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Original article

Life Course Adiposity and Adolescent Depressive Symptoms Among Hong Kong Adolescents

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A B S T R A C T

Purpose: Depression is a public health issue, which often emerges in adolescence. Adiposity may be a factor in this emergence; however, in Western settings, both adiposity and depression tend to be socially patterned, making it unclear whether any association is biologically based or contextually specific.
Methods: Multivariable analysis was used to assess the adjusted association of birth weight and life course body mass index (BMI) z score (at 3 and 9 months and 3, 7, 9, 11, and 12 years of age) and changes in BMI z score with adolescent depressive symptoms score at ~14 years of age, assessed from Patient Health Questionnaire–9 (PHQ-9) in a population-representative Chinese study, Hong Kong's "Children of 1997" birth cohort, which has little social patterning of birth weight or BMI. We also assessed whether associations varied with sex.
Results: PHQ-9 was available for 5,797 term births (73% follow-up). Birth weight z score, BMI z scores at 3 and 9 months and at 3, 7, 9, 11, and 12 years of age, and successive BMI z score changes had little association with PHQ-9 at ~14 years of age, adjusted for socioeconomic position, parental depressive symptoms, and survey mode.
Conclusions: In a developed non-Western setting, life course adiposity does not appear to be a factor in the development of depressive symptoms in adolescence, suggesting that observed associations to date may be contextually specific rather than biologically based.
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IMPLICATIONS AND CONTRIBUTION

In a developed non-Western setting with little social patterning of birth weight, infant, childhood, or adolescent body mass index, we provide prospective evidence that neither birth weight nor life course adiposity were related to the development of depressive symptoms in early adolescence. Varying associations by setting suggest some unmeasured confounding.

Depression is one of the most prevalent psychiatric disorders and is projected to be the leading cause of disability-adjusted life years globally. [1] Depression often emerges in adolescence [2] and can track into adult life. Adolescent depression is increasing [3] in parallel with obesity [4], which might be a coincidence, a cause or might indicate common pathways between depression and obesity [5], via the hypothalamic-pituitary-adrenal axis [6], because depression and obesity share symptoms such as sedentary behaviors, sleep problems, and unregulated food intake [7]. In Western settings, the association of childhood obesity with depression symptoms in later life is inconclusive, with some positive associations [5,8], especially in girls [9], no association [10], and even a negative association [11]. However, all these studies are based on cross-sectional or longitudinal data without repeated measures of obesity or accounting for weight fluctuations and are only capable of indicating correlation rather than causation. A meta-analysis of prospective studies from Western settings found that the association between adiposity and depressive symptoms is greater in adolescents [12]. Adolescence is a vulnerable and sensitive life stage during which biological, psychological, and social transitions occur. At this stage, weight takes on a new meaning and concerns about appearance and peer approval increase, so that

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adiposity may be stigmatized and associated with psychological and social burdens [13].

Observational studies are difficult to interpret because of the clustering of attributes together, which are often difficult to capture comprehensively and control for in the analysis, for example, obesity and depression may be associated with many unmeasured aspects of socioeconomic position (SEP), making estimates open to residual confounding. In Western settings, SEP may confound the association of adiposity with depression, because low SEP is usually associated with lower birth weight [14] and adiposity in childhood [15]. This makes it difficult to know whether any observed associations represent modifiable risk factors for which interventions are warranted from a mental health perspective or whether the observed associations are the result of uncontrolled and most likely uncontrollable confounding. Low birth weight is associated with increased risk of some specific psychiatric disorders, such as schizophrenia [16] and attention deficit and hyperactivity disorder [17], but its association with depression is uncertain [18,19]. Hong Kong is a recently developed non-Western setting with a standard of living and social infrastructure similar to Western Europe or North America [20]. However, the Hong Kong population has also experienced very rapid economic development from pre-to post-industrial living conditions over a lifetime, because the population was largely formed by migration in the mid 20th century from the neighboring Guangdong Province of China. Hong Kong is different from many Western countries in having little association of SEP with birth weight, infant, childhood, or adolescent body mass index (BMI) [21], perhaps as a result of such a recent history of very limited living conditions and the inevitable social reassortment with migration. Hence, Hong Kong, with a different confounding structure for obesity, provides a valuable setting in which to triangulate the evidence and to verify observations from Western settings that are potentially confounded by SEP, because adiposity is not as clearly socially patterned in Hong Kong as in most Western settings. Here, we took advantages of a large, contemporary, population-representative Hong Kong Chinese birth cohort "Children of 1997" to assess the association of birth weight and life course adiposity with adolescent depressive symptoms at ~14 years of age.

