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Published in:
Journal of Psychiatric Research

DOI:
[10.1016/j.jpsychires.2022.12.007](https://doi.org/10.1016/j.jpsychires.2022.12.007)

Publication date:
2023

Document Version
Publisher's PDF, also known as Version of record

[Link to publication in Tilburg University Research Portal](#)

Citation for published version (APA):
Hulsbosch, L. P., van de Poel, E., Nyklicek, I., & Boekhorst, M. G. B. M. (2023). Trait mindfulness facets as a protective factor for the development of postpartum depressive symptoms. *Journal of Psychiatric Research*, 157, 264-270. <https://doi.org/10.1016/j.jpsychires.2022.12.007>

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Trait mindfulness facets as a protective factor for the development of postpartum depressive symptoms

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ARTICLE INFO

Keywords:

Postpartum depressive symptoms
First postpartum year
Trait mindfulness
Non-judging
Growth mixture modeling
Trajectories

ABSTRACT

Background: Postpartum depression has a prevalence rate of up to 17%. As there are many negative consequences of postpartum depressive symptoms, it is important to examine possible protective factors, such as trait mindfulness. Since postpartum depressive symptoms are variable over time between and within individuals, this study focused on the possible association between facets of trait mindfulness and trajectories of postpartum depressive symptoms throughout the first postpartum year.

Methods: A subsample of 713 women that participated in the HAPPY study completed the Three Facet Mindfulness Questionnaire-Short Form at 22 weeks of pregnancy and the Edinburgh Postnatal Depression Scale (EPDS) at six weeks, four months, eight months, and twelve months postpartum. Possible different EPDS trajectories were obtained by means of growth mixture modeling.

Results: Two EPDS trajectories (classes) were found: a *low stable* symptom class (N = 647, 90.7%) and an *increasing-decreasing* symptom class (N = 66, 9.3%). Women in the *low stable* class showed higher ‘acting with awareness’ and ‘non-judging’ scores. A higher score on the ‘non-judging’ facet of trait mindfulness was associated with a higher likelihood of belonging to the *low stable* class (OR = 0.79, 95% CI [0.72, 0.87], $p < 0.001$), adjusted for confounders and the other mindfulness facets.

Conclusions: The non-judging facet of trait mindfulness was associated with low stable levels of depressive symptoms during the first postpartum year. Mindfulness-based programs, focusing on enhancing non-judging may be of benefit for pregnant women to possibly decrease the risk of developing postpartum depressive symptoms after childbirth.

1. Introduction

Postpartum depression is often defined as an episode of a major depressive disorder that occurs in the postpartum period, which can range up to one year postpartum (O’Hara and McCabe, 2013). Postpartum depression affects around 17% of postpartum women worldwide (Wang et al., 2021) and has many negative consequences for the mother and her newborn. For the mother, symptoms of postpartum depression could affect physical and psychological health, social relationships, interaction with her partner, and quality of life (Slomian et al., 2019). Consequences for the newborn include a negative impact on growth and development (Oyetunji and Chandra, 2020; Rogers et al., 2020). Moreover, negative associations have been reported with breastfeeding behavior, mother-infant interaction, and mother-infant bonding (Oyetunji and Chandra, 2020; Slomian et al., 2019).

Given the many negative consequences of postpartum depression, it is important to study factors associated with its onset and development. Factors that have been reported to be associated with the etiology of postpartum depressive symptoms are similar to those associated with antenatal depressive symptoms, including age, level of education, lack of support, history of depression, unplanned pregnancy, and pregnancy complications (Alshikh Ahmad et al., 2021; Caparros-Gonzalez et al., 2017; Guintivano et al., 2018; Wang et al., 2021). Moreover, perinatal specific factors such as a woman’s negative childbirth experience, pre-term birth, and breastfeeding have been reported to be significant in the occurrence of postpartum depressive symptoms (Alshikh Ahmad et al., 2021; Batt et al., 2020; Bell and Andersson, 2016; Guintivano et al., 2018; Wang et al., 2021). Nonetheless, there may be specific maternal characteristics that could protect against the development of postpartum depressive symptoms. The maternal characteristic trait mindfulness

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<https://doi.org/10.1016/j.jpsychires.2022.12.007>

Received 3 October 2022; Received in revised form 28 November 2022; Accepted 10 December 2022

Available online 12 December 2022

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could be such a protective factor.

