



# Mindfulness skills during pregnancy: Prospective associations with mother's mood and neonatal birth weight

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## ABSTRACT

**Objectives:** Mindfulness skills have been associated with better mood and several health related outcomes. Because depressed mood during pregnancy has been related to worse child outcomes, the aim was to examine the association of mindfulness skills during pregnancy with the mother's depressive symptoms, gestational age, and neonatal birth weight.

**Methods:** A subsample of 905 pregnant women who participated in the longitudinal cohort HAPPY study (Holistic Approach to Pregnancy and the first Postpartum Year) completed the 12-item Three Facet Mindfulness-Questionnaire-Short Form at 22 weeks of gestation. The Edinburgh Depression Scale was completed to assess depressive symptoms at 12, 22 and 32 weeks. The obstetric medical records were examined for gestational age and birth weight.

**Results:** Mindfulness skills Acting with Awareness and Nonjudging at 22 weeks were associated with less depressive symptoms at 22 weeks and at 32 weeks. When controlled for depressive symptoms at 22 weeks, the association was still significant for Nonjudging predicting depressive symptoms at 32 weeks (Beta = - 0.12,  $p < 0.01$ ). Regarding the obstetric medical records, only Nonreacting was (positively) associated with birth weight (Beta = 0.09,  $p < 0.01$ ). Controlling for gestational age, sex, parity, depressive symptoms, and health behavior, Nonreacting predicted a normal birth weight (OR = 1.12, 95% CI = 1.06–1.19), in contrast to low birth weight.

**Conclusion:** It seems that different mindfulness skills during pregnancy are important in predicting mother's depressive symptoms compared to the prediction of child's birth weight. Potential mechanisms are discussed.

## 1. Introduction

Distressed mood during pregnancy, especially depressive symptom severity, has been related to worse birth outcomes, such as pre-term birth and low birth weight [1–4]. Although evidence is not consistent [5], reviews and meta-analyses suggest a negative effect on gestational age and birth weight, the strength being dependent on the country and whether premature births are included [6,7]. The mechanism may involve effects of distress on the maternal cardiovascular system [5,8], increased activation of the maternal hypothalamus-pituitary-adrenal (HPA) system [9], and maternal inflammatory processes [10]. Specifically, regarding the cardiovascular system, maternal abnormal autonomic drive to the heart has been shown to be associated with a larger risk of hypertension and pre-eclampsia, which are risk factors for unfavorable term outcomes, such as pre-term birth [11,12]. Activation of the maternal HPA system facilitates the onset of labor and has been shown to be negatively related to fetal neurodevelopmental maturation independent of gestational age [10,13].

Finally, maternal inflammatory processes, which are enhanced by infection or depression, increase the risk of pre-term birth and possibly other unfavorable neonatal outcomes [14].

Mindfulness has been defined as the nonjudgmental attention to phenomena occurring in the present moment [15,16]. As a habitual tendency, it has been associated with better mood, and lower symptoms of depression and anxiety [15,17,18], also in pregnant women [19]. More importantly, mindfulness-based interventions have been shown to decrease symptoms of anxiety and depression in various populations with a medium to large effect size as reported in meta-analyses [20,21]. In pregnant women, only a small number of trials have been performed to date, showing some promising results regarding decrease of symptoms of anxiety and depression [22]. However, studies were often uncontrolled and applying unconventional intervention formats, precluding clear conclusions in this population at the moment [23].

Also, mindfulness and mindfulness-based interventions have been associated with decreased blood pressure and cortisol levels [24–28],

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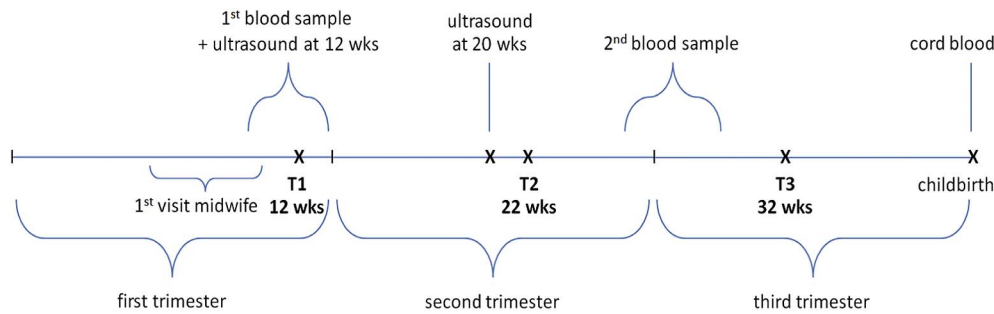


Fig. 1. Time line depicting assessment points during pregnancy in the HAPPY study. For this study, only the questionnaires at T1–T3 are used, not the ultrasound or blood samples.

suggesting that mindfulness may also have beneficial physiological effects that may be relevant during pregnancy. Indeed, recently it has been shown that a higher score on general mindfulness skills was associated with a more favorable trajectory of heart rate variability during pregnancy [29]. Specifically, the heart rate variability component driven by the parasympathetic nervous system was higher across trimesters and the typical decrease in this index over the course of the pregnancy was less pronounced.

