Infant or childhood obesity and adolescent depression

CM Schooling *, KYL Hon, SL Lin, MK Kwok, SM Stewart

KEY MESSAGES

1. Higher body mass index was not associated with depressive symptoms in early adolescence.

2. Depressive symptoms were associated with several unhealthy behaviours (ever-smoking, ever-drinking, and unhealthy diet). Higher Rutter score was associated with ever-smoking.

CM Schooling, KYL Hon, SL Lin, MK Kwok, SM Stewart

School of Public Health, The University of Hong Kong

* Principal applicant and corresponding author: cms1@hkucc.hku.hk; mschooli@hunter.cuny.edu

Introduction

Depression is a leading cause of morbidity. The prevalence of common mental disorders has been reported to be 16.4% in a small but representative population of Hong Kong Chinese adolescents.[1] Most psychiatric disorders in adults are thought to originate in childhood and adolescence. There may be risk factors for developing unhealthy behaviours, with life-long detrimental effects on health. The pathway to depression and obesity may be similar.[2] In the west, both depression and obesity tend to be associated with lower socio-economic status. In Hong Kong, there is little social patterning of early life obesity.[3] This study used a large, population-representative Hong Kong Chinese birth cohort 'Children of 1997' to examine longitudinally the association of birth weight and life course body mass index with psychological well-being in late childhood and with depressive symptoms in early adolescence. The association of psychological well-being with adolescent health behaviours was also examined.

Methods

This study was conducted from October 2009 to January 2013. It was approved by the University of Hong Kong-Hospital Authority Hong Kong West Cluster Joint Institutional Review Board. The Children of 1997 birth cohort has been described elsewhere.[3] In brief, it is a population representative birth cohort consisting of 88% of children born in April to May in 1997 in Hong Kong. Height/length and weight measurements at 3 months, 9 months, 36 months were collected from the Maternal and Child Health Centres. The health checks at the Student Health Service included measurement of height and weight every year from age 6 years and assessment of pubertal status and some aspects of psychological well-being in alternate years. In 2010-

2012, a questionnaire was used to obtain depressive symptoms, environmental stressors, and health behaviours of the cohort from age 12 to 15 years and their families.

Birth weight was considered as sex- and gestational age-specific z-scores. Adiposity was proxied by body mass index (BMI) z-score in infancy (3 months and 9 months), childhood (~3 years, ~7 years, ~9 years and ~11 years) and adolescence (~12 years) for depressive symptoms only, relative to the 2006 and 2007 World Health Organization growth references. Childhood overweight (or obesity) was defined as a BMI for age and sex equivalent to an adult BMI of ≥25.

Psychological well-being was evaluated using the Chinese version of the Revised Parent's Rutter Scales[4] for emotional and behavioural outcomes (higher scores indicate worse outcome), the Chinese version of the Form A of the Culture-Free Self-Esteem Inventories[5] for self-esteem (lower scores indicate lower self-esteem), and the Patient Health Questionnaire (PHQ)-9[6] for depressive symptoms (higher scores indicate depression). Smoking and drinking was considered as never and ever. Diet was assessed from a food frequency questionnaire and dichotomised as a healthy or unhealthy diet.[7] Physical activity was counted as hours of physical activity per day and dichotomised as low (<1 hour per day) or high (1+ hour per day).

Multivariable linear regression was used to assess the adjusted association of birth weight and life-course BMI with psychological well-being. Multivariable logistic regression was used to assess the adjusted association of psychological well-being with health behaviours. Whether association differed by sex from the heterogeneity across strata and the significance of the relevant interaction terms was assessed. Multiple imputation was used for missing exposures and confounders.

Results

From the Student Health Service, Rutter scores of 5589 children and self-esteem scores of 7089 children at ~11 years were available. Valid responses were obtained for depressive symptoms (n=5799), ever-smoking (n=5798), ever-drinking alcohol (n=5794), physical activity (n=3688), and diet (n=3657).

The mean Rutter score at ~11 years was 8.4 (standard deviation [SD], 6.0). The mean self-esteem score at ~11 years was 36.6 (SD, 7.4). The mean PHQ-9 score at ~13 years was 3.1 (SD, 3.5). Higher maternal depressive symptoms, feeling overwhelmed by school work, and poor perceived academic performance were all independently associated with higher Rutter score, lower self-esteem, and more depressive symptoms.

After adjusting for age, sex, and socio-economic status, lower birth weight was associated with a higher Rutter score at ~11 years, but BMI from infancy to childhood was not associated with Rutter score (Table 1). Birth weight was not associated with self-esteem at ~11 years, but a higher BMI at 7, 9, and 11 years was associated with lower self-esteem. Birth weight and BMI from infancy to age ~12 years was not associated with depressive symptoms at ~13 years. Similar results were obtained for depressive symptoms using multivariable partial least squares

TABLE 1. Adjusted association of birth weight and body mass index z-scores at different ages with Rutter score and self-esteem score at ~11 years and with Patient Health Questionnaire (PHQ)-9 score for depressive symptoms at ~13 years*