Trait mindfulness can be defined as the dispositional capacity of paying and maintaining attention to present-moment experiences with an open and non-judgmental attitude (Brown and Ryan, 2003). Trait mindfulness involves a person's capability to be mindful in daily life and has been shown to be a relatively stable characteristic in both non-pregnant and pregnant populations (Baer et al., 2006; Brassel et al., 2020; Jensen et al., 2016, 2019; Veehof et al., 2011). Mindfulness can also be defined as a state, which is dependent on the situation and has varying levels across time (Bishop et al., 2004; Tanay and Bernstein, 2013). State mindfulness can be trained when carrying out meditation exercises, and throughout time an increase in state mindfulness could improve trait mindfulness (Kiken et al., 2015).

Previous studies that focused on non-pregnant populations have reported an inverse association between trait mindfulness and depressive symptoms (Branstrom et al., 2011; Cash and Whittingham, 2010; Nyklíček et al., 2015). Moreover, a recent study showed trait mindfulness to be associated with low stable levels of depressive symptoms throughout pregnancy (Hulsbosch et al., 2022). However, it is still unknown whether trait mindfulness is also associated with postpartum depressive symptoms. While there is plenty of research that focuses on postpartum depression, most of these studies are based on single measurements of the symptoms. However, research by Nandi et al. (2009) pointed out that a cross-sectional approach will not suffice, as depressive symptoms are variable over time between and within individuals. Therefore, the current study used four repeated measurements of postpartum depressive symptoms, to possibly establish different patterns of postpartum depressive symptoms in women throughout the first postpartum year, by means of growth mixture modeling. In addition, up until now a clear consensus of the definition of mindfulness as unidimensional construct is lacking as previous studies used varying facets of mindfulness in its definition (Bergomi et al., 2013). Therefore, instead of addressing mindfulness as a unidimensional construct, we examined different facets of mindfulness in their association with postpartum depressive symptoms.

The current study aimed to examine the possible association between facets of trait mindfulness and trajectories of postpartum depressive symptoms during the first postpartum year. We hypothesized: (i) that trajectories of postpartum depressive symptoms throughout the first postpartum year would be determined; (ii) that trait mindfulness would be independently and negatively related to the trajectories characterized by heightened postpartum depressive symptoms throughout the first postpartum year.

2. Material and methods

2.1. Procedure

This study was part of the Holistic Approach to Pregnancy and the first Postpartum Year (HAPPY) study, a population-based longitudinal prospective cohort study following women from early pregnancy to the end of the first postpartum year (Truijens et al., 2014). Dutch-speaking women with low-risk pregnancies (N = 2269) were recruited by midwives of 17 midwife practices at the time of their first prenatal visit. Exclusion criteria were multiple pregnancy, severe psychiatric disorder (e.g., schizophrenia, borderline personality disorder and bipolar disorder) and/or a documented history of chronic disease (e.g., diabetes and thyroid dysfunction). Recruitment took place from January 2013 until September 2014. The HAPPY study was conducted in accordance with the latest version of the Declaration of Helsinki (WMA, 2013), was approved by the ethical committee of Tilburg University (protocol number EV-2012.25), and reviewed by the Medical Ethics Committee of the Máxima Medical Centre Veldhoven. All participants gave their written informed consent.

3. Participants

Only the participating women (N = 911) who were included in the HAPPY study between March and December 2013 were asked to fill out a questionnaire assessing trait mindfulness at 22 weeks of pregnancy. Out of these 911 women, 198 participants did not have a complete measurement of postpartum depressive symptoms throughout the first postpartum year. These women were excluded from analyses, and the final study sample included 713 women. This was 78% of the total 'mindfulness sample'.

