Maternal Alexithymic Traits, Prenatal Stress, and Infant Temperament

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Abstract

We aimed at investigating, whether maternal alexithymia or prenatal anxiety influences infant temperament (Infant Temperament Questionnaire, IBQ) at six months. Maternal alexithymic trait of "Difficulty in Identifying Feelings" predicted higher infant "Duration of Orienting". "Fear of Bearing a Handicapped Child" predicted lower infant "Activity Level".

Keywords: alexithymia, anxiety, prenatal, temperament, infants

Temperament refers to the individual differences in activity, affectivity, attention, and self-regulation resulting from interplay between biological dispositions and environment (Shiner, Buss, McClowry, Putnam, Saudino & Zentner, 2012). In Rothbart's (1981) theoretical framework, two major temperament dimensions in infants have been identified: negative emotionality referring to the intensity of fearfulness (fear) and anger proneness (distress to limitations); and positive emotionality including tendency to smile (smiling and laughter), attention span (duration of orienting), motor activity (activity level) and the effectiveness of the soothing techniques after negative affect (soothability). The importance of assessing infant temperament lies partially in its predictive characteristics. Temperament dimensions predict cognitive and emotion regulatory trajectories with developmentally specific characteristics: e.g. infant positive emotionality relates to later toddler effortful control, while positive emotionality later in childhood is more in the continuum of adult personality dimensions of extraversion and positive emotionality. High orienting capacity or attention is generally associated with later effortful control (Rothbart & Putnam, 2002). Infant negative emotionality is thought to be rather stable and predict adult negative emotionality and neuroticism (Deater-Deckard & Wang, 2012).

There is evidence, that maternal prenatal stress, i.e. symptoms of stress, anxiety or depression during pregnancy, is associated with increased infant negative affectivity (e.g. Baibarazova, van de Beek, Cohen-Kettenis, Buitelaar, Shelton & van Goozen, 2013; Davis, Glynn, Schetter, Hobel, Chicz-Demet & Sandman, 2007). Pregnancy-specific anxiety (PSA) predicts higher reactivity and lower goal-directedness, indicative of lower level of attention, in three- and eight-month-old infants (Buitelaar, Huizink, Mulder, de Medina & Visser, 2003). Further, maternal PSA experienced during mid-gestation has been linked with child negative affectivity at two years of age (Blair, Glynn, Sandman & Davis, 2011). In general, maternal PSA has been shown to be stronger predictor of birth outcomes compared to trait anxiety (e.g. Blair, Glynn, Sandman & Davis, 2011). Finally, maternal stress or PSA in specific, seems to contributre to the early programming of the brain, and has been linked with e.g. decreased brain gray matter volume in the prefrontal cortex of infants (Buss, Davis, Muftuler, Head & Sandman, 2010) and neurocognitive outcomes (Buss, Davis, Hobel, & Sandman, 2011; Huizink, de Medina, Mulder, Visser & Buitelaar, 2003). However, research using infant temperament as an outcome of prenatal stress, is relatively scarce, so far.

Alexithymia is defined as multifaceted personality construct characterized by several deficiencies in emotional processing (Sifneos, 1973). Alexithymia is associated with difficulties in identifying and describing feelings, problems in distinghuishing between bodily sensations and feelings, scarity of fantasies and externally oriented cognitive style. Alexithymia is also present in the context of several psychiatric disorders and somatic illnesses (Mattila, 2009). The role of

parental alexithymia on infant development and temperament remains unknown. To our knowledge, prospective data on the associations of maternal alexithymia and child temperament or cognitive skills are not available, while some repports on the association between difficulties in identifying emotions and lower neurocognitive functioning (e.g. executive function) exist in adults (Koven & Thomas, 2010).

In this study, we wanted to examine the effects of maternal alexithymic traits and PSA on maternal report of infant temperament emphasizing the role of alexithymic traits, as this area has not been covered by earlier reseach. We expected, that both maternal PSA and alexityhmic features would predict infant temperament characteristics at six months.

The present study population is derived from the first phase of the FinnBrain Birth Cohort Study (www.finnbrain.fi). The recruitment took place during the first trimester of pregnancy. The sample was recruited between May and December 2010. Initially, altogether 203 families agreed to enter the study, and of these n=153 (75.4 %) families actually returned the first questionnaires. Of these, the present sample comprises the mothers (n=102; 66.7 %), who returned the six-month study questionnaires. The mothers who dropped out, had significantly higher depression symptom scores (p=0.016) and were more likely to have lower level of education (p<0.001) than those remaining in the study (see measures below).

