**Maternity blues: A risk factor for anhedonia, anxiety, and depression components of Edinburgh Postnatal Depression Scale.**

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**Running title.** Maternity blues and early post-partum depressive symptoms.

**Abbreviations:** MBS, Maternity Blues Scale.

 EPDS, Edinburgh Postnatal Depression Scale.

PPD, post-partum depression.

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**Abstract**

Positive affect, negative affect, and depression are important aspects of maternity blues. This study used a prospective observational design and included concurrent validation analysis of the 16-item Maternity Blues Scale (MBS) Dutch version to determine the direction and magnitude on the Edinburgh Postnatal Depression Scale (EPDS) symptoms, including three factors, anhedonia, anxiety, and depression in 320 uncomplicated pregnancies early after childbirth. We found a statistically significant correlation between MBS and EPDS global scores (0.22, p<0.001). Moreover, Negative affect was significantly correlated with the EPDS global score (0.23, p<0.001), anhedonia (0.12, p< 0.05), and anxiety (0.25, p<0.001; Positive affect with the EPDS global score (0.14, p<0.05) and depression (0.13, p<0.05); and Depression subscale with EPDS global score (0.15, p<0.05), anhedonia (0.12, p<0.05), and anxiety (0.12, p<0.05), and depression (0.12, p<0.05). In addition, the subgroup of women 33 (10.3%) with EPDS >12 presented significantly higher Global MBS score (2.51+0.38 vs 2.26+0.38, p=0.01), and namely negative affect (2.88+0.67 vs 2.62+0.38 p=0.04) and positive affect (2.52+0.69 vs 2.32+0.38, p=0.04) and depression (2.09+0.75 vs 1.82+0.36, p =0.02). These findings together suggest that women with higher maternity blues scores may represent a distinct subgroup of post-partum women at increased risk of depression symptoms.

**Keywords**. Edinburgh Postnatal Depression Scale; Dutch Maternity Blues Scale; Maternity Blues; Puerperium.

1. **Introduction**

Women undergo adaptive physical and psychological changes during pregnancy, labour, and puerperium (Brunton & Russel, 2008), which make them vulnerable to psychological disorders.One frequently reported expression of these adaptations is post-partum depression (PPD), distinguished from other forms of depression in 1994 by American Psychiatric Association in the 4th edition of Diagnostic and Statistical Manual of Mental Disorders, by a specific time period after delivery (“post-partum onset”).

The prevalence of PPD ranges from 7.6% to 39% in various areas of the world and differs according to the population tested and screening tools used (APA, 2000; Goker et al. 2012). The first symptoms usually appear between the fourth and sixth week postpartum. Studies, however, have suggested that mothers at risk of postnatal depression may be identified early in the postpartum period (Epperson, 1999; Heron et al., 2004; Matthey, 2008). PPD is considered as a relevant health problem in modern societies. The importance of PPD lies in the fact that it is associated with long-term effects on family and child. Marital relationships are frequently affected (Zelkowitz & Milet, 2001). Women with PPD tend to discontinue breastfeeding and cognitive development of the child is also shown to be impaired due to insufficient maternal-infant interaction (Carter et al., 2001; Dennis & McQueen, 2009). Therefore, it is important both to identify risk factors for PPD and to diagnose depressive symptoms in the early postpartum period to enable an immediate intervention.

 Numerous risk factors can lead to women acquiring PPD after childbirth. There seems to be some degree of association between PPD and mood disturbance, commonly described as ‘the blues’, affecting up to 40-80% of new mothers, given that it may overlap with the beginning of a postnatal depression and symptomatically resemble depression, which have longtime been described (Matthey, 2008). Conversely, postpartum or maternity blues were regarded as a physiological phenomenon, with a characteristic peak between three and five days postpartum, but models and criteria for maternity blues have not been well established (Henshaw et al., 2013).

 In addition, the few studies that have examined the risk of postpartum depression associated with maternity blues in healthy mothers with spontaneous births of healthy full-term infants, involved a number of methodological problems.