4. Measures

4.1. Trait mindfulness

Trait mindfulness was measured at 22 weeks of pregnancy using the 12-item Three Facet Mindfulness Questionnaire-Short Form (TFMQ-SF) (Truijens et al., 2016). The TFMQ-SF was derived from the Five Facet Mindfulness Questionnaire (FFMQ) (Baer et al., 2006) and included only the three mindfulness facets that were reported to be associated with symptoms of psychological distress (de Bruin et al., 2012). These three facets each contain four items and assess a distinct facet of mindfulness: (1) *acting with awareness*, which means being attentive to experiences in the here-and-now, (2) *non-judging*, which translates to being accepting of one's own thoughts and feelings, and (3) *non-reacting*, which means not getting carried away by one's own thoughts and feelings, but instead allowing thoughts and feelings to come and go. The total scores per subscale vary from 4 to 20. Higher scores reflect higher levels of mindfulness. The validity of the TFMQ-SF has been established in Dutch pregnant women (Truijens et al., 2016). The Cronbach's alphas in the current study were 0.86 (*acting with awareness*), 0.80 (*non-judging*), and 0.80 (*non-reacting*).

4.2. Postpartum depressive symptoms

Postpartum depressive symptoms were measured six weeks, four months, eight months, and twelve months postpartum using the 10-item Edinburgh Postnatal Depression Scale (EPDS) (Cox et al., 1987; Pop et al., 1992). Total scores on this scale range from 0 to 30. Higher scores reflect higher levels of postpartum depressive symptoms. The validity of the EPDS is established in Dutch postpartum women with appropriate psychometric properties (Pop et al., 1992). In the current study, the Cronbach's alphas were 0.87 (six weeks postpartum), 0.86 (four months postpartum), 0.89 (eight months postpartum), and 0.85 (twelve months postpartum).

4.3. Descriptive characteristics

Several demographic characteristics, lifestyle habits, perinatal specific factors, and psychological characteristics were assessed by means of a questionnaire. Demographic characteristics included *age*, *level of education* (low or medium/high (high = Bachelor's degree or higher)), *employment* (yes/no), and *living with partner* (yes/no). Lifestyle habits included *pre-pregnancy BMI*, *smoking during pregnancy* (yes/no), and *alcohol use during pregnancy* (yes/no). Perinatal specific factors included *parity* (primiparous/multiparous), *unplanned pregnancy* (yes/no), *pregnancy complications* (one (or more) of the following obstetric complications during pregnancy: antepartum haemorrhage, intrauterine growth restriction, evidence of ultrasound abnormalities on the standardized 20-week ultrasound, pre-eclampsia, and diabetes gravidarum) (yes/no), and *breastfeeding six weeks postpartum* (exclusive breastfeeding or both breastfeeding and formula/only formula). Psychological characteristics included *previous diagnosis of depression* (yes/no). Moreover, obstetric data were extracted from the obstetric records, such as *spontaneous birth* (childbirth without any intervention during labor (augmentation and/or an instrumental birth: vacuum- or forceps-assisted vaginal birth,

caesarean section) (yes/no) and *preterm birth* (yes/no).

4.4. Statistical analyses

Growth mixture modeling was performed to determine longitudinal trajectories (classes) of postpartum depressive symptoms, using Mplus version 8.7 (Muthén and Muthén, 1998–2017). The EPDS scores at six weeks, four months, eight months, and twelve months postpartum were used. The MLR estimation (maximum likelihood estimation with robust standard errors) was used since the EPDS scores were positively skewed (with a substantial number of scores equal to zero). The starting point was a one-class model, after which models with increasing numbers of classes were fitted. Based on several fit indices the optimal number of classes was determined. In order to make this decision, the following fit indices were used: Bayesian Information Criterion (BIC), Lo-Mendell-Rubin Likelihood Ratio (LMR-LRT), and the Bootstrapped Likelihood Ratio Test (BLRT) (Jung and Wickrama, 2008; Nylund et al., 2007). Moreover, the entropy was considered as well as the parsimony and interpretability of the models (Jung and Wickrama, 2008). A lower BIC value means a better fit of the model, and significance of the LMR-LRT and BLRT indicates that the model has a better fit than a model with one class less (Collins and Lanza, 2010). The closer the entropy value is to 1, the better the participants fit into the concerning classes (Collins and Lanza, 2010).

