of Ucn2 (uroctin II). Results are mean and standard error of the mean (in brackets). Statistics: astatistic by LSD post-hoc analysis.

Table 3. Anthropometric parameters and food intake consumption of fatty, sugary, and junk food of the study population spread according to expression analysis levels (<25th, 25-75th, and >75th percentiles) of Tas1r3 (Taste receptor type 1 member 3) and of Ucn2 (uroctin II). Results are mean and standard error of the mean (in brackets). Statistics: astatistic by LSD post-hoc analysis.

Figure 1. Expression levels of Tas1r3 (A, B) and Ucn2 (C, D) in peripheral blood cells in the study population spread according to consumption frequencies (<25th, 25-75th and >75th percentiles) of sugary and junk food (for Tas1r3, taste receptor type 1 member 3) and fatty and junk food (for Ucn2, uroctin II). Results are mean ± standard error of the mean expressed in arbitrary units (AU). The number of children in each group is indicated. Statistics: astatistic by LSD post-hoc analysis; p-values of one-way ANOVA are indicated.

Figure 2. Changes (Δ) in anthropometric parameters (BMI, waist circumference, and sum of skin-folds) over 2 years in a subset of the study population spread according to expression levels of taste receptor type 1 member 3 and of Ucn2 (uroctin II). Results are mean ± standard error of the mean (in brackets). Statistics: astatistic by LSD post-hoc analysis.