

# Postnatal medical complications and behavioral inhibition in the offspring<sup>1</sup>

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**ABSTRACT.** It has been suggested that behavioral inhibition is an important temperamental predictor for child, adolescent and even adult emotional development. Accordingly, the aim of this experimental study was to investigate the impact of pre-, peri-, and postnatal complications on behavioral inhibition. Toddlers' behavioral inhibition was measured in a standardized laboratory procedure at 14 months postnatal age in 101 children. Medical complications were assessed by the Rutter Scales filled in by the examiner from in-patient records and the routine out-patient pregnancy documentations. Inclusion criteria were a birth weight above 2500g, gestational age 37 weeks or older and all APGAR scores had to be above 7. Postnatal complications assessed comprised icterus neonatorum, disorders of adaptation, infectious diseases and others. Medical complications in the postnatal but not pre- or perinatal period proved to significantly increase behavioral inhibition at fourteen months postnatal age. Preventive efforts for infant and child emotional development should take into consideration that children with neonatal complications appear to be at higher risk for internalising disorders in later life.

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**KEYWORDS.** Child development. Temperament. Anxiety disorders. Prevention. Experimental study.

**RESUMEN.** Se ha sugerido que la inhibición conductual representa un indicador temperamental importante en la predicción del desarrollo emocional del niño, del adolescente e incluso del adulto. En consonancia, el objetivo de este estudio experimental fue investigar el impacto de las complicaciones pre-, peri-, y postnatales sobre la inhibición conductual. Se midió la inhibición conductual de niños que empiezan a andar mediante un procedimiento estandarizado de laboratorio en 101 niños con 14 meses de edad postnatal. Las complicaciones médicas fueron evaluadas a través de las *Rutter Scales*, tomadas por el examinador de registros médicos de las pacientes internadas, y de documentaciones sobre el embarazo en el caso de las no hospitalizadas. Los criterios de inclusión fueron un peso al nacer por encima de 2500g, 37 semanas o más de gestación y puntuaciones *APGAR* por encima de 7. Las complicaciones postnatales evaluadas abarcaron ictericia fisiológica, trastornos de adaptación, enfermedades contagiosas, entre otras. Las complicaciones médicas en el periodo postnatal pero no en el pre- o perinatal resultaron aumentar significativamente la inhibición conductual a los 14 meses de edad postnatal. Los esfuerzos preventivos orientados al preescolar y al desarrollo emocional del niño deberían tomar en consideración que los niños con complicaciones neonatal parecen tener un mayor riesgo de presentar trastornos de internalización en su vida posteriormente.

**PALABRAS CLAVE.** Desarrollo del niño. Temperamento. Trastornos de ansiedad. Prevención. Estudio experimental.

**RESUMO.** Tem sido sugerido que a inibição comportamental representa um indicador temperamental importante na predição do desenvolvimento emocional da criança, do adolescente e inclusivamente do adulto. Em consonância, o objectivo deste estudo experimental foi investigar o impacto das complicações pre-, peri-, e pós-natais sobre a inibição comportamental. Mediu-se a inibição comportamental de crianças que começam a andar através de um procedimento estandardizado de laboratório em 101 crianças com 14 meses de idade pós-natal. As complicações médicas foram avaliadas através das escalas de *Rutter*, registos médicos das pacientes internadas, e de documentação sobre a gravidez no caso das não hospitalizadas. Os critérios de inclusão foram um peso ao nascer acima de 2500g, 37 semanas ou mais de gestação e pontuações *APGAR* acima de 7. As complicações pós-natais avaliadas incluíram icterícia fisiológica, perturbações da adaptação, doenças contagiosas, entre outras. As complicações médicas no período pós-natal, mas não no pré- ou perinatal resultaram num aumento significativo da inibição comportamental aos 14 meses de idade pós-natal. Os esforços preventivos orientados para o pré-escolar e para o desenvolvimento emocional das crianças deveriam tomar em consideração que as crianças com complicações neonatais parecem ter um maior risco de apresentar perturbações de internalização posteriormente na sua vida.

**PALAVRAS CHAVE.** Desenvolvimento da criança. Temperamento. Perturbações de ansiedade. Prevenção. Estudo experimental.

## Introduction

Behavioral inhibition has been defined as a bias to respond to unfamiliar events with uncertainty (Kagan, Reznick, and Snidman, 1988). A body of evidence suggests that extremely inhibited toddlers are likely to be inhibited with peers in later childhood (Biedermann *et al.*, 2001). Also, inhibited children at 14 months have been shown to be more shy and withdrawn at age 3 and 4 and to have a higher rate both of social anxiety at age 7.5 and of social phobia in adolescence (Aksan and Kochanska, 2004; Hirshfeld, Rosenbaum, and Biedermann, 1992). Furthermore, anxious children have been shown to have a higher amount of somatic complaints (Hofflich, Hughes, and Kendall, 2006). However, the factors underlying this personality dimension have not yet been completely elucidated. Recently, a modest association with an allele of the CRH-linked locus has been described (Smoller *et al.*, 2003). Still, the presumed vulnerability underlying behavioral inhibition so far could not be attributed solely to child rearing or to genetic factors. Recently, Hirshfeld-Becker and Coworkers (2004) found that perinatal complications lead to an increase of anxiety disorders in at risk populations. Because this observation seems highly important for prevention, this experimental study (Montero and León, 2005; Ramos-Alvarez, Valdés-Conroy, and Catena, 2006) examined whether pre-, peri- or postnatal medical complications increase behavioral inhibition in a community sample.

