



# Low Birth Weight and Its Association with Attention Deficit Hyperactivity Disorder (ADHD) in Young Children

Bunga Astria Paramashanti, Rosma Fyki Kamala, Dwi Nur Rahmawati  
Department of Nutrition, Faculty of Health Sciences, Universitas Alma Ata

## OBJECTIVE

Attention deficit hyperactivity disorder (ADHD) is a neurobehavioral disorder in children characterized with symptoms of inattention, hyperactivity, or impulsiveness (1). It can affect learning ability, academic achievement, social interactions, and well-being of children (1,2). Indeed, it also impacts on the child's family in term of social and financial difficulties (3).

The prevalence of ADHD varies from one country to another ranging from 5% to 10% (1,4). This variability seemed to be explained by different methods used in a study (5). A systematic review in China revealed ADHD in children and adolescents was 6.26% (6). In Indonesia, the prevalence of ADHD nationally remained unclear. However, a small-scale study in Padang Timur Subdistrict showed that the prevalence of ADHD among school-age children was 8% (7).

There was still limited study investigating the relationship between birth weight and hyperactivity in Indonesia, especially in young children (11). Therefore, this study was aimed to analyze the relationship between low birth weight and attention deficit hyperactivity disorder (ADHD) in young children.

## METHODS

This study used cross-sectional design. Subjects were a total of 185 young children aged 36 – 59 months selected by using probability proportional to size where Posyandu used as a cluster. Respondents were mothers or main caregivers of children. The study was conducted in Sedayu Subdistrict, Bantul District, Daerah Istimewa Yogyakarta, in December 2016 until February 2017.

Abbreviated Conners' Rating Scale was used to measure ADHD symptoms, followed by a psychologist confirmation of ADHD diagnosis. Data on birth weight was obtained by observing Maternal and Child Health Handbook. Low birth weight (LBW) was considered as birth weight below 2500 g. Statistic analysis included descriptive statistics and chi-square test at 0.05 level of significance.

## RESULTS

A total of 185 child-mother/caregiver pairs participated in this study. Picture 2 presented that ADHD prevalence was 29.19% in this study. The majority of children were in the category of 36-47 months of age (61%). Meanwhile, more than half of mothers' age were above 30 years old (64%) as shown in Picture 1.

Table 1. Association between LBW and ADHD

Variable	ADHD	Not ADHD	OR	P-value
LBW	8 (53.3%)	7 (46.7%)	2.8	0.03
Not LBW	46 (27.1%)	124 (72.9%)		

Table 1 showed that LBW was related with ADHD significantly ( $p < 0.05$ ). Thus, it can be concluded that young children whose birth weight below 2500 g had 2.8 times higher risk of having hyperactivity symptoms than young children who had birth weight equal to or more than 2500 g. This result is in line with previous study conducted in Finland that revealed the significant association between LBW and ADHD (9). Moreover, the effect is also shown in later age children. In Denpasar, LBW was linked with ADHD symptoms in school age children (11).

The finding suggested that fetal growth restriction, as reflected in LBW children, may increase ADHD symptoms in young children. Growth restriction during pregnancy affects infant brain structure by reducing total brain volume, thus reducing grey matter volume. This mechanism may affect the maturity of attention-interactive score (9). Another study explains that birth weight has indirect effect on ADHD through primary neuropsychological functions. In fact, children with ADHD are more likely to have neuropsychological function problems, especially in children aged 3-4 years old (12).

Limiting factor of this study was that LBW variable could not be specified into low birth weight due to preterm birth or small gestational for age.

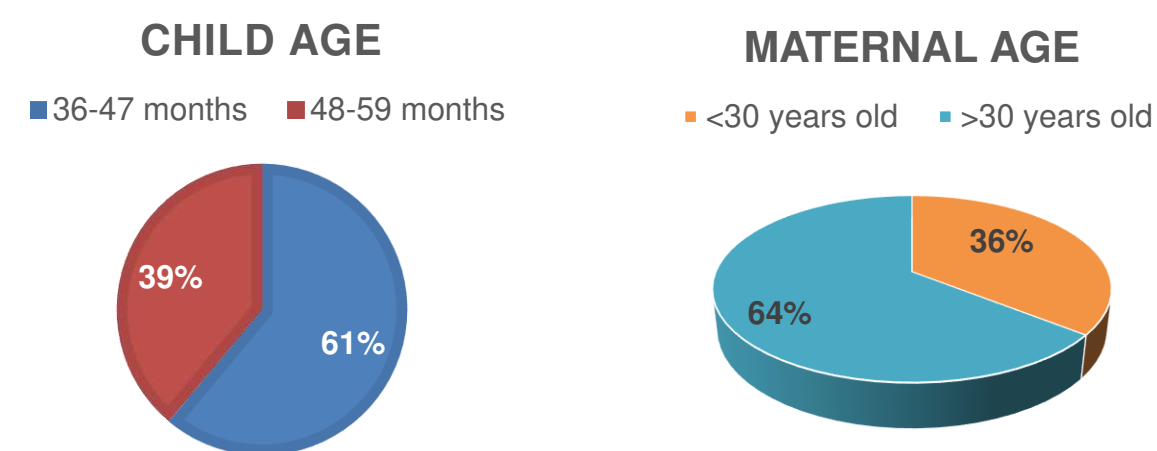
Further study is needed where LBW definition is made by considering gestational age. In addition, this cross-sectional design cannot be used to draw causal-effect relationship. However, this study provides additional sights in the relationship between LBW and ADHD where there is still limited study on this topic in Indonesia.

