A fMRI controlled randomized clinical trial proposing a mindfulness-based intervention for anxious adolescents: where we are with the Mindfulteen Study

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INTRODUCTION

Identification of **precursor symptoms** and early intervention strategies are central for the prevention of psychiatric illnesses (McGorry et al., 2014). In adolescents, expression of **anxiety** could represent a common and **transdiagnostic risk factor** (Duffy et al., 2014; Johnstone et al., 2005; Shah et al., 2017). **Mindfulness-based interventions (MBI)** can improve anxiety in adults (Gotink et al., 2015; Goyal et al., 2014), but their efficacy in adolescents as well as the underlying mechanisms are still largely unexplored (Kallapiran et al., 2015; Zoogman et al., 2015). In this 3-year longitudinal study with a nested randomized controlled trial (Fig. 1), we aim to assess the clinical impact of MBI practice in adolescents and associated biological changes.

METHODS

Young adolescents (13-15 year old) from **the general population** (no current psychiatric follow-up) are recruited trough advertisement in Geneva. Participants are allocated into a **"high" or "low" anxiety groups** based on the State Trait Anxiety Inventory (STAI) score before being randomized into an **"early" or "late" 8-week MBI** (fig. 1 and 2). Pre- and post-treatment assessment include a thorough **clinical characterization** (structured psychiatric interview and self-assessment questionnaires), **multimodal brain magnetic resonance imaging** (task and resting-state functional, structural, diffusion, whole-brain spectroscopy imaging), **physiological markers of stress** (hair cortisol, heart rate variability, skin conductance), **blood sampling** (genetics, oxidative and inflammatory markers) as well as a **safety learning** and **emotion regulation task** (fig. 3). Clinical characterization is performed at the screening visit (V0) and outcomes assessments are performed at baseline (V1), after MBI completion (V3) and 18 months after MBI (V3). Participants on the late intervention group undergo an extra assessment at the end of MBI (V2bis), to allow a pre-post comparison.
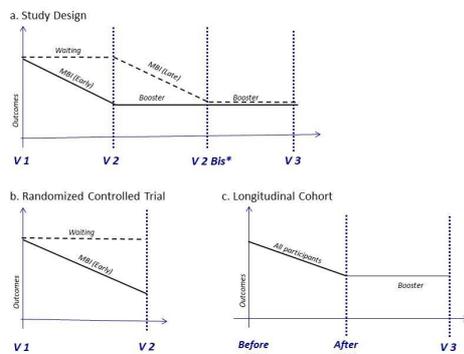
Figure 1. a. Study design. * The V2bis visit is proposed to participants on the Late MBI group, after the intervention. **b.** Nested randomized controlled trail. **c.** Longitudinal Cohort. Data from both early and late MBI groups will be merged to test for the effect of MBI.
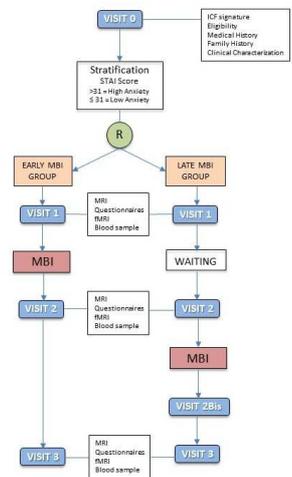
Figure 2. Study's flow chart. Participants are stratified based on the STAI-T score. Participants in each group are then randomized for the intervention as early MBI group or late MBI group. The late MBI group is the control group.
STAI: State and Trait Anxiety Disorder. R: Randomization

RESULTS

- 43 participants included between January 2019 and July 2020
- 51% male, mean age 14,4
- 76.2% of the participants were identified as "high anxiety" group at the STAI-T
- 86 MRI visits performed (40 V1, 34 V2 and 12 V2bis)
- 2 participants refused MRI at V2bis
- Until July 2020 4 MBI groups were proposed, with 31 participants enrolled
- No drop-offs of the MBI or the study were identified
- Teenagers' attendance on the MBI is of 92%
- The average satisfaction about the MBI is of 84.8%
- 87% of participants would recommend this MBI to a friend
- No adverse events were identified
- Preliminary results of a task evaluating qualitatively spontaneous emotion regulation strategies suggest higher resort to relaxation after MBI (Figure 3).
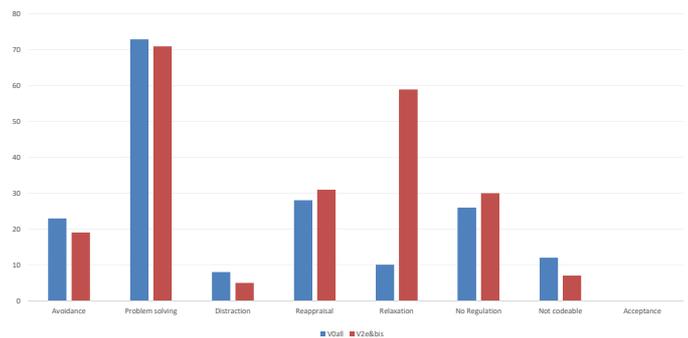
Figure 3. Emotion Regulation Task: preliminary results. Emotion Regulation Task results of 29 participants, comparing before (at V0) and after (at V2 for the early group and V2bis for the late group) MBI.

CONCLUSION

The proposed MBI is well accepted by adolescents, with high attendance and satisfaction scores, and we will continue recruiting until the target size sample is obtained (N=120). We expect that this MBI can improve anxiety and reduce reactivity to stress in adolescents. From a pathophysiological perspective, we anticipate that the analysis of MRI data will show a normalization of activity in brain circuits involved in the regulation of emotions, which will correlate with a reduction of biological stress and inflammatory markers.

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