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Introduction

Responsible for 3 million deaths per year worldwide, alcohol consumption causes various diseases and social problems (WHO, 2018). In France, it is the second cause of avoidable mortality with 41.000 deaths in 2015 (Bonaldi et al., 2019). Reducing its consumption prevalence is a public health priority, especially among youth that displays alarming heavy drinking patterns (Bräcker et al, 2015). In that regard, measures are recommended, including alcohol advertising restrictions (WHO, 2018). For instance in some countries, laws mandate advertising to strictly convey factual and objective information on alcohol products and ban advertising that convey sport, music, seduction, etc. claims. The reward system is a set of brain regions responding to a reward or to the anticipation of a reward (Schacht et al., 2011). To assess the effectiveness or not of this measure, our research aims at measuring, using BOLD fMRI, the influence of alcohol ads contents on the activation of brain structures and in the reward circuit in particular.

Methods

An advertising agency created 192 alcohol ads and 96 water (control) ads containing existing brands. Geometric features (position and size) of the bottle and the logo remained consistent across ads. Different contents were created with elements displayed in the background: (1) neutral green or gray background, (2) picture suggesting an attractive context (party or sport) without character or (3) containing a character. After approval from the Institutional Review Board (Clinical Trials: NCT03818750), 78 young drinkers (age 18-25) were included. Subjects were scanned using a 3T Siemens Prisma system equipped with a 64-channel phased-array coil. An MPRAGE sequence provided structural data while functional data was obtained with a T2*-weighted single-shot spin-echo EPI sequence (TR=1.2s, TE=30ms, 54 axial slices, matrix size 84x84, resolution=2.5x2.5x2.5mm3, MB 3) for a duration of 25 minutes. During the fMRI task, the participants were presented 288 trials gathered in blocks of 6 trials lasting 25s in a mixed block/event-related design. A single trial consisted in viewing a beverage ad during 3s and replying to the question: "Does this ad make you want to consume the product?" within a 1.2s delay. Images were processed using SPM12. At the first level, the BOLD signal was modeled using a 2x2x2 factorial design within the general linear model framework. The factors were type of beverage (alcohol, water), context (with, without), presence of a character (yes, no). Corresponding events were modeled with the canonical hemodynamic response function. Six movement parameters were also entered in the model. Whole-brain analysis was performed to extract the activations elicited by the presentation of different beverages and different ad contexts. A cluster-size threshold of 99 voxels was obtained by running Monte Carlo

simulations with AlphaSim to correct for multiple comparisons. The preliminary results on 25 subjects are presented below.

Results

Figure 1 depicts significant activations in the mid cingulum, right dorsolateral and anterior (BA10) prefrontal cortices (PFC) and in the precuneus for the beverage effect; bilaterally in the fusiform gyrus, the hippocampus and the caudate nucleus as well as in the right amygdala for the context effet; bilaterally in the ventro medial PFC and the parietal inferior lobule, precuneus and fusiform gyrus as well as visual and parahippocampal areas when the ad contains a character.

Conclusion

The activations found in the reward circuit areas with increased ad attractiveness demonstrate that adding a context to an ad can influence the desire to consume a product. If this preliminary work needs validation with the entire group of participants, it supports that regulation of ad content adopted in some countries can be beneficial.

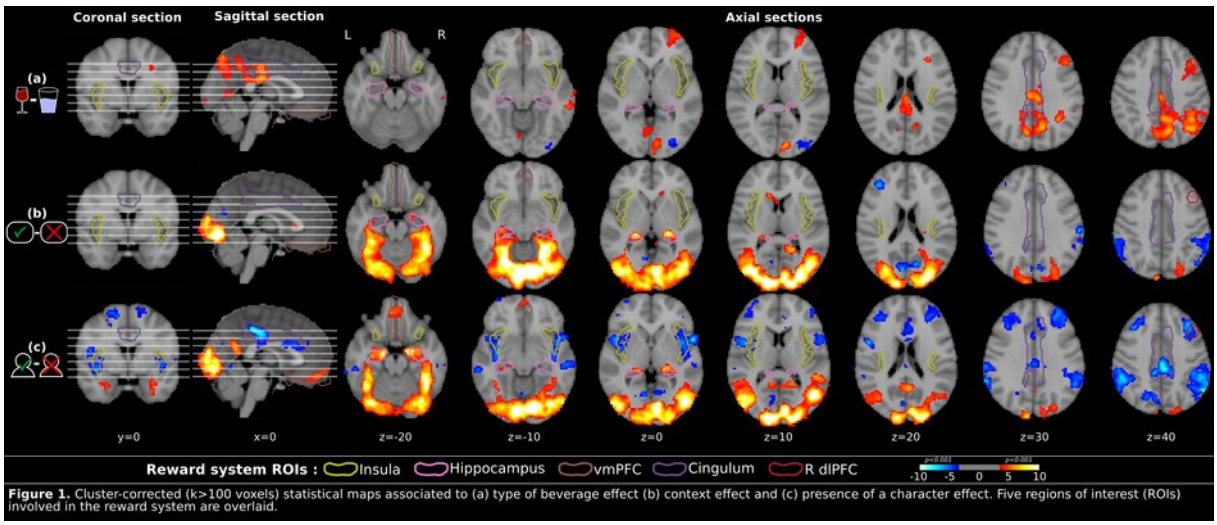

Figure 1. Cluster-corrected (k>100 voxels) statistical maps associated to (a) type of beverage effect (b) context effect and (c) presence of a character effect. Five regions of interest (ROIs) involved in the reward system are overlaid.

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