Some used retrospective reports of blues (Buesching et al., 1986; Pitt, 1968). Others have used instruments to assess postnatal blues that have not been systematically developed and validated or devised for other purposes (Henshaw et al., 2013; Hapgood et al., 1988; Fossey et al., 1997). Thus far, most research has been focused on negative affect symptoms of the blues such as depression, anxiety and distress.

New concepts of maternity blues have also been proposed. Kennerley and Gath (1989) developed the Maternity Blues Scale (MBS) to assess maternal mood symptoms during the first postpartum week. The recent Dutch version of the MBS of Kennerley and Gath (1989) revealed a 16-item scale with three subscales with adequate model fit: negative affect (5 items), positive affect (6 items), and depression (5 items). The negative and positive affect subscales of the MBS were used to define a rapid cycling mood symptoms group mothers. In addition, all three MBS negative affect, positive affect and depression subscales correlated highly and significantly with the Edinburgh Postnatal Depression Scale (EPDS) (Pop et al., 2015). This is relevant, considering that, the EPDS was meant to be unidimensional, including questions tapping into several aspects of depression (Cox et al., 1987). In addition, depression does not come in an all-or-none way, and PPD represents the end of a continuum of severity of symptoms (Zanardo et al., 2015). Thus, recently, several authors have also studied the structure of the EPDS and found that it measures not only postpartum depressive symptomatology but also other dimensions. In some studies, a factor comprising items 1 and 2 has been labelled “anhedonia” (Petrozzi & Gagliardi, 2013; Tuohy & McVey, 2008) whereas the “anxiety” factor, usually including items 3, 4, and 5 (Jomeen & Martin, 2005; Tuohy & McVey, 2008) appears to be the most consistent.

It is remarkable that most if not all of this research on the MBS and EPDS does encompass respective factor analysis, but these items are recoded to enable that higher scores reflect higher mood and postnatal depression risk factors. Consequently, both MBS and EPDS factor analysis in the early postpartum period are understudied. Hence, primary aim of the study was to validate the 16-item MBS Dutch version (Pop et al., 2015) for use in our Italian puerperae population, representative of developed, industrialized country supporting advanced educational levels, good socio-economic status, low and late fertility, and quite high caesarean section rates. Secondary aim was to undertake an analytical study by the MBS three-factor structure, negative affect, positive affect and depression, with a convenience reference group of puerperae, to determine the direction and magnitude of the effect of on the EPDS, distinguishing depression, anxiety, and anhedonia in singleton, at term, uncomplicated pregnancies.

1. **Method**

2.1. Study design

The study was prospective and observational design and used widely used instruments such as MBS 18 (distinguishing negative and positive affect, and depression) and EPDS 19 (distinguishing anhedonia, anxiety and depression).

2.2. Procedure and participants

We administered the EPDS 19 and an Italian translation of the16-item self-rating Dutch MBS of Pop et al. (2015) to patients in the maternity ward of Policlinico Abano Terme in order to examine their psychometric characteristics in early post-partum. The Dutch MBS had been derived from the 28-item MBS of Kennerley and Gath (1989). The hospital where the study took place is located in an industrialized area of North-Eastern Italy supporting advanced educational levels, good socio-economic status, occupation, and low and late fertility. Institutional Review Board approval (Policlinico Abano Terme) was obtained before the study began. Exclusion criteria were: anaesthesia; presence of prepartum psychological problems (whether currently undergoing treatment or not); under treatment for psychological problems; or mother not able to sufficiently read and understand Italian. In addition, women who gave birth to a child with serious congenital abnormalities or who had a postnatal hospitalization of the newborn were excluded from the analysis. Demographic data included age, marital status, educational level and obstetric features (e.g. parity, mode of delivery). Some additional data regarding obstetric and neonatal outcomes were collected from medical records during hospitalization. Additional details were reported in a previous publication (Zanardo et al., 2015).