Variable	Rutter score	Self-esteem score	PHQ-9 score
	β (95% CI)	β (95% CI)	β (95% CI)
Birth weight	-0.04 (-0.18, 0.10)	-0.24 (-0.40, -0.08)	0.08 (-0.12, 0.27)
Age			
3 months	-0.09 (-0.30, 0.11)	0.005 (-0.21, 0.21)	-0.05 (-0.29, 0.20)
9 months	0.08 (-0.15, 0.32)	-0.05 (-0.32, 0.22)	-0.03 (-0.43, 0.38)
3 years	0.04 (-0.24, 0.32)	-0.20 (-0.38, -0.03)	-0.12 (-0.47, 0.23)
7 years	-0.10 (-0.44, 0.23)	-0.17 (-0.30, -0.04)	-0.20 (-0.35, -0.04)
9 years	-0.02 (-0.36, 0.32)	-0.14 (-0.26, -0.02)	-0.21 (-0.35, -0.06)
11 years	0.17 (-0.34, 0.68)	-0.10 (-0.22, 0.02)	-0.25 (-0.39, -0.10)
12 years	-0.03 (-0.47, 0.41)	-	-

* Adjusted for age, sex, parental education, mother's place of birth, and survey mode for PHQ-9

TABLE 2. Adjusted association of Rutter score, self-esteem score, and Patient Health Questionnaire (PHQ)-9 score with ever smoking, ever drinking, low physical activity, and unhealthy diet

Model*	Rutter score >12	Self-esteem score ≤19	PHQ-9 score ≥11
	OR (95% CI)	OR (95% CI)	OR (95% CI)
Ever-smoking (90/5893, 1.5%)			
1	1.11 (1.05, 1.18)	0.95 (0.91, 0.99)	1.15 (1.09, 1.22)
2	1.09 (1.02, 1.16)	0.97 (0.92, 1.03)	1.14 (1.04, 1.24)
Ever-drinking (545/5887, 9.3%)			
1	1.02 (0.99, 1.05)	0.97 (0.95, 0.98)	1.11 (1.08, 1.14)
2	1.00 (0.98, 1.03)	0.98 (0.96, 1.00)	1.11 (1.07, 1.16)
Low physical activity (2483/3738, 66.4%)			
1	1.01 (1.00, 1.03)	0.98 (0.97, 0.99)	1.02 (1.00, 1.04)
2	1.00 (0.99, 1.02)	0.98 (0.97, 0.99)	1.01 (0.99, 1.03)
Unhealthy diet (599/3925, 15.3%)			
1	1.02 (1.00, 1.04)	0.97 (0.95, 0.98)	1.06 (1.03, 1.08)
2	1.00 (0.98, 1.02)	0.97 (0.96, 0.99)	1.04 (1.01, 1.07)

* Model 1 adjusted for age, sex, socio-economic status, parental marital status and survey mode, whereas model 2 additionally adjusted for the other measures of psychological well-being

regression to take account of measurements potentially being collinear. There was no evidence of different associations by sex (all p-values for interactions >0.05).

A high level of depressive symptoms was more common among adolescents without two parents living at home, and among adolescents whose parents had depressive symptoms. A minority of adolescents reported ever smoking (1.5%) or ever use of alcohol (9.3%), 15% had an unhealthy diet and 66% reported low physical activity. After adjusting for age, sex, socio-economic status, parental marital status, survey mode, and the other two measures of psychological well-being, a higher Rutter score was independently associated with ever-smoking, whereas lower self-esteem was independently associated with low physical activity and unhealthy diet, and more depressive symptoms were independently associated with ever smoking, ever use of alcohol and unhealthy diet (Table 2). There was little evidence that the associations differed by sex (P>0.05 for interaction).

Discussion

In the Children of 1997 birth cohort, birth weight and life-course BMI had a limited domain-specific association with psychological well-being. There was little evidence that birth weight or life-course BMI was associated with early adolescent depressive symptoms. Nonetheless, lower birth weight was associated with higher Rutter score at ~11 years, and higher BMI in late childhood was associated with lower self-esteem at ~11 years. Similarly, there was a domain-specific association of psychological well-being with health behaviour. Depressive symptoms were associated with unhealthy behaviours (ever-smoking, ever-drinking, and unhealthy diet), although higher Rutter score was associated with ever-smoking, and lower self-esteem was associated with low physical activity and unhealthy diet.

There were limitations to the study. Psychological well-being based on the questionnaire scores is not the same as a diagnosis. In addition, depressive symptoms were assessed at the same time as health behaviours.

Prevention of low birth weight and obesity among children is important. Poor psychological well-being in adolescence may be a forerunner of life-long unhealthy behaviour, with implications for prevention, if our findings are replicated in an evaluation of an intervention or a Mendelian randomisation study.

Acknowledgements

References

1. Leung PW, Hung SF, Ho TP, et al. Prevalence of DSM-IV disorders in Chinese adolescents and the effects of an impairment criterion: a pilot community study in Hong Kong. Eur Child Adolesc Psychiatry 2008;17:452-61.
2. Reeves GM, Postolache TT, Snitker S. Childhood obesity and depression: connection between these growing problems in growing children. Int J Child Health Hum Dev 2008;1:103-14.
3. Schooling CM, Hui LL, Ho LM, Lam TH, Leung GM. Cohort profile: 'children of 1997': a Hong Kong Chinese birth cohort. Int J Epidemiol 2012;41:611-20.
4. Wong CK. The Rutter Parent Scale A2 and Teacher Scale B2 in Chinese. I. Translation study. Acta Psychiatr Scand 1988;77:724-8.
5. Battle J. Culture-free SEI: self-esteem inventories for children and adults. Washington: JB Preston; 1981.
6. Richardson LP, McCauley E, Grossman DC, et al. Evaluation of the Patient Health Questionnaire-9 Item for detecting major depression among adolescents. Pediatrics 2010;126:1117-23.
7. Lazarou C, Panagiotakos DB, Matalas AL. Lifestyle factors are determinants of children's blood pressure levels: the CYKIDS study. J Hum Hypertens 2009;23:456-63.