Methods

Source of data

Hong Kong's "Children of 1997" birth cohort is a population-representative Chinese birth cohort (n = 8,327) that covered 88% of all births from April 1, 1997 to May 31, 1997. It has been described in detail elsewhere [22]. The study was initially established to investigate the association between secondhand smoke exposure and infant health. [22] Families were recruited at the first postnatal visit to any of the 49 Maternal and Child Health Centers in Hong Kong, which parents of all newborns are encouraged to attend for free postnatal care, developmental checks, and vaccinations until the age of 5 years. Baseline characteristics were obtained at recruitment using a self-administered questionnaire in Chinese, which included SEP, birth weight, gestational age, parity (birth order of the child), breastfeeding, and secondhand smoke exposure. Passive follow-up via record linkage was instituted in 2005 to obtain (1) weight and height from birth to 5 years of age from the Maternal and Child Health Centers (96% success); (2) annual measurements of weight and height (grade 1 onwards) from the Student Health Service, Department of Health, which provides free annual checkups for all school students; (3) hospital discharge records from the Hospital Authority that manages all public hospitals, and (4) death records from the Death Registry. Active follow-up via direct contact was instituted in 2007. A postal survey (survey I) was conducted in 2008–2009. Survey II was conducted in 2010–2012 as a postal and telephone survey including the Patient Health Questionnaire–9 (PHQ-9) for cohort members and their parents. Pilot studies for full-scale mass follow-up were initiated in 2011 and included PHQ-9. The study was reviewed by and received approval from the University of Hong Kong-Hospital Authority Hong Kong West Cluster Joint Institutional Review Board and the Ethics Committee of the Department of Health, Government of the Hong Kong SAR, People's Republic of China.

Measures of life course adiposity

Adiposity was considered as z scores (i.e., standard deviation [SD] score) of routine measurements at the Maternal and Child Health Centers or Student Health Services of birth weight, BMI at 3 and 9 months, 3, 7, 9, 11, and 12 years of age, and all changes in BMI z scores between 3 months and ~12 years of age (i.e., from 3 to 9 months, 9 months to 3 years, 3 to 7 years, 7 to 9 years, 9 to 11 years, and 11 to12 years of age). Age- and sex-specific BMI z scores were calculated according to the World Health Organization growth standards [23,24], for comparability with other studies. Moreover, we are interested in internal comparisons within our cohort, which will not be affected by any slight differences from the World Health Organization growth standards. These standards were interpolated onto a daily scale by the akima package in R version 2.3.1 (R Development Core Team, Vienna, Austria). The closest available measurements to 3 months (within 2–4 months), 9 months (within 8–10 months), 36 months (within 32–40 months), 7 years (within 6.2–8 years), 9 years (8.2–10 years), 11 years (10–11 years), and 12 years (11–12 years of age) were used to ensure the use of routine, rather than other measurements.

Outcome

Depressive symptoms were assessed at ages 12–15 years, on average at 14 years, from PHQ-9. PHQ-9 is a validated instrument for assessing depression [25]. PHQ-9 has good sensitivity and specificity in detecting depression in youth [26] and has been used in Hong Kong Chinese [27]. We used PHQ-9 as a continuous measure (number of symptoms endorsed and their frequency), where a higher score indicates more depressive symptoms. PHQ-9 consists of a set of nine items describing symptoms and functional impairment, with each item scored 0 for not at all, 1 for several days, 2 for more than half the days, and 3 for nearly every day. The highest PHQ-9 score possible is 27, where a higher score indicates more depressive symptoms. The presence of PHQ-9 depression is usually defined as a total score of 11 or more mapping onto Diagnostic and Statistical Manual of Mental disorders, fourth edition criteria [25]. PHQ-9 has different language versions, including Portuguese, Spanish, French, Thai, and Korean, and is widely used in different countries and in a variety of settings [25]. The Hong Kong Chinese version of PHQ-9 has the same construction as in Western settings and also has good reliability and validity; the structure of PHQ-9 is universal and can be generalized to many different groups [27].

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