2.3. Measurements

While the original MBS scale of Kennerley and Gath (1989) included seven clusters (primary blues, decreased alertness, hypersensitivity, decreased self-confidence, depression and despondency), the16-item MBS Dutch version of Pop et al. (2014) included only three clusters (negative and positive affect and depression), each represented by a group of items referring to symptoms and measured on a 5-point Likert scale (much less than usual, less than usual, no different, more than usual, much more than usual), where higher scores reflected higher intensity of blues symptoms. Specifically, the negative affect subscale consisted of 5 items, the depression subscale of 5 items and the subscale positive affect of 6 items.

The Edinburgh Postnatal Depression Scale (Cox et al., 1987) is a self-administered questionnaire composed of 10 items scored on a 4-point Likert scale (0–3) designed to screen for postpartum depression symptoms. PPD represents the end of a continuum of severity of symptoms, and in this study the best cutoff point for depressive symptomatology risk assessment was >12 (Matthey, 2008). Recently, several authors have also studied the structure of the EPDS and have found that it measures not only postpartum depressive symptomatology risk but also other dimensions, such as anxiety and anhedonia (Miller et al., 2006; Petrozzi & Gagliardi, 2013). Following Tuohy and McVey (2008) in this study three subscales were also extracted: anhedonia (items 1 and 2), anxiety (items 3–6), and depression (items 7–10).

2.4 Statistical methods

The different groups of participants were described using frequencies or means and standard deviations (SD). In order to test the validity and the consistence of the 16-item MBS of the Dutch study and of its subscales in the Italian context we initially computed Cronbach’s α for the whole group of 16 items and for each subscale. Following Tuohy and McVey (2008),we also performed a factor analysis with varimax rotation on the 16 items. As this initial test with Cronbach’s α was highly successful, the inclusion criteria for the factor loadings were less stringent than usual: items with the absolute value of the highest loading (main loading) of at least 0.40 were considered important and maintained in the analysis. If an item loaded on more than one dimension, we looked at its loadings for the first 3 factors (one for each subscale). If the absolute difference between the main loading and any other loading (cross loadings) was less than 0.20 and the cross loading was higher than 0.4, the item was deleted.The MBS and EPDS scores were correlated using Spearman’s correlation. Finally, t-tests were used to assess the statistical significance of eventual differences between groups of interest. A p <0.05 was regarded as statistically significant. The Statistical Package for Social Sciences (SPSS) was used for calculations.

**3. Results**

3.1. Patient sample

 A total of 334 third late trimester (>37<42 weeks) pregnant women met the inclusion criteria and consented to participate. Of these, 320 (95%) fully completed the MBS and the EPDS questionnaires at the second day postpartum while still in hospital. Of those who did not complete the questionnaires, 13 were discharged on day 1 postpartum and 1 subsequently refused participation. Among the 320 women that were finally included in the study, maternal age was 33.08 ±5.06 years, gestational age was 39.3 ±1.30 weeks, 5.31% of the women were primiparous and 80.74% of the childbirths occurred spontaneously. Overall, the university degree rate was 38.12%, smoking and alcohol habits amounted to 11.87% and 15.93%, respectively, occupation amounted to 73.75% and breastfeeding at discharge to 90.32%. (Table 1)

3.2. Validation of the 16-item, 3-factor Dutch MBS version.

The Dutch version of the MBS [18] revealed three subscales that adequately fitted our puerperae sample: negative affect (five items, Cronbach's α = 0.713), positive affect (six items, α = 0.762) and depression (five items, α = 0.802). Cronbach’s α for the total 16-item scale was 0.849.

In order to further validate the 16-item Dutch MBS version in the Italian context, we performed a factor analysis with varimax rotation explaining 43.8% of the variance. Following the selection criteria described in the methods, none of the items was excluded from the analysis. (Table 2)

The validity of the 3-factor structure Dutch MBS version was finally tested by correlating the MBS subscales with those of the EPDS. (Table 3).