Therefore, the aim of the current study was to examine the association of mindfulness skills during pregnancy with the mother's depressive symptoms later in pregnancy and the neonatal outcomes. We hypothesized that mindfulness may be associated not only with a lower level of depressive symptoms later in pregnancy, but also with a more favorable gestational age and birth weight of the child, adjusted for important confounders.

## 2. Methods

### 2.1. Participants

The Holistic Approach to Pregnancy and the first Postpartum Year (HAPPY) study is a longitudinal cohort of pregnant women in southern Netherlands, who are followed from the early stages of the pregnancy until one year post-partum. Participants were recruited from 17 community midwife practices. Eligible pregnant women were those who were Dutch speaking and Caucasian (or third generation of other ethnic groups). This was done because of the suboptimal mastery of Dutch language and/or culturally influenced different semantic understanding of the questions in many of the first and second generation ethnic minority women. Exclusion criteria were: gemelli pregnancy (or higher order pregnancies), endocrine disorder, use of thyroid medication, severe psychiatric disease (schizophrenia, borderline, or bipolar disorder), HIV, drug or alcohol addiction problems, or any other disease resulting in treatment with drugs that are potentially adverse for the foetus and need careful follow-up during pregnancy [30]. About 3250 women received oral and written information about the study at the first visit of which 2275 (70%) were willing to participate and provided informed consent. Questionnaire sets were not identical for all women: the present study is based on a random subsample of women who received the 12-item Three Facet Mindfulness-Questionnaire-Short Form (TFMQ-SF) (Truijens et al., 2016) at 22 weeks of gestation as part of their questionnaire set (about 45% of the total sample).

The study has been approved by the ethical committee of Tilburg University and by the Medical Ethics committee of the Máxima Medical Centre Veldhoven.

### 2.2. Material

Sociodemographic questions were completed by the mother at 12 weeks of gestation on, among others, age, highest educational level attained, history of previous depression, if pregnancy was planned or not, pre-pregnancy body mass index (BMI), parity, smoking (no/yes; if

yes: how many), and alcohol consumption (no/1 glass per week/2–4 glasses per week/ > 4 glasses per week).

Antenatal depressive symptoms during the past seven days were assessed at 12, 22, and 32 weeks of gestation (Fig. 1) using a validated Dutch version of the 10-item Edinburgh Depression Scale (EDS) [31]. Each item has a four-point scale and total scores range from 0 to 30 with higher scores indicating higher levels of depressive symptoms. Cut-off values of  $\geq 11$  during the first and  $\geq 10$  during the second and third trimesters of pregnancy have been reported [32]. Cronbach's  $\alpha$  in the present study ranged from 0.83 to 0.88 across the measurement points.

Mindfulness was assessed at 22 weeks using the Three Facet Mindfulness Questionnaire-Short Form (TFMQ-SF) [19], which is originally derived from the short form [33] of the frequently used Five Facet Mindfulness Questionnaire [15]. It consists of three subscales, each containing four items, conceived of as most relevant in the pregnancy and close to the most widely used definition of mindfulness: (i) Acting with Awareness, which is the opposite of acting on automatic pilot, (ii) Nonjudging of one's thoughts and feelings, but rather being accepting towards them, and (iii) Nonreacting to one's disturbing thoughts and feelings. The validity of the measure is established and indices of internal reliability were found to be adequate [19], the Cronbach alphas being 0.87 (Acting with Awareness), 0.84 (Nonjudging), and 0.80 (Nonreacting) in the present sample.

The midwifery practices and the obstetric departments of the two regional hospitals provided full obstetric records for the determination of, among other, gestational age, sex, Apgar score, and birth weight.

### 2.3. Statistical analysis

Potential differences between the women who completed the mindfulness questionnaire and the rest of the cohort were examined using *t*-tests for independent samples and Chi-square tests. Bivariate correlations between relevant variables were computed. To adjust for covariables in the main analyses, those were selected which are known or theoretically may be expected to be associated with the outcome variables. This resulted in a similar set of variables for depressive symptoms, gestational age, and birth weight, see below. Because of highly skewed distributions, smoking and alcohol consumption were dichotomized.

For depressive symptoms at 32 weeks of gestation as outcome a multiple linear regression analysis was used using mindfulness skills at 22 weeks as predictors, adjusting for depressive symptoms at 22 weeks and the following sociodemographic and clinical variables: age, highest level of education, BMI, smoking (yes/no), alcohol consumption (yes/no), history of depression (yes/no), and if pregnancy was planned (yes/no) [34,35].

Gestational age and birth weight as continuous outcomes were first analyzed using multiple linear regression analyses including as predictors: depressive symptoms, mindfulness skills, age, level of education, BMI, smoking behavior, alcohol consumption, parity (and gestational age in the case of birth weight) [36]. To avoid associations being

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