The background variables or potential confounders measured included maternal age, education (low < 10 years schooling, medium = 10–15 years schooling & high > 15 years schooling), smoking during pregnancy (yes/no), and infants gender and gestational weight. The level of education was distributed as follows: low 22.1% (n=21), medium 26.3 % (n=25), and high 51.6% (n=49). The mean length of gestation was 39.4 weeks (SE=0.22), mean age was 29.8 years (SE=0.49) and the mean gestation weight of the babies was 3480 grams (SE=62.7). There were n=47 girls (48.9 %) and n=49 boys (51.0 %, data on sex was missing n=6) in the sample. All of the subjects gave their written informed consent. The Joint Ethics Committee of the University of Turku and the Hospital District of South-West Finland has approved the study protocol.

Maternal prenatal depression was assessed as a potential confounder, by using the Edinburgh Postnatal Depression Scale (EPDS) (Cox, Holden & Sagovsky, 1987; Choi, Kim, Park, Ko, Park & Shin, 2012) at gestational weeks 18–22 and 32–34. EPDS consists of 10 questions scored on a four-point Likert scale with 0-3 points/item. A single variable (EPDS mean score, simple average value) was created from the two prenatal EPDS scores.

IBQ (Infant Behavior Questionnaire; Rothbart, 1981) was used to assess infant temperament at the age of six monts. The IBQ is a reliable and valid measure for infant temperament assessment (Rothbart, 1986) and it consists of 96 items measuring the threshold, intensity and activity of the child temperament traits in six subscales *Activity level*, *Smiling and*

laughter, Fear, Distress to Limitations, Soothability & *Duration of Orienting*. In each question, mothers are asked to assess their infant's behavior in different everyday situations based on the past week. Both indiviual item scores and subscale total scores range between 1 and 7.

PRAQ-R (Pregnancy-Related Anxiety Questionnaire Revised) was used in gestational weeks 32–34 to assess maternal PSA. The PRAQ-R is a 10-item self-report and the scores on each item range from 1 (definitely not true) to 5 (definitely true), and has shown good internal concistency and correlation between the three dimensions (Huizink, Mulder, Robles de Medina, Visser & Buitelaar, 2004). The PRAQ-R measures three dimensions of PSA: *Fear of Giving Birth* (factor 1), *Fear of Bearig a Handicapped Child* (factor 2) and *Concern about One´s own Appearance* (factor 3).

Alexithymia was measured at gestational weeks 18–22 using the 20-item Toronto Alexithymia Scale (TAS-20) (Bagby, Parker & Taylor, 1994, a, b). Each item is scored by using a five-point Likert-type scale ranging from "strongly disagree" to "strongly agree" (theoretical range 20-100). TAS-20 consists of three factors representing alexithymia dimensions: *Difficulty in Identifying Feelings* (factor 1), *Difficulties in Describing Feelings* (factor 2) and *Externally Oriented Thinking* (factor 3). The psychometric properties of the scale, including its Finnish version, have been proven satisfactory in several populations (Mattila, 2009).

IBQ variables were normally distributed (for mean values see Table 1), but TAS-20 (range 23-68, mean 39.3, median 38.0, SD 9.53) and PRAQ-R (range 10-50, mean 23.4, median 23.0, SD 7.88) were asymmetrical. Associations between TAS-20 factor scores and PRAQ-R factor scores and IBQ-dimensions were evaluated with Spearman correlation coefficients (Table 1). Based on correlations, regression models with manual backward elimination for the temperament dimensions of *Duration of Orienting* and *Activity Level* were conducted with TAS-20 and PRAQ-R factor scores as independent variables. With the exception of EPDS total score (range 0-16, mean 5.00, median 4.00, SD 3.66), the potential confounders (maternal age, education, smoking, infants' gender, gestational weight) did not correlate with dependent variables and were not included in the model, unlike EPDS total symptom score, which was considered in the analyses. The statistical analysis of the data was executed by SAS JMP 10.0.0.

Spearman correlations for IBQ-dimensions and TAS-20 and PRAQ-R factors are shown in Table 1. In the final regression model for *Duration of Orienting* (R^2 =0.129), the only significant independent variable was TAS-20 factor 1 (Table 2). Regression analysis with *Activity Level* as the dependent variable supported the associaiton between the temperament dimension and PRAQ-R F2 scores but didn't provide additional results.

Table 1. Spearman Correlation Coefficients (r) for maternal alexithymic traits, pregnancy-specific anxiety, symptoms of depression and infant temperament (N=102).