After the optimal number of classes was determined, a variable that represented the class membership was exported to Statistical Package for Social Sciences (SPSS version 28, IBM, Chicago IL, USA). This variable was used in subsequent analyses. Differences between the obtained trajectories, regarding the facets of trait mindfulness and covariates, were analyzed at a univariate level using two sample *t*-tests and chi-square tests. Thereafter, the three facets of trait mindfulness (independent variables) and the covariates that showed a significant relation with the determined trajectories at a univariate level ($p < 0.05$) were included in the multiple logistic regression analysis, with the obtained trajectories of postpartum depressive symptoms as dependent variable. The trajectory with the highest percentage of women constituted as the reference group.

5. Results

The characteristics of the study sample ($N = 713$) are shown in Table 1. When comparing the characteristics of the study sample ($N = 713$) with the remainder of the HAPPY sample ($N = 1556$), we found that women in the study sample were more often highly educated, with partner, and primiparous ($\chi^2(1) = 4.1$ to 15.4 , all $p < 0.05$, phi coefficient = 0.04 to 0.09). In addition, the women in the study sample smoked less often during pregnancy, less often had an unplanned pregnancy, and a previous diagnosis of depression ($\chi^2(1) = 4.9$ to 15.7 , all $p < 0.05$, phi coefficient = 0.05 to 0.08). Moreover, the women in the study sample more often had a spontaneous birth, less often had a preterm birth, and less often breastfed their baby six weeks postpartum ($\chi^2(1) = 4.2$ to 19.8 , all $p < 0.05$, phi coefficient = 0.05 to 0.09). All differences showed small effect sizes. No differences were found regarding age, employment, BMI, alcohol use during pregnancy, and pregnancy complications.

5.1. Trajectories of postpartum depressive symptoms

Based on the fit indices (BIC, LMR-LRT, BLRT) and entropy, the two-class model was chosen to be the best model to represent the trajectories of postpartum depressive symptoms (Supplementary Table 1). Fig. 1 shows the two-class model. The first class ($N = 647$, 90.7%) was labeled “low stable” and contained women who reported low levels of depressive symptoms throughout the first postpartum year (with mean EPDS scores between 3.3 and 4.1). The low stable class was regarded as the reference class, since it included the highest percentage of women. The second

Table 1
Characteristics of the 713 participating women.

	N (%)	Mean (SD)	Range
<i>Demographics</i>			
Age		30.2 (3.6)	19–43
High level of education	484 (68.8)		
Employment	653 (92.8)		
Living with partner	701 (98.3)		
<i>Lifestyle habits</i>			
BMI (pre-pregnancy)		23.8 (3.8)	17.2–41.4
Smoking during pregnancy	25 (3.5)		
Alcohol use during pregnancy	26 (3.6)		
<i>Perinatal specific factors</i>			
Multiparity	331 (46.4)		
Unplanned pregnancy	34 (4.8)		
Pregnancy complications ^a	80 (11.2)		
Spontaneous birth ^b	333 (46.7)		
Preterm birth	27 (3.8)		
Breastfeeding six weeks postpartum	360 (50.5)		
<i>Psychological features</i>			
Previous depression	95 (13.5)		
TFMQ-SF at 22 weeks of pregnancy			
Acting with awareness		14.6 (3.1)	7–20
Non-judging		16.2 (3.1)	5–20
Non-reacting		11.9 (4.1)	4–20

Note. SD, standard deviation; High level of education, Bachelor’s degree or higher; BMI, body mass index; TFMQ-SF, Three Facet Mindfulness Questionnaire-Short Form.

^a Pregnancy complications: one (or more) of the following obstetric complications during pregnancy: antepartum haemorrhage, intrauterine growth restriction, evidence of ultrasound abnormalities on the standardized 20-week ultrasound, pre-eclampsia, and diabetes gravidarum.

^b Spontaneous birth: childbirth without any intervention during labor (augmentation and/or an instrumental birth: vacuum- or forceps-assisted vaginal birth, caesarean section).

