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# Bidirectionality and gender differences in emotional disturbance associations with obesity among Taiwanese schoolchildren

Po-Huang Chiang [a,b], Lin-Yuan Huang [a], Yuan-Ting Lo [c], Meei-Shyuan Lee [c,d], Mark L. Wahlqvist [a,c,d,*]

[a] Division of Preventive Medicine and Health Services Research, Institute of Population Health Sciences, National Health Research Institutes, 35 Keyan Road, Zhunan Town, Miaoli County 350, Taiwan, ROC
[b] Department of Health Risk Management, College of Management, China Medical University, No.91 Hsueh-Shih Road, Taichung 40402, Taiwan, ROC
[c] School of Public Health, National Defense Medical Center, No.161, Sec. 6, Minchuan East Road, Taipei 114, Taiwan, ROC
[d] Monash Asia Institute, Monash University, 5th Floor, H Building, 900 Dandenong Road, Caulfield East, VIC 3145, Australia

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ABSTRACT

Childhood obesity is associated with psychological problems, but little is known about its association with emotional disturbance (ED) in the educational setting, especially by gender. In the population representative Elementary School Children's Nutrition and Health Survey in Taiwan 2001–2002 of children aged 6–13 ($n = 2283$), we have considered whether ED is associated with obesity by gender. Schoolchildren were assessed with the modified scale for assessing emotional disturbance questionnaires. For some subscales, boys and girls had ED associations with obesity which were bidirectional. With normal weight as referent and relevant adjustments, the significant ED subscales predictable by obesity were relationship problems (RP) in boys (odds ratio, OR = 1.89 with 95% CI: 1.08–3.30) and inappropriate behavior (IB) in girls (OR = 2.88: 95% CI: 1.47–5.61). Conversely, with 'no-specific-ED' as referent, obesity was predictable by fully-adjusted specific-EDs in the same subscales, namely RP in boys (OR = 1.88 with 95% CI: 1.13–3.13) and IB in girls (OR = 3.03: 95% CI: 1.57–5.85). Child obesity prevalence showed no trend with school grade from 1 to 6, but for aggregate ED and most of its subscales the prevalence increased with grade ($P$ for trend $<0.01$). Thus, there is some dissociation of obesity and ED as judged by their trend presence with school grade. Where obesity and ED occurred together (for inability-to-learn and unhappiness or depression), there were upward trends with grade ($P < 0.01$). There are probably some selected bidirectional pathogenicities for obesity-ED associations with different expression in boys and girls and during elementary education. This provides some policy direction while mechanisms and causality require elucidation.


## 1. Introduction

Little is known about how emotional disturbance and obesity might be linked in Asia where child obesity is on the rise as elsewhere and where societal and parental focus is often intense in regard to schooling, often with gender favoritism. The

* Corresponding author. Tel.: +886 37 246166x36366; fax: +886 37 36366/+886 37 246166x36366.
*E-mail addresses:* chiangp@nhri.org.tw (P.-H. Chiang), hluzero@nhri.org.tw (L.-Y. Huang), yuantinglo@gmail.com (Y.-T. Lo), mmsl@ndmctsgh.edu.tw (M.-S. Lee), profmlw@nhri.org.tw (M.L. Wahlqvist).

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prevalence of childhood and adolescent overweight and obesity has been steadily increasing worldwide (Janssen et al., 2005; Ogden, Carroll, Kit, & Flegal, 2012), and already, large numbers of children are overweight or obese in Asia. In mainland China, by 2005, roughly 14% of boys and 9% of girls, about 21 million school-age children and adolescents in all, were overweight or obese (Ji & Cheng, 2009). Similarly, the prevalence of obesity and its related comorbidities has markedly increased in Taiwanese schoolchildren in recent years (Chu & Pan, 2007).