A positive and significant correlation was observed between MBS and EPDS global scores (r=0.22, p<0.001). Furthermore, in most cases all three MBS subscales were significantly correlated with the EPDS subscales and in all cases the significance was below 0.10. MBS Global score correlated highly and significantly with the EPDS subscales anhedonia (0.14, p< 0.05), anxiety (0.20, p<0.001), and depression (0.15, p<0.01). MBS depression subscale significantly correlated with the EPDS global score (0.15, p<0.01) and subscales anhedonia (0.12, p< 0.05), anxiety (0.12, p<0.5), and depression (0.12, p<0.05). MBS negative affect subscale significantly correlated with the EPDS global score (0.23, p<0.001) and subscales anhedonia (0.12, p< 0.05), and anxiety (0.25, p<0.001). Finally, MBS positive affect subscale significantly correlated with the EPDS global score (0.14, p<0.05) and subscale depression (0.13, p<0.05).

3.3 Identification of a subgroup of women with high mood symptoms at risk of postpartum depression.

The average score to the 16-item MBS scale was 2.28 (+0.57), to the 5-item subscale negative affect 2.65 (+0.78), to the 5-item subscale depression 1.85 (+0.74), to the 6-item subscale positive affect 2.34 (+0.64). The average score to the EPDS scale was 6.48 (+3.93), to the 2-item subscale anhedonia 0.19 (+0.38), to the 4-item subscale anxiety 1.16 (+0.61), and to the 4-item subscale depression 0.37 (+0.45). (Table 4).

We observed that 33 mothers (10.3%) had an EPDS score >12. We then tested if these mothers also presented significantly higher mood symptoms higher Global MBS score (2.51+0.38 vs 2.26+0.38, p=0.01), namely negative affect (2.88+0.67, p=0.15 vs 2.62+0.38, p=0.04) and positive affect (2.52+0.69 vs 2.32+0.38, p=0.04) and depression (2.09+0.75 vs 1.82+0.36, p=0.02). The results of these comparisons can be seen in Table 5.

**4. Discussion**

This study investigated, for the first time, the 3-factor structure of the 16-item MBS Dutch version (Pop et al., 2015) in the Italian context. Specifically, we wanted to determine the direction and magnitude of any interaction between negative affect, positive affect, and depression on EPDS anhedonia, anxiety, and depression subscales in at term, healthy women living in an industrialized area of North-Eastern Italy two days after delivery. We found a statistically significant correlation between MBS and EPDS global scores and most subscales. In addition, the subgroup of puerperae (10.3%) with early after delivery high levels of depressive symptoms (EPDS >12) showed statistically significantly higher negative and positive affect and depression mood symptoms. These findings suggest that women with higher maternity blues scores represent a distinct subgroup of postpartum women at increased risk of depression symptoms.

The validation process of the Dutch version of the MBS of Pop et al. (2015) revealed that a 16-item scale with three subscales adequately fitted our data: negative affect (five items, α = 0.713), positive affect (six items, α = 0.762) and depression (five items, α = 0.802). This was also confirmed by a factor analysis and by assessing the correlation between the Dutch MBS score and subscales with the traditional EPDS ones.

The relationship between maternity blues and perinatal depressive symptomatology is however, complex (Buesching et al., 1986; Pitt, 1968), not completely understood (Henshaw et al., 2004) and is perhaps bidirectional (i.e. gestational depressive symptomatology and anxiety might causally contribute to maternity blues and/or postnatal mood might contribute to postpartum depressive symptomatology) (Tuohy & McVey, 2008). This relationship is also directly linked to puerperium, a period during which previously dormant psychological issues such as fears about physical changes, role adaptation, psychosocial stress, and mothering abilities come to the surface, resulting also of great importance to the major consequences for mother, family, and child (Takahashi & Tamakoshi, 2014). This is relevant, considering that our subject criteria originally included no complication-related pregnancy and delivery, no mental diseases in the past, normal birth, and healthy normal infants. Noteworthy, among our study subjects, positive and negative affect and depression defined by three-factor structure MBS were significantly higher in women at higher risk (>12 EPDS score) depressive symptoms at 2 days after delivery.