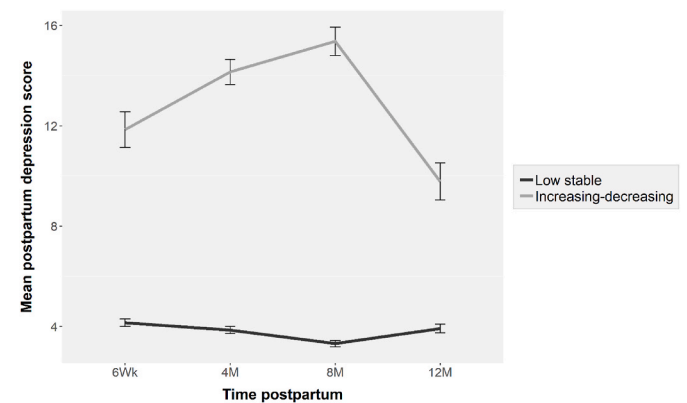


Fig. 1. Longitudinal trajectories of postpartum depressive symptoms during the first postpartum year ($N = 713$).

class ($N = 66$, 9.3%) was labeled “increasing-decreasing” and contained women with increasing levels of postpartum depressive symptoms from six weeks postpartum until eight months postpartum (mean from 11.8 to 15.4), which then showed a decrease towards the end of the first postpartum year (to a mean of 9.8). The postpartum depressive symptom scores were significantly higher in the *increasing-decreasing* class compared to the *low stable* class at each time point ($t(53.5$ to $637) = 7.8$ to 21.8 , all $p < 0.001$, Cohen’s $d = 1.48$ to 3.79 , large effect sizes).

5.2. Trait mindfulness in relation to trajectories of postpartum depressive symptoms

The women belonging to the *low stable* class scored significantly higher on the mindfulness facets acting with awareness ($t(711) = 2.9$, p

Table 2

Comparison between two trajectories of postpartum depressive symptoms during the first postpartum year (N = 713).

	Low stable N = 647 (90.7%)		Increasing-decreasing N = 66 (9.3%)		p-value	
	N (%)	Mean (SD)	N (%)	Mean (SD)	χ^2	ANOVA F
<i>Demographics</i>						
Age		30.2 (3.5)		29.9 (4.1)		0.593
High level of education	447 (70.1)		37 (56.9)		0.029	
Employment	593 (92.9)		60 (90.9)		0.543	
Living with partner	637 (98.5)		64 (97.0)		0.018	
<i>Lifestyle habits</i>						
BMI (pre-pregnancy)		23.8 (3.7)		24.1 (4.5)		0.453
Smoking during pregnancy	22 (3.4)		3 (4.5)		0.630	
Alcohol use during pregnancy	22 (3.4)		4 (6.1)		0.272	
<i>Perinatal specific factors</i>						
Multiparity	301 (46.5)		30 (45.5)		0.807	
Unplanned pregnancy	30 (4.7)		4 (6.1)		0.624	
Pregnancy complications ^a	75 (11.6)		5 (7.6)		0.325	
Spontaneous birth ^b	307 (47.4)		26 (39.4)		0.211	
Preterm birth	24 (3.7)		3 (4.5)		0.735	
Breastfeeding six weeks postpartum	322 (49.8)		38 (57.6)		0.231	
<i>Psychological features</i>						
Previous depression	74 (11.4)		21 (31.8)		< 0.001	
TFMQ-SF at 22 weeks of pregnancy						
Acting with awareness		14.7 (3.1)		13.5 (3.1)		0.003
Non-judging		16.5 (3.0)		13.8 (3.3)		< 0.001
Non-reacting		11.9 (4.3)		11.9 (2.6)		0.985

Note. SD, standard deviation; high level of education, Bachelor's degree or higher; BMI, body mass index; TFMQ-SF, Three Facet Mindfulness Questionnaire-Short Form; χ^2 , chi-square test; F, one-way ANOVA.

Bold: significance as defined by $p < 0.05$.

^a Pregnancy complications: one (or more) of the following obstetric complications during pregnancy: antepartum haemorrhage, intrauterine growth restriction, evidence of ultrasound abnormalities on the standardized 20-week ultrasound, pre-eclampsia, and diabetes gravidarum.

