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Body size at birth and psychiatric disorders among adolescents: a clinical study of 310 under-age inpatient adolescents in Northern Finland

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Abstract

Background: Deviant birth measure is a risk factor for later somatic illness but also for later psychiatric disorders of the offspring. Only a few studies have examined the association of birth measures to later psychiatric disorders among adolescents. Studies on sex differences in these associations are scarce as well.
Methods: The cases consisted of 508 adolescents (208 boys and 300 girls) aged 12–17 years, who were admitted to inpatient psychiatric hospitalization between 2001 and 2006. In addition, 478 healthy controls were derived from the Northern Finnish Birth Cohort 1986, born in approximately the same period and same area as the cases. Data of birth measures were collected from the National Birth Register for cases and from antenatal clinics for controls. Both cases and controls were interviewed using the Schedule for Affective Disorder and Schizophrenia for School-Age Children-Present and Lifetime (K-SADS-PL) to assess psychiatric disorders.
Results: The adolescent patients were statistically significantly shorter and had higher ponderal index at birth compared to healthy controls. In addition, the age of the mothers at adolescent's birth was significantly younger in the patients than the controls. After controlling for various covariates, a 2.4-fold increased likelihood for internalizing disorders was seen among male adolescents with high ponderal index.
Conclusions: The association of birth measures to psychiatric disorders was confirmed in our study, particularly among male adolescents suffering from internalizing disorders. Further studies in larger adolescent samples are needed to confirm our findings and clear up the association of high ponderal index to specific psychiatric disorders.

1. Introduction

Barker's hypothesis postulates that adult diseases have origins in foetal exposures [1,2]. For example studies of the relation between prenatal famine and later adult physical and mental health have shown consistent association to for example diabetes and schizophrenia [3]. Persons exposed to Dutch Hunger Winter of 1944/1945 during the early gestation had two-fold risk of schizophrenia compared those not exposed to famine [4]. Later both low birth weight and high birth weight i.e. a U-shaped relationship were found to be a risk factor for somatic and psychiatric disorders [5–8].

Indeed, of all obstetric complications birth weight has received a special interest in different studies in the field of psychiatry. For decades, evidence has accumulated on an association of low birth weight with schizophrenia [9–12,8], but also with depression [13,14], anxiety disorders [15] and behavioural problems [16,17]. On the other hand, some studies have reported associations between high birth weight and psychiatric disorders, such as schizophrenia [18] and depression [19].

Compared to birth weight studies, fewer studies have examined the association of birth length and psychiatric disorders. In a meta-analysis of schizophrenia three studies showed no association between birth length and later risk of schizophrenia [20], while other studies have found that shortness associates with psychotic disorders [21–23,8]. In

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the study by Moilanen and workgroup (2010) short and long birth length, as well as low and high birth weight, associated with later onset of schizophrenia both in males and females [8]. Another schizophrenia study found that the inverse association extended across the full range of birth lengths so that particularly short babies had an increased risk [23]. In a child population short birth length was found to associate with behavioural problems at the age of seven [24]. To our knowledge only one study has reported a sex difference concerning birth length and later psychiatric disorder in favour of boys [22].

Only few studies have examined the association of ponderal index (birth weight/length^3) with later risk of psychiatric disorders. Niemi and colleagues showed that both a low ponderal index at the time of birth and a high body mass index at the age of seven associated with later schizophrenia spectrum disorders [22]. Another study found an increased risk for psychotic symptoms among children aged 12 years if ponderal index was low at the time of birth [25]. A low ponderal index has also been shown to associate with schizophrenic disorders before the age of twenty-one only among males [26]. Some studies have not found any association of ponderal index at the time of birth with the onset of schizophrenia [8] or depression [27].

To our knowledge, the association of birth measures and later psychiatric disorders is rarely assessed in adolescent population samples [16,28,25,17]. In our study we investigated whether the association of birth measures (birth weight, length and ponderal index, *i.e.,* the measure of nutritional status/thinness) with psychiatric disorders is found among adolescent psychiatric inpatients aged 12–17 years. The comparison group consisted of the general population sample of healthy controls of the same age from the Northern Finland Birth Cohort 1986.

2. Methods

2.1. Samples

2.1.1. Patient sample

The patient sample is based on the data from the Study-70 project, which was initiated to examine the association of various psychosocial risk factors with severe psychiatric disorders among hospital-treated adolescents. The original study sample consisted of 508 adolescent inpatients, 208 (40.9%) males and 300 (59.1%) females aged 12 to 17 years (with mean age of 15) who had been admitted to the inpatient adolescent psychiatric Unit 70 at the Oulu University Hospital between April 2001 and March 2006. The catchment area of Unit 70 covers the districts of Oulu and Lapland; all adolescents from this area who need acute psychiatric hospitalization in a closed ward are initially treated in Unit 70. The mean (sd) age (in years) at admission was 15.5 (1.4) in the data as a whole; 15.4 (1.3) among boys and 15.5 (1.3) among girls. Subjects who were older than 18 years, people diagnosed with mental retardation, or had organic brain disorders were excluded from the study population. Subjects and their parents participated in the study with informed, voluntary, and written consent. The study project has earlier been described in detail in an earlier publication [29]. The study protocol was approved by the Ethics Committee of Oulu University Hospital, Finland.

2.1.2. Healthy controls

The sample of healthy controls originates from the Northern Finland Birth Cohort 1986 (NFBC 1986) follow-up study of 9432 infants born alive with expected date of birth between July 1, 1985 and June 20, 1986 from the same geographical areas as the Study-70 population. The population in these geographical areas as in Finland in general is genetically homogenous which makes the comparison of these two groups justifiable. We used a mentally healthy subpopulation of NFBC 1986 [30] as a healthy control population in our study. This healthy control population was derived from the total population of NFBC 1986 by first screening them for ADHD symptoms. Based on the screening results, a subgroup of 464 people was invited to participate in a direct clinical assessment and was interviewed using Schedule for Affective Disorder and Schizophrenia for School-Age Children-Present and Lifetime (K-SADS-PL) questionnaire, a diagnostic schedule to diagnose psychiatric disorders according to DSM-IV criteria [31]. As a result, 264 adolescent aged 15–16 years were defined as a healthy control population without any psychiatric disorders diagnosed by K-SADS-PL. The NFBC study protocol was approved by the Ethical Committee of the Northern Ostrobothnia Hospital District.

2.2. Body size measures at birth

Information on birth weight and birth length of the patient sample was obtained from the national Medical Birth Register from the National Institute for Health and Welfare (previously THL) that covers birth data in Finland since 1987. Thus, the patient sample of the present study consists of the 310 adolescents, 125 (40.3%) boys and 5 (59.7%) girls, for whom the information on birth measures was available from that register. The corresponding information of the healthy controls was based on the data of pregnancy and delivery, and children's survival collected by the antenatal clinics.

In addition to weight and length at birth, the intrauterine growth pattern was assessed ponderal index (birth weight/length^3), which is a measure of thinness/nutritional status. The gender-specific upper quartiles (85th percentiles) based on the birth measures (weight, length, ponderal index) of the healthy controls were used as cut-offs to indicate the extreme values of the measure. The following cut-offs were used: birth weight ≥ 4020 g in boys, ≥ 3850 g in girls; birth length ≥53 cm in boys, ≥52 cm in girls; ponderal index (1000*g/cm^3), ≥ 28.9 in boys, 29.8 in girls.