The negative consequences of childhood obesity for physical health are well-recognized (Chu & Pan, 2007; van Wijnen, Wendel-Vos, Wammes, & Bemelmans, 2009) as are, increasingly, its associations with psychosocial and mental health problems (BeLue, Francis, & Colaco, 2009; Britz et al., 2000; Drukker, Wojciechowski, Feron, Mengelers, & Van Os, 2009; Griffiths, Parsons, & Hill, 2010; Tsiros et al., 2009). Food insecurity, which can manifest in disordered eating patterns and a range of food intake disorders, may help to explain associations between emotional disturbance and obesity (Chen, Wahlqvist, Teng, & Lu, 2009). The relationship of obesity with behavioral problems and emotional distress with may be bi-directional or synergistic (Mamun et al., 2009; Ternouth, Collier, & Maughan, 2009). At least some childhood obesity-related health risks are known to persist into adulthood (Maggio et al., 2011; Reinehr, de Sousa, Toschke, & Andler, 2006). School-based programs aimed at preventing overweight and obesity could improve their effectiveness by taking associated physical, psychosocial and mental health issues into account (van Wijnen et al., 2009). If it is found that childhood obesity contributes to the onset of behavioral problems or emotional distress, this information could be used to improve exiting early intervention programs (Mamun et al., 2009; Russell-Mayhew, McVey, Bardick, & Ireland, 2012), and help to prevent progression to more serious obesity-related health problems, such as diabetes and related mental health conditions in later life (Wahlqvist et al., 2012).

Findings have been inconsistent in population-based studies which have reported associations between childhood and adolescent overweight/obesity and emotional or behavioral problems (BeLue et al., 2009; Drukker et al., 2009; Frisco, Houle, & Martin, 2009; Goodman & Whitaker, 2002; Wardle, Williamson, Johnson, & Edwards, 2006). In some studies the focus has been on self-esteem (Franklin, Denyer, Steinbeck, Caterson, & Hill, 2006; Griffiths et al., 2010; Wille et al., 2010) or quality-of-life (QOL) (Chan & Wang, 2013; Kolotkin et al., 2006; Wille et al., 2010; Williams, Wake, Hesketh, Maher, & Waters, 2005). Studies among Chinese or other Asian children are few, but do provide data for domestic, child care and school settings (Chan & Wang, 2013). In Thailand, the link between body weight and school performance is more in evidence in later than in earlier grades (Mo-suwan, Lebel, Puetpaiboon, & Junjana, 1999). There is a further literature which considers principally diet rather than body composition in regard to emotional disturbance (Lee et al., 2012) and school performance in Taiwanese children (Fu, Cheng, Tu, & Pan, 2007; Lee et al., 2012). The role of gender in the relationship between mental health problems and obesity has not previously been examined systematically (Griffiths et al., 2010). Our study examined the role of gender in the relationship between emotional disturbance (ED) as defined by the Individuals with Disabilities Educational Act Amendments (IDEA) of 1977 (Epstein, Cullinan, Ryser, & Pearson, 2002a; Epstein, Nordness, Cullinan, & Hertzog, 2002b) and obesity among children, within an educational setting in Taiwan. This has allowed us to test the general hypothesis that obesity is associated with emotional disturbance, evident in the school environment, and that any such association is gender-dependent.

## 2. Methods

### 2.1. Participants

Participants were schoolchildren aged 6–13 years, in the 2001 and 2002 Elementary School Children's Nutrition and Health Survey in Taiwan (NAHSIT) (Chiang et al., 2011; Lee et al., 2012); details of the surveys' sampling procedures and study design have been published elsewhere (Tu et al., 2007). All of Taiwan's 359 townships and districts were grouped into 13 strata by regional dietary patterns, urbanization, and geographic characteristics. The survey used the PPS (probability proportional to population size) sampling method to select 2407 children from 104 elementary schools (8 schools from each stratum) randomly. Demographic and anthropometric information on the children was acquired through household interview and physical examinations. The NAHSIT data were linked to birth weight data obtained from Taiwan's Ministry of the Interior. Children ($n = 119$) without birth weight data and those whose gender did not match between two datasets ($n = 15$) were excluded from the study. Thus, 2283 schoolchildren were included in this study. The study was approved by the Institutional Review Board of the National Health Research Institutes, Taiwan.

### 2.2. Measures

The modified scale for assessing emotional disturbance (SAED), developed by Epstein and Cullinan (Cheng, 2001; Epstein & Cullinan, 1998; Lee et al., 2012), was included in the questionnaires, which were used to assess the NAHSIT children's school and social performance. The SAED is a rating scale designed to assist in identifying students who may be experiencing emotional and/or behavioral difficulties within the educational setting. The SAED operationally defines ED as described in IDEA (Epstein & Cullinan, 1998; Epstein et al., 2002a). Its test–retest reliability coefficient is above $>0.80$, and most of its subscales have inter-rater reliability coefficients over 0.79 (Epstein, Cullinan, Harniss, & Ryser, 1999). The Chinese modification of SAED as used in this study has a high overall reliability of 0.92 and validity of 0.76 (Cheng, 2001). We employed the three sections referred to as "Student Emotional and Behavioral Problems" namely, emotional disturbance, ED,