^b Spontaneous birth: childbirth without any intervention during labor (augmentation and/or an instrumental birth: vacuum- or forceps-assisted vaginal birth, caesarean section).

= 0.003, Cohen's $d = 0.39$, small to medium effect size) and non-judging ($t(711) = 6.8$, $p < 0.001$, Cohen's $d = 0.86$, large effect size) compared to those belonging to the *increasing-decreasing* class (Table 2). No significant difference was found in non-reacting scores between women in the *low stable* class and women in the *increasing-decreasing* class ($p = 0.985$). With regard to the covariates, women in the *low stable* class were more often highly educated ($\chi^2(1) = 4.7$, $p = 0.029$, phi coefficient = 0.08) and with partner ($\chi^2(1) = 5.7$, $p = 0.018$, phi coefficient = 0.09), and less often had a previous diagnosis of depression ($\chi^2(1) = 20.9$, $p < 0.001$, phi coefficient = 0.17), all with small effect sizes. No differences between the two trajectories were found in age, employment, BMI, smoking during pregnancy, alcohol use during pregnancy, parity, unplanned pregnancy, pregnancy complications, spontaneous birth, preterm birth, and breastfeeding six weeks postpartum.

The multiple logistic regression analysis (with outcome variable: trajectories of postpartum depressive symptoms) included the three facets of trait mindfulness (acting with awareness, non-judging, and non-reacting) as independent variables. In addition, only the significantly related covariates at univariate level were included in the logistic regression analysis as confounders. Hence, the full model included six predictors (acting with awareness, non-judging, non-reacting, level of education, living with partner, and depression earlier in life). The full model was statistically significant ($\chi^2(6) = 56.5$, $p < 0.001$), which indicates that the model was capable to differentiate between women belonging to the *low stable* class and women belonging to the *increasing-decreasing* class. The total model explained between 7.7% (Cox and Snell R Square) and 16.8% (Nagelkerke R Square) of the variance in trajectories of postpartum depressive symptoms. Table 3 shows the contribution of each predictor to the model. Higher scores on the mindfulness facet non-judging were significantly and independently associated with a higher likelihood of belonging to the *low stable* class (OR = 0.79, 95% CI [0.72, 0.87], $p < 0.001$), compared to belonging to the *increasing-decreasing* class. An odds ratio (OR) of 0.79 should be interpreted as

follows: per unit increase in non-judging, the likelihood of belonging to the *low stable* class increased with 21%. No significant association was found between the mindfulness facets acting with awareness and non-reacting and the trajectories of postpartum depressive symptoms ($p = 0.422$ and $p = 0.357$, respectively). However, a logistic regression model including only the mindfulness facet acting with awareness as independent variable (adjusting for the same confounders), showed higher scores on acting with awareness to be associated with a higher likelihood of belonging to the *low stable* class (OR = 0.88, 95% CI [0.80, 0.96], $p = 0.004$), compared to belonging to the *increasing-decreasing* class.

Moreover regarding the confounders, a high education level was significantly related to lower odds of belonging to the *increasing-decreasing* class (OR = 0.55, 95% CI [0.31, 0.98], $p = 0.044$), whereas a previous diagnosis of depression was significantly associated with higher odds of belonging to the *increasing-decreasing* class (OR = 2.63, 95% CI [1.42, 4.85], $p = 0.002$), compared to belonging to the *low stable* class.

Table 3

Multiple logistic regression with trajectories of postpartum depressive symptoms during the first postpartum year as dependent variable (N = 713).

	Increasing-decreasing vs. Low stable		
	OR	95% CI	p-value
TFMQ-SF: Acting with awareness	0.96	[0.86, 1.06]	0.422
TFMQ-SF: Non-judging	0.79	[0.72, 0.87]	< 0.001
TFMQ-SF: Non-reacting	0.96	[0.88, 1.05]	0.357
High level of education	0.55	[0.31, 0.98]	0.044
Living with partner	0.32	[0.03, 3.32]	0.339
Previous depression	2.63	[1.42, 4.85]	0.002

Note. TFMQ-SF, Three Facet Mindfulness Questionnaire-Short Form; OR, Odds Ratio; CI, Confidence Interval.