Both in clinical practice and for research purposes, positive items on a MBS scale are usually recoded. This is remarkable while it has longtime been recognized that, apart from the typical crying spells, feeling tense and irritability, the blues concept includes also abrupt changes of low and high mood: from one moment of crying or irritability without any reason the woman feels elated, happy or ‘mentally relaxed’ (O’Hara & McCabe, 2013). In the literature, it has repeatedly been reported that blues might be also a risk factor for subsequent postpartum depression (Dennis et al., 2003; Reck et al., 2009). In previous European and American studies, Henshaw et al. (2004) also reported that British women with severe blues are 2.8 times as likely to experience postpartum depression at 6 months as those without. In Nigerian women, Adewuya (2006), showed that women with maternity blues at day 5 are 12 times more likely to be diagnosed at 4 weeks and 10 times more likely to be diagnosed as depressed at 8 weeks postpartum than those without the maternity blues. These results suggest that the screening of maternity blues in the early postpartum phase may lead to the identification of postpartum depression risk later.

Although EPDS has been widely used to screen for at risk women of post-partum depression for decades, in recent years it has been suggested that it measures not only depression, but also other psychological dimensions. One study argued that the instrument is a general measure of psychological distress rather than a one-dimensional measure of depression (Tuohy & McVey, 2008). The multifactorial structure of the EPDS scale has already been suggested in other studies, and several authors have found that EPDS is, in reality, a two- or even a three-factor scale (Fabrigar et al.,1999) with a secondary dimension of anxiety symptomatology often apparent (Tuohy & McVey, 2008), and with a tertiary dimension of anhedonia, but the exact identification of factors differs across studies (Petrozzi & Gagliardi, 2013). This study has adopted the EPDS score of 12 or above, to indicate the presence of postpartum depressive symptomatology (Matthey, 2008). Followed the recommendations of an influential and widely cited article (Fabrigar et al., 1999) we also adopted a three-factor structure EPDS and identified these three factors as depression, anxiety and anhedonia, in agreement with those detected by Tuohy and McVey (2008). With the due caution advised when interpreting the subscales findings of a single administration of EPDS, there were some statistically significant associations observed. In agreement with other authors (Tuohy & McVey, 2008) we believe that because EPDS measures different dimensions, it does not necessarily mean that a high total score represents a true risk of depression: a high score could depend on a single subscale. Against the low sensitivity of EPDS in the first days after birth reported by Petrozzi and Gagliardi (2013) our results show a single statistically significant correlation between depression and positive affect subscales and a double statistically significant correlation between negative affect and anhedonia and anxiety subscales, respectively.

This study had some limitations. First, our study was not designed to study the longitudinal follow-up of women with mood changes. Second, although we analyzed maternity blues two days after birth, we did not elucidate a number of confounding factors that may have an impact on mental state after child birth, including length of labor, birth complications, use of medications during delivery, any trauma occurring during delivery, how long the couple was trying to conceive and whether it was a spontaneous or medically assisted conception. Third, we did not confirm the diagnosis of PPD in our women at risk sample, using specific criteria defined in the medical literature. On a more general level, an observational study such as this cannot guarantee that the observed relationships represent causal factors. However, this may not invalidate our results, because the demographic and clinical variables in the studied sample reflect the general population of healthy mothers. In any case, our study demonstrates that the MBS detects psychological distress around delivery, making it useful for prediction of postpartal psychoemotional distress and indicating that this mechanism is involved in postnatal depression symptoms, anhedonia, anxiety, and depression.

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**Contribution to authorship.** VZ, FV and GS (Gianluca Straface) were involved in conception and design of the study LG, and FdeL were involved in data collection and performed the statistical analyses. VZ and GS (Gino Soldera) drafted the manuscript. MP and AG reviewed the manuscript. All authors read and approved the final manuscript.

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