IBQ Scales	Mean value	TAS-20 F1 r	TAS-20 F2 r	TAS-20 F3 r	PRAQ-R F1 r	PRAQ-R F2 r	PRAQ-R F3 r	EPDS r
Activity Level	4.65	-0.02	-0.01	0.07	-0.11	-0.21*	-0.016	0.01
Smiling and Laughter	4.77	-0.01	0.02	-0.05	-0.05	-0.14	-0.09	0.05
Distress and Latency to Approach Sudden or Novel Stimuli	2.40	0.15	0.12	0.06	0.09	0.10	0.08	0.15
Distress to Limitations	3.28	-0.02	0.00	-0.00	-0.08	-0.07	0.10	0.07
Soothability	4.93	-0.00	-0.06	-0.05	-0.10	-0.00	-0.12	0.08
Duration of Orienting	3.22	0.26**	0.23*	-0.01	0.23*	0.04	0.01	0.24*

*p < 0.05, **p < 0.01

Toronto Alexithymia Scale-20 (TAS-20) factors, Pregnancy-Specific Anxiety (PRAQ- R) factors, Edinburgh Postnatal Depression Scale (EPDS), and Infant Behavior Questionnaire (IBQ)

Table 2. Full and Final Regression Models for the Infant Duration of Orienting (N=102).

Model	Variables	Beta	Lower CI 95%	Upper CI 95%	SE	p
Full*	PRAQ-R factor 1	0.040	-0.037	0.117	0.039	0.308
	PPAQ-R factor 2	-0.025	-0.079	0.030	0.027	0.365
	PRAQ-R factor 3	-0.025	-0.081	0.030	0.028	0.369
	EPDS sum score	0.023	-0.053	0.100	0.038	0.548
	TAS-20 factor 1	0.059	-0.006	0.125	0.033	0.075
	TAS-20 factor 2	0.041	-0.033	0.116	0.038	0.275
	TAS-20 factor 3	-0.049	-0.099	0.000	0.025	0.052
Final**	TAS-20 factor 1	0.082	0.041	0.123	0.021	<0.001

* Adjusted R^2 =0.107 ** Adjusted R^2 =0.129

TAS-20: Toronto Alexithymia Scale-20 (TAS-20) factors, PRAQ-R: Pregnancy-Specific Anxiety, EPDS: Edinburgh Postnatal Depression Scale, IBQ: Infant Behavior Questionnaire

In our study, maternal alexithymic trait of *Difficulty in Identifying Feelings* predicted higher *Duration of Orienting* in infants at the age of six months. Duration of orienting reportedly predicts later traits of extraversion, such as approach and anticipation (Komsi et al., 2006) and effortful control (Kochanska, Murray & Harlan, 2000) rather than socially impaired behaviors,

which are more likely in alexithymia (Picardi, Toni & Caroppo, 2005). However, there is evidence showing, that duration of orienting does not always relate to optimal future outcomes. In some studies, higher duration of orienting in babies is associated with less effective gaze-following in joint visual attention, which is one of the cornerstones for social interaction development (Todd & Dixon, 2010). Higher duration of orienting could also indicate delayed habituation development, thus, lack of age-specific attentional shifting skills due to social deprivation. Interestingly, an association between higher duration of orienting and autism has also been reported (Zwaigenbaum, Bryson, Rogers, Roberts, Brian & Szatmari, 2005).

Several studies indicate, that alexithymic traits alter the way individuals perceive emotions (van der Velde et al., 2014) and that mothers high in these traits seem to be less accurate in interpreting their child´s behavioral cues (Lumley, Mader, Gramzow & Papineau, 1996). In turn, high duration of orienting could be seen as an infant strategy to manage possibly passive parenting behavior (Morales, Mundy, Crowson, Neal & Delgado, 2005). This is in line with the findings of family dysfunction (King & Mallinkrodt, 2000) and especially low family expressiveness (e.g. Kench & Irwin, 2000) associated with alexithymic traits in the offspring. Thus, high orienting capacity can be indicative of a an adaptive strategy equipping the child with a specific sensitivity to the environment. In conclusion, the environment provided by mothers with elevated alexithymic features may contribute to disruption of the development of some emotion-related skills of the children, but on the other hand, might also shape child dispositions towards environmental sensitivity, attention and self-regulation that are useful in low-stimuli environments.