Bold: significance as defined by $p < 0.05$.

6. Discussion

The current study identified two trajectories of postpartum depressive symptoms during the first postpartum year, including a *low stable* symptom class (90.7%) and an *increasing-decreasing* symptom class (9.3%). Women belonging to the *low stable* postpartum depressive symptom class showed higher acting with awareness and non-judging scores. The non-judging facet of mindfulness was independently associated with low stable levels of postpartum depressive symptoms during the first postpartum year, adjusted for confounders and the other mindfulness facets.

Our findings suggest that especially the trait mindfulness facet non-judging may have the ability to ‘protect’ against enhanced postpartum depressive symptoms in the year after childbearing. Non-judging refers to the ability to accept thoughts and feelings without self-criticism or judgment (Brown and Ryan, 2003). A previous study reported self-criticism to increase in the postpartum period, and also showed self-criticism to be negatively related to the mindfulness facet non-judging (Brassel et al., 2020). It makes sense that especially in the postpartum period women are vulnerable for self-criticism, given the major changes in their role and responsibilities as a (new) mother. Higher non-judging levels may help postpartum women to be less self-critical and more empathetic towards themselves when facing (new) challenges, such as sleeping difficulties, breastfeeding, possibly changing relational aspects with their partner, and combining motherhood with a paid job. As a result, postpartum women with higher non-judging levels might experience fewer depressive symptoms. This is in line with previous studies that showed non-judging to be of importance in stress reduction (Chin et al., 2019; Lindsay and Creswell, 2017).

We previously reported all three facets of trait mindfulness to be associated with low stable levels of depressive symptoms throughout pregnancy (Hulsbosch et al., 2022). Although the results of the study by Hulsbosch et al. (2022) suggest that the facets acting with awareness and non-reacting may play a role in ‘protecting’ against enhanced depressive symptomatology during pregnancy, the findings of the current study suggest that these two trait mindfulness facets might be less significant in stress reduction in the *first year after childbirth*. Acting with awareness refers to the ability to be attentive to experiences in the present moment (Brown and Ryan, 2003), whereas non-reacting refers to the ability of letting thoughts and feelings come and go, without getting preoccupied by them (Baer et al., 2006; Bohlmeijer et al., 2011).

Women in the *low stable* class did however show higher acting with awareness scores. Also, when only the facet acting with awareness was included in the logistic regression analysis as independent variable (adjusting for confounders), we did find a significant association between acting with awareness and low stable levels of depressive symptoms during the first postpartum year. Indeed, postpartum women with higher acting with awareness scores may be more attentive to special moments with their child (e.g., when caring for their child), or may react better to difficulties (e.g., in the interaction with their child), which might help against experiencing depressive symptoms in the postpartum period. It could be speculated that both acting with awareness and non-judging might ‘protect’ against developing postpartum depressive symptoms. However, our results suggest that non-judging may be stronger in ‘protecting’ against depressive symptomatology in the postpartum period as compared to acting with awareness.

In addition, it could be speculated that the ability to detach from negative thoughts and feelings (non-reacting) might feel less appropriate for postpartum women. In the perinatal period, an intrapsychic development occurs in women: the Motherhood Constellation (Stern, 1995). Mothers undergo a healthy adjustment by becoming preoccupied with the protection and well-being of their (unborn) child. Therefore, for postpartum women it may not feel emotionally right to let go of thoughts and feelings that arise from this healthy preoccupation with their baby’s needs, which may explain our results regarding the non-reacting facet of mindfulness.

Moreover, our findings showed that women with a high education level were more likely to belong the *low stable* postpartum depressive symptom class. This is in line with earlier studies pointing out that a lower education level could be a risk factor for the development of postpartum depression (Alshikh Ahmad et al., 2021; Caparros-Gonzalez et al., 2017; Matsumura et al., 2019; Wang et al., 2021). Women with a history of depression showed to be more likely to belong the *increasing-decreasing* postpartum depressive symptom class in the current study. History of depression is indeed a widely recognized risk factor for the development of depressive symptoms during the postpartum period (Alzahrani, 2019; Bina and Harrington, 2017; Fiala et al., 2017; Guintivano et al., 2018; van der Zee-van den Berg et al., 2021).