## CONCLUSIONS

Low birth weight is related with attention deficit hyperactivity disorder in young children. This evidence underlines the importance of optimum nutritional and health status during windows of opportunity period. Achievement of growth potential in perinatal period may improve growth and development in later age.

## BIBLIOGRAPHY

- American Academy of Pediatrics. ADHD: Clinical Practice Guideline for the Diagnosis, Evaluation, and Treatment of Attention-Deficit/ Hyperactivity Disorder in Children and Adolescents. Pediatrics [Internet]. 2011 [cited 2017 Dec 11];128(5).
- Loe IM, Feldman HM. Academic and Educational Outcomes of Children With ADHD. J Psychiatr Psychol [Internet]. 2007 May 28 [cited 2017 Dec 12];32(6):643–54.
- Harpin VA. The effect of ADHD on the life of an individual, their family, and community from preschool to adult life. Arch Dis Child [Internet]. 2005 [cited 2017 Dec 12];90:2–7.
- Thomas R, Sanders S, Doust J, Beller E, Glasziou P. Prevalence of Attention-Deficit/Hyperactivity Disorder: A Systematic Review and Meta-analysis. Pediatrics [Internet]. 2015 Apr 2 [cited 2017 Dec 12];135(4):e994–1001.
- Chinawa JM, Obu HA. Epidemiology of Attention Deficit/Hyperactivity Disorder. In: ADHD - New Directions in Diagnosis and Treatment [Internet]. InTech; 2015 [cited 2017 Dec 12].
- Wang T, Liu K, Li Z, Xu Y, Liu Y, Shi W, et al. Prevalence of attention deficit/hyperactivity disorder among children and adolescents in China: a systematic review and meta-analysis. BMC Psychiatry [Internet]. 2017 [cited 2018 Apr 6];17(1):32.
- Novriana DE, Yanis A, Masri M. Prevalensi Gangguan Pemusatan Perhatian dan Hiperaktivitas pada Siswa dan Siswi Sekolah Dasar Negeri Kecamatan Padang Timur Kota Padang Tahun 2013. J Kesehat Andalas [Internet]. 2014;3(2):141–6.
- Monk C, Spicer J, Champagne FA. Linking prenatal maternal adversity to developmental outcomes in infants: The role of epigenetic pathways. Dev Psychopathol [Internet]. 2012 [cited 2018 Mar 7];24(4):1361–76.
- Heinonen K, Räikkönen K, Pesonen A-K, Andersson S, Kajantie E, Eriksson JG, et al. Behavioural symptoms of attention deficit/hyperactivity disorder in preterm and term children born small and appropriate for gestational age: a longitudinal study. BMC Pediatr [Internet]. 2010 Dec 15 [cited 2017 Dec 10];10:91.
- Petersson E, Sjölander A, Almqvist C, Anckarsäter H, D'Onofrio BM, Lichtenstein P, et al. Birth weight as an independent predictor of ADHD symptoms: a within-twin pair analysis. J Child Psychol Psychiatry [Internet]. 2015 Apr [cited 2018 Apr 20];56(4):453–9.
- Adiputra IMS, Sutarga IM, Pinatih GNI. Faktor Risiko Attention Deficit Hyperactivity Disorder ( ADHD ) pada Anak di Denpasar. Public Heal Prev Med. 2015;3(1):43–8.
- Hatch B, Healey DM, Halperin JM. Associations between birth weight and attention-deficit/hyperactivity disorder symptom severity: indirect effects via primary neuropsychological functions. J Child Psychol Psychiatry [Internet]. 2014 Apr [cited 2017 Dec 10];55(4):384–92.



Picture 1. Maternal and Child Characteristics

Factors associated with ADHD are heritability, central nervous system, and environmental risk factors. Of all environmental risk factors, pregnancy-related risk is the most common including tobacco smoking, prenatal substance exposure, low birth weight (LBW), and maternal distress (1,8). A previous study in Finland showed that LBW was related with higher ADHD symptoms (9). The same result shown in a Sweden study that LBW was an independent factor of all ADHD symptom forms, even after controlling genetic and environmental aspects (10).

Picture 2. Distribution of ADHD

