

**Title:** Socioeconomic and cultural impact on the cognitive and neural mechanisms of dietary decision-making

**Collaborators:**

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ICM/Sorbonne collaborator: Dr. Liane Schmidt, ICM, Sorbonne University

**Topic:** Cognitive and neural mechanisms of unhealthy nutritional habits in women, socioeconomic sources for inter-individual differences in sticking to healthier diets, and behavioral change.

**Objectives:** We propose to combine our complementary expertise to:

- (1) Uncover how optimism biases in diet-associated health risk estimations determine dietary decision-making.
- (2) Identify the underlying neural mechanisms measured with task-based functional magnetic resonance imaging (fMRI).
- (3) Identify sources of inter-individual differences by assessing socioeconomic variables and by comparing women and men.

**Context**

Unhealthy dietary patterns are associated with an increased risk of all-cause mortality (English et al., 2021) and carry a significant economic burden (Scarborough et al., 2012). However, unhealthy dietary consumption behavior and the associated health hazards such as obesity are on the rise worldwide (Imamura et al., 2015). Although there is a global trend, there are interesting cultural and country-specific variations. For instance, more men than women are at risk of obesity in developed countries, whereas the reverse is observed in developing countries (Kapoor et al., 2021, Ng et al., 2014). Moreover, the link between nutrition and obesity is moderated by socioeconomic inequality for European women more than their male counterparts (Vinci et al., 2019). Poverty predisposes women to a greater risk of obesity in India (Gouda & Prusty, 2014), and lower-level education is a factor associated with obesity in France (Gallus et al., 2015). Given the differences in the socioeconomic status of men and women, socioeconomic inequality may influence unhealthy dietary habits and health consequences. Therefore, it is essential to understand the potential sex differences in the socioeconomic and cognitive mechanisms that lead to unhealthy dietary decision-making. Here, we combine our complementary expertise in cognitive and decision neuroscience, gender research, and experimental psychology to tackle the problem of unhealthy eating habits. We focus on value-based dietary decision-making and its potential cognitive biases linked to over-optimism in health risk estimations.

A growing body of research has demonstrated that people hold optimistically biased beliefs about their risks of experiencing adverse life events (Sharot, 2011; Sharot et al., 2011; Eil and Rao, 2011; Korn et al., 2012; Garrett and Sharot, 2014; Kuzmanovic et al., 2015; Moutsiana, 2015; Sharot and Garrett, 2016; Kuzmanovic and Rigoux, 2017, Kuzmanovic et al., 2018). They believe they are less likely to experience adverse life events than others. Moreover, when confronted with new information contradicting an initial belief, people consider favorable information (i.e., good news) more than unfavorable information (i.e., bad news). Optimism biases and optimistically biased belief updating are crucial in maintaining mental and physical health (Taylor and Brown, 1988; Scheier et al., 2001; O'Mara et al., 2011; Berger-Tal and Avgar, 2012). However, ignoring negative information can also prove disadvantageous in certain situations and lead to a lack of precaution (Burger and Burns, 1988; Dillard et al., 2006; Katapodi et al., 2009; Garrett et al., 2018). Optimism biases decrease with environmental exposure to daily stressors and economic scarcity. Moreover, it has been studied extensively how optimism biases impact food behavior in Western societies (Miles & Scaife, 2003). Findings indicate that individuals who see themselves as less at risk from unhealthy dieting-related hazards than others might be less influenced by policies and messages aimed at behavioral and diet change. However, the extent of optimism bias in decision-making has been rarely investigated in

non-western countries. How optimistically biased belief updating affects food valuation and differs between men and women in non-western countries remains unanswered.

### **Hypothesis**

We proffer that the effect of socioeconomic adversity on optimism biases in belief updating is experienced differently by men and women in developed, gender-equal compared to developing, gender-inequitable countries. Our working hypothesis proposes that optimism biases in belief updating mediate the effects of taste and health information on food choices. This mediation is sex-specific and moderated by socioeconomic and cultural differences.

### **Methods and Organization of the PhD thesis:**

We propose jointly assessing food choices and belief-updating biases with a validated cognitive task paradigm. The paradigm involves estimating different eating-related health risks for oneself and others before and after being presented with base rates for these events in the general population. Incidentally, participants will also choose how much they want to eat snack items of varying tastiness and healthiness. Optimism bias is measured by the difference in health risk estimations for oneself versus for somebody else, and optimistically biased belief updating will be measured by how much estimations are updated after an initial overestimation versus an underestimation of risks. A sizeable online study will be conducted on Indian and French participants to uncover how optimism biases in beliefs determine how much tastiness and healthiness influence food choices. In addition, the data will be tested for sex differences and interactions of socioeconomic status (e.g., income, education, occupation, family size) and mental health variables (e.g., depression, anxiety, stress). We will use mediation analyses and computational drift-diffusion models to uncover the effects of optimism biases on hidden, latent variables of food choice formation (e.g., initial choice biases, decision thresholds, speed of evidence accumulation in favor of an option over an alternative). Moreover, we will follow up with a task-based fMRI study in a smaller sample conducted at ICM in Paris to uncover where in the brain food preference formation is influenced by optimism biases in beliefs about food behavior-related health risks.

The data collection for this thesis will be conducted at and from the Paris Brain Institute (ICM) in France, but the candidate is expected to travel to IIT Dehli at least twice during the three years of the PhD thesis. Data collection will be carried out online at both campuses, and in person at ICM, which will allow the collaborators to leverage their expertise and institutional resources and compare the effects obtained from participants from both Western and non-Western societies. Notably, online data collection will be beneficial for targeting such a large and international sample of participants. Data will be shared between both labs following data-sharing agreements and consent from participants for data reuse. Ethics approval has been obtained from IIT Delhi and is under review by the Sorbonne University IRB. Dr. Liane Schmidt, who co-leads the Belief Decision Neuroscience team at ICM, will supervise the PhD candidate. Scientific advice will be further given by the collaborator at IIT Dehli, Dr. Varsha Singh.

### **Expected outcomes and impact:**

This thesis proposal combines approaches and concepts from neurobiology, cognition, and psychology to address women's health, cognitive biases in food preferences, and their moderation by stressors such as socioeconomic inequalities. The project will add crucial insights into the impact of socioeconomic inequalities on beliefs (optimism), behavior (dietary choices), and sex-specific neural responses that might contribute to unhealthy food choices predisposing women, particularly penalized by socioeconomic inequality in developing countries. This is important to gain insight into more effective risk communication, adherence to preventive actions, and understanding of food behavior-related health risks in Indian and French societies.

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