A strength of the current study is the longitudinal design with different time points of assessment of postpartum depressive symptoms throughout the first postpartum year. This facilitated the estimation of longitudinal trajectories by means of growth mixture modeling, unlike most studies on postpartum depression. Another strength is the large sample size (N = 713). A limitation is the use of self-report measurements, as this could have induced bias (e.g., response tendencies) including socially desirable responding (Paulhus and Vazire, 2007; Steenkamp et al., 2010; Tourangeau and Yan, 2007). Moreover, especially in the self-report assessment of mindfulness, participants might have different semantic understandings of the items (Bergomi et al., 2013).

Another limitation constitutes a limited generalizability of the results, as the study sample consisted of mainly Dutch and white women, who often had a higher education level. Future research should address the association between trait mindfulness and trajectories of postpartum depressive symptoms in a more diverse sample. Moreover, while there were many time points in which postpartum depressive symptoms were assessed, there was only one measuring moment of trait mindfulness. Nevertheless, earlier studies have reported trait mindfulness to be rather stable across time in both non-pregnant and pregnant populations (Baer et al., 2006; Brassel et al., 2020; Jensen et al., 2016, 2019; Veehof et al., 2011). Therefore, we presumed that women in the current study could rely on their trait mindfulness scores (assessed at 22 weeks of pregnancy) throughout the entire first postpartum year.

Moreover, a limitation is that we used total scores of EPDS assessments when performing growth mixture modeling, as it is assuming that each EPDS item has an equal reliability in assessment of postpartum depressive symptoms, which in psychological research might not often be the case. *Second-order* growth mixture modeling might have provided a solution for this (Grimm and Ram, 2009; Kim and Wang, 2017). However this statistical method still has unresolved methodological issues, which should be fixed first (Shen and Wang, 2022). Nevertheless, the Cronbach’s alphas of the EPDS in the current study were all ≥ 0.85 , indicating good reliability. Although the Cronbach’s alphas of the EPDS do not indicate ‘perfect’ reliability without measurement errors, the reliability is still good, indicating limited measurement errors. Thus, there may have been a considerable consensus between the first- and second-order growth mixture models. Future research should focus on resolving the methodological issues regarding second-order growth mixture modeling, and thereafter address the extent to which second-order growth mixture models differ from first-order growth mixture models in the case of good reliability (comparable to the EPDS reliability in the current study).

7. Conclusion

This study is among the first showing an association between distinct facets of trait mindfulness and longitudinal trajectories of postpartum depressive symptoms. The non-judging facet of mindfulness is independently associated with low stable levels of postpartum depressive symptoms during the first postpartum year and might thus ‘protect’ against developing postpartum depressive symptoms after childbirth. Mindfulness-based interventions that specifically focus on enhancing

non-judging may be beneficial for pregnant women. Especially for those at risk for developing postpartum depressive symptoms, for instance women with a history of depression or a lower level of education. When partaking in a mindfulness-based intervention, pregnant women could increase their state mindfulness levels by practicing mindfulness meditation (Kiken et al., 2015). An increase in state mindfulness could improve their trait mindfulness levels across time (Kiken et al., 2015). Previous studies have already shown promising positive effects of mindfulness-based programs on the facets of trait mindfulness. A study by Duncan and Bardacke (2010) for instance showed a significant improvement in the facet non-judging in pregnant women after partaking in a mindfulness-based program. Future studies should focus on the effectiveness of mindfulness-based programs during pregnancy on postpartum depressive symptoms.

Author contributions

Lianne Hulsbosch: Conceptualization, Methodology, Formal analysis, Writing - Original Draft, Visualization, Supervision. Emma van de Poel: Methodology, Formal analysis, Writing - Original Draft. Ivan Nyklíček: Writing - Review & Editing. Myrthe Boekhorst: Validation, Investigation, Writing - Review & Editing.

Funding statement

No funding

Declaration of competing interest

None.

Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.jpsychires.2022.12.007>.

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