We also noted, that *Fear of Bearing a Handicapped Child* during pregnancy predicted maternal report of lower infant activity level. There are data suggesting maternal prenatal stress affects child cognitive and psychomotor development (Glover, 2011; Pechtel & Pizzagalli, 2011; Beydoun & Saftlas, 2008; Huizink, Robles de Medina, Mulder, Visser, Buitelaar, 2003). Thus, prenatal stress could possibly result in lower activity e.g. via slower psychomotor development, while previous research has not reported specific effects of PSA on the activity level. It is possible, that mothers who were anxious about fetal health are also worried about infant health later on and pay more attention to the activity of their infants and also interpret it differently than mothers without a fear of having an unhealthy baby.

Maternal prenatal depression expectedly associated with infant tempermemnt (review: Field, 2011), but was not retained in the final model including maternal PSA and alexityhmia.

There are several limitations in our study. First, the drop-out rate was quite high, and the attrition may have diluted the results e.g. due to the bias towards higher educational level or lowere levels of depression among those retaining to the study. Second, TAS-20 was measured only once and observational methods to assess infant gaze-following, social development or mother-

infant interaction were not included, which could have shed more light to the mechanisms behind the observed relation between maternal alexithymic trait and maternal report of infant temperament. Larger population and observational methods are needed to further examine the significance of maternal alexithymic features on child neurocognitice development.

To conclude, the findings of our research preliminarily suggest, that alexithymic traits of the mother might be related to the development of regulation of social attention or habituation of infants. Moreover, maternal fear of bearing a handicapped child was related to later infant lower activity level, further underlining the importance of investigating PSA in the context of infant temperament and development.

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References

Bagby, R.M., Parker, J.D. & Taylor, G.J. (1994a). The twenty-item Toronto Alexithymia Scale--I. Item selection and cross-validation of the factor structure. Journal of Psychosomatic Research, 38, 23–32.

Bagby, R.M., Taylor, G.J. & Parker, J.D. (1994b). The Twenty-item Toronto Alexithymia Scale-II. Convergent, discriminant, and concurrent validity. Journal of Psychosomatic Research, 38, 33–40.

Baibazarova, E., van de Beek, C., Cohen-Kettenis, P.T., Buitelaar, J., Shelton, K.H. & van Goozen, S.H. (2013). Influence of prenatal maternal stress, maternal plasma cortisol and cortisol in the amniotic fluid on birth outcomes and child temperament at 3 months. Psychoneuroendocrinology, 38, 907–915.

Beydoun, H., Saftlas, A.F. (2008). Physical and mental health outcomes of prenatal maternal stress in human and animal studies: a review of recent evidence. Paediatr Perinat Epidemiol, 22, 438-66.

Blair, M.M., Glynn, L.M., Sandman, C.A. & Davis, E.P. (2011). Prenatal maternal anxiety and early childhood temperament. Stress, 14, 644–651.

Buitelaar, J.K., Huizink, A.C., Mulder, E.J., de Medina, P.G. & Visser, G.H. (2003). Prenatal stress and cognitive development and temperament in infants. Neurobiology of Aging, 24, 53–60.

Buss, C., Davis, E.P., Muftuler, L.T., Head, K. & Sandman, C.A. (2010). High pregnancy anxiety during mid-gestation is associated with decreased gray matter density in 6-9-year-old children. Psychoneuroendocrinology, 35, 141–153.

Buss, C., Davis, E.P., Hobel, C.J. & Sandman, C.A. (2011). Maternal pregnancy-specific anxiety is associated with child executive function at 6-9 years age. Stress, 14, 665–676.

Choi, S.K., Kim, J.J., Park, Y.G., Ko, H.S., Park, I.Y. & Shin, J.C. (2012). The simplified Edinburgh Postnatal Depression Scale (EPDS) for antenatal depression: is it a valid measure for pre-screening? International Journal of Medical Sciences, 9, 40–46.

Cox, J.L., Holden, J.M., and Sagovsky, R (1987). Detection of postnatal depression: development of the 10 item Edinburgh Postnatal Depression Scale. Br J Psychiatry 150, 782–786.

Davis, E.P., Glynn, L.M., Schetter, C.D., Hobel, C., Chicz-Demet, A. & Sandman, C.A. (2007). Prenatal exposure to maternal depression and cortisol influences infant temperament. Journal of the American Academy of Child and Adolescent Psychiatry, 46, 737–746.

Deater-Deckard, K., & Wang, Z. (2012). Anger and Irritability. In M. Zentner & R.L. Shiner, (Eds.): Handbook of temperament. New York: Guilford.

Field T (2011). Prenatal depression effects on early development: a review. Infant Behav Dev, 34, 1-14.