## Method

The sample of this study consisted of a volunteer sample of 101 healthy Caucasian children after singletons pregnancies. Eligibility criteria were full-term deliveries and infant weight above 2500 grams, APGAR scores > 7 and good health of the child at the time of assessment. Exclusion criteria were inability acute maternal psychiatric disorder, as well as the use of drugs or medications posing a risk to the fetus and/or excessive smoking (> 5 cigarettes/day) or alcohol consumption during pregnancy. Written informed consent was obtained from all participants and the study was approved by the local ethics committee. Out of 114 mothers who decided to take part in the study, 13 decided against it shortly before study inclusion so that 101 children finally participated in the assessment.

Data about the medical course of pregnancy were gathered with the ALSPAC-index (Rutter, Greenwood, Northstone, and Golding, 2003), rendering separate pre-, peri- and postnatal scores. The scale was filled in by the examiner after access to medical in-patient records and the routine out-patient documentations filled out by obstetricians for each pregnant woman after the prescribed monthly prenatal examinations.

For assessment of behavioral inhibition mothers and toddlers visited the laboratory at a day time, when the child was fed and rested. They underwent a standardized battery, as previously described (Kagan, 1994; Moehler, Brunner, Wiebel, Kaufmann, and Resch, 2006). Childrens' behavior was coded by at least two raters independently observing the videotaped sessions. Individual fear scores were composed of the number of trials with withdrawal reactions. Interrater-reliability was good with an intraclass-correlation of .92.

Data were analyzed by STATA. Medical complications were dichotomized according to their occurrence/non occurrence. Analysis of Variance (ANOVA) was performed.

Results

Mothers were between the ages of 25 and 45 ( $M = 33.3$  years), none smoked or drank more than an occasional glass of wine or beer during pregnancy and all had full term deliveries. Median birth weight was 3497 grams ( $SD = 3.8$ ). 45 % of the children were girls. 81% of mothers had a college degree, 19% a high school degree. All mothers were in a partnership with the child’s father at the time of assessment.

The 72 children with prenatal medical complications had a mean fear score of 3.36, the 29 children without prenatal medical complications had a mean fear score of 2.65 (see Table1). The difference was not significant ( $F_{(2, 99)} = 2.09, p = .15$ ). The 26 children without perinatal complications had a mean fear score of 3.19, the 75 with perinatal complications had a mean fear score of 3.14 (see Table1). This difference was not significant ( $F_{(2, 99)} = .01, p = .92$ ). 85 children did not have any medical complications in the neonatal period and those had a mean fear score of 2.96. 16 children had medical complications in the postnatal period. These children had a mean fear score of 4.18 (see Table 1). This difference is statistically significant ( $F_{(2, 99)} = 4.18, p = .04$ ).

**TABLE 1.** Mean and standard deviation of fear score for pre-, peri- and postnatal complications.

	<i>fear score</i>		<i>n</i>	<i>%</i>	<i>p<sup>a</sup></i>
	<i>M</i>	<i>SD</i>			
prenatal complications					.15
yes	3.36	1.85	72	71.8	
no	2.65	2.34	29	28.2	
perinatal complications					.92
yes	3.14	2.25	75	74.6	
no	3.19	2.20	26	25.4	
postnatal complications					.04
yes	4.18	2.16	16	15.5	
no	2.96	2.20	85	84.5	
Total sample	3.16	2.23	101	100	

*Note.*  $p^a$ -values are the results of analysis of variance relating the fear score as dependent variable.

Discussion

These data support an association of fearfulness to the unfamiliar in the second year of life and early medical complications with potential clinical relevance as shown by Hirshfeld-Becker, Biederman, Faraone, Robin, Friedman, Rosenthal and Rosenbaum (2004). This relation might be biologically based as it has previously been shown that

pregnancy related stressors have an impact on human infant reactivity (Moehler, Parzer, Brunner, Wiebel, and Resch, 2006) an established early precursor of behavioral inhibition. However, another, potentially mediating factor might be maternal anxiety, since a relation between parental anxiety disorders and behavioral inhibition has been reported (Rosenbaum *et al.*, 1992) and elevated maternal anxiety might follow neonatal complications. Also, maternal depression has been linked to childhood anxiety (Pauli-Pott, Mertesacker, and Beckmann, 2004) and might be associated with postnatal complications. A third line of reasoning could argue for parental overprotection after neonatal complications increasing behavioral inhibition in the offspring. As this stable behavioral trait has demonstrated significance for the development of depression and anxiety even in adulthood, the clinical relevance of this study is the identification of children with postnatal medical complications as potential targets for preventive efforts with long-term benefit.

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