Glover, V. (2011). Annual Research Review: Prenatal stress and the origins of psychopathology: an evolutionary perspective. Journal of Child Psychology and Psychiatry, 52, 356–367.

Huizink, .A.C., Robles de Medina, P.G., Mulder, E.J., Visser, G.H., Buitelaar, J.K. (2003). Stress during pregnancy is associated with developmental outcome in infancy. J Child Psychol Psychiatry, 44, 810-8.

Huizink, A.C., Mulder, E.J., Robles de Medina, P.G., Visser, G.H., Buitelaar, J.K. (2004). Is pregnancy anxiety a distinctive syndrome? Early Human Development, 79, 81-91.

King, J. L., & Mallinckrodt, B. (2000). Family environment and alexithymia in clients and non-clients. Psychotherapy Research, 10, 78–86.

Kochanska, G., Murray, K.T. & Harlan, E.T. (2000). Effortful control in early childhood: Continuity and change, antecedents, and implications for social development. Developmental Psychology, 36, 220–232.

Komsi, N., Raikkonen, K., Pesonen, A.K., Heinonen, K., Keskivaara, P., Jarvenpaa, A.L. & Strandberg, T.E. (2006). Continuity of temperament from infancy to middle childhood. Infant Behavior & Development, 29, 494–508.

Koven, N. S., & Thomas, W. (2010). Mapping facets of alexithymia to executive dysfunction in daily life. Personality & Individual Differences, 49, 24–28.

Lumley, M.A., Mader, C., Gramzow, J. & Papineau, K. (1996). Family factors related to alexithymia characteristics. Psychosomatic Medicine, 58, 211–216.

Mattila A. (2009). Alexithymia in Finnish general population. Acta Universitatis Tamperensis, 1377. Tampere University Press: 40−46.

Morales, M., Mundy, P., Crowson, M., Neal, A.R., & Delgado, C. (2005). Individual differences in infant attention skills, joint attention and emotion regulation behavior. International Journal of Behavioral Development, 29¸ 259–263.

Pechtel, P & Pizzagalli, D.A .(2011). Effects of Early Life Stress on Cognitive and Affective Function: An Integrated Review of Human Literature. Psychopharmacol 214, 55-70.

Picardi, A., Toni, A. & Caroppo, E. (2005). Stability of alexithymia and its relationships with the 'big five' factors, temperament, character, and attachment style. Psychotherapy and Psychosomatics, 74, 371–378.
Rothbart, M. K. (1981). Measurement of temperament in infancy. Child Development, 52, 569–578.

Rothbart, M. K. (1986). Longitudinal observation of infant temperament. Developmental Psychology, 22, 356–365.

Rothbart, M. K., & Putnam, S. (2002). Temperament and socialization. In L. Pulkkinen & A. Caspi, (Eds.). Paths to successful development: Personality in the life course. New York: Cambridge University Press, 19–45.

Shiner, R., Buss, K., McClowry, S., Putnam, S., Saudino, K. & Zentner, M. (2012). "What is Temperament Now? " : Assessing progress in temperament research on the twenty-fifth anniversary of Goldsmith et al. (1987). Child Development Perspectives, 6, 436–444.

Sifneos, P. (1973). The prevalence of "alexithymic" characteristics in psychosomatic patients. Psychotherapy and Psychosomatics, 22, 255−262.

Kench, S. & Irwin, H.J. (2000). Alexithymia and childhood family environment. Journal of Clinical Psychology, 56, 737–745.

Taylor, G.J., Bagby, R.M. & Parker, J.D. (2003). The 20-Item Toronto Alexithymia Scale. IV. Reliability and factorial validity in different languages and cultures. Journal of Psychosomatic Research: 55, 277–283.

Todd, J.T. & Dixon, W.E. Jr. (2010). Temperament moderates responsiveness to joint attention in 11-month-old infants. Infant Behavior & Development, 33, 297–308.

van der Velde, J., Gromann, P.M., Swart, M., Wiersma, D., de Haan, L., Bruggeman, R., Krabbendam, L. & Aleman, A. (2014). Alexithymia influences brain activation during emotion perception but not regulation. Social Cognitive and Affective Neuroscience, April 2014, doi: 10.1093/scan/nsu056.

Zwaigenbaum, L., Bryson, S., Rogers, T., Roberts, W., Brian, J. & Szatmari, P. (2005). Behavioral manifestations of autism in the first year of life. International Journal of Developmental Neuroscience, 23, 143–152.