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Prevalence of Screening-Detected Eating Disorders in Chinese Females and Exploratory Associations with Dietary Practices

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Abstract

Objective—China is undergoing dramatic Westernization, hence may be able to provide unique insights into the role of sociocultural factors in disease. The purpose of this exploratory study was two-fold: to describe the prevalence of screening-detected eating disorders and disordered eating in China at the first occasion of assessment in the large-scale China Health and Nutrition Survey (CHNS) and to explore the associations between dietary practices and disordered eating.

Regarding the first objective, participants are provincially representative and in subsequent waves will be followed longitudinally.

Method—CHNS participants were recruited using multistage, cluster random sampling, beginning in 1989. In this study, participants comprised 259 female adolescents (12–17 years) and 979 women (18–35 years) who participated in the CHNS 2009 survey, which is the first CHNS survey to assess disordered eating. Dietary practice-disordered eating associations were investigated with logistic regression adjusting for age, body mass index, and urbanization.

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Results—Of the participants, 6.3% (95% CI: 4.8, 8.2) of adults and 7.8% (95% CI: 5.0, 12.0) of adolescents had a screening-detected eating disorder. Dietary practices had non-significant associations with disordered eating at the general population level, except for protein consumption among women. There was evidence that skipping meals and a high-fat diet may confer risk.

Discussion—Screening-detected eating disorders in China are lower in prevalence than in developed countries. Dietary practices had fairly limited associations with disordered eating at the general population level; protein consumption, skipping meals, and a high-fat diet are candidate dietary practice exposures for disordered eating.

Keywords

China; China Health and Nutrition Survey; dietary practices; disordered eating; screening; overweight; SCOFF

Introduction

Despite decades of research, we have been less than effective in understanding how environmental factors act to increase risk for eating disorders. In part, this may be because the cultures in which we typically study eating disorders are uniformly saturated with putative risk factors (e.g., media, Internet). Regions undergoing accelerated sociocultural change offer rare possibilities to examine the role of sociocultural factors in disordered eating. A well-known example is research in Fiji, revealing increases in disordered eating (which had previously been rare) following the introduction of Western television to the traditional culture (Becker, Burwell, Herzog, Hamburg, & Gilman, 2002).

The dramatic changes that have characterized China over the past two decades make it an ideal setting to study the effects of rapid, sweeping globalization on nutrition and health outcomes. The China Health and Nutrition Survey (CHNS) (Popkin, Du, Zhai, & Zhang, 2010) has documented striking changes in related health behaviors such as eating, drinking, smoking, and physical activity which are contributing to a rapid increase in obesity accompanied by an increase in associated chronic disease-related morbidity and mortality (Wang, Mi, Shan, Wang, & Ge, 2007). We anticipate that the changes taking place will also have effects on the incidence and prevalence of eating disorders and disordered eating. Moreover, we expect that elucidating the underlying mechanisms of risk transmission will shed direct light on the etiology of eating disorders and have global implications for health promotion and prevention research. The CHNS represents a unique opportunity for insight into the role of sociocultural factors in disordered eating. In the present study, associations between dietary practices and risk of disordered eating in the Chinese population will be investigated.

The first objective of this study is to establish a baseline level of screening-detected eating disorders and disordered eating in the CHNS study population. This will be based on the 2009 survey, which is the first CHNS survey to measure disordered eating. Participants in CHNS are provincially representative and will be followed up longitudinally. Eating disorders have been uncommon in medical settings in China, but are gaining increased notice and rising in rate anecdotally (Lee & Lee, 2000). Likewise, disordered eating has

historically been less widespread in China relative to Western countries (Lee, 1993; Lee & Lee, 2000). Monitoring changes in sociocultural exposures and disordered eating over time will assist us to observe and account for environmentally induced shifts in incidence and prevalence. The second objective is to explore the association between dietary practices and risk of disordered eating within a general population sample. Given the sparse scientific literature on these relations, this study is explicitly exploratory.

Method

Design and Participants

The CHNS is an ongoing open cohort, international collaborative project between the Carolina Population Center at the University of North Carolina at Chapel Hill and the National Institute of Nutrition and Food Safety at the Chinese Center for Disease Control and Prevention (Popkin et al., 2010). The first survey wave took place in 1989 using a multistage, random cluster sampling method to draw a sample of approximately 26,000 individuals, in 4,400 households, spanning nine provinces, with variation in geography, economic development, and public resources. A household can have 1 to 9 waves of data, with missing waves at the household level due to losses-to-follow-up (i.e., families who migrate from one community to another and are not followed-up) and the addition of new households in 1997 to replace households no longer participating. The most recent database released for research includes data up to the 2009 wave inclusive. The 2009 survey is the first CHNS survey to incorporate eating disorder screening items. Eating disorder screening items were administered to females aged 12–35 years only; hence, it was not possible to include males or older females in the present study. The participation rate in the CHNS survey at the household level is around 99% for each wave (S. Du, personal communication, May 22, 2014). The present study has a cross-sectional design and uses data from the 2009 wave.

The inclusion criteria used to select participants were female sex, age between 12–35 years, and household resident (i.e., non-guest) status. There were no exclusion criteria. This led to a total of 1,238 eligible participants. For the purposes of the present study, participants were split by age category into an adolescent (12 to < 18 years) and adult (18 to 35 years) sample.

The adolescent sample ($N = 259$) had a mean age of 14.41 years ($SD = 1.63$) and a mean body mass index (BMI) of 19.01 kg/m² ($SD = 2.99$), and 93.1% were in school. The adult sample ($N = 979$) had a mean age of 28.18 years ($SD = 5.09$) and a mean BMI of 21.69 kg/m² ($SD = 3.08$). Approximately 75.0% were married, 22.9% were single, and 2.1% were separated, divorced, or widowed. One quarter (27.3%) had technical or college education, and 66.1% were employed.

CHNS was approved by both Institutional Review Boards at the Chinese Center for Disease Control and Prevention and the University of North Carolina at Chapel Hill and the present study was approved by the Institutional Review Board at the University of North Carolina at Chapel Hill.

Measures

A separate CHNS questionnaire is completed for children and adolescents (<18 years) and adults (≥18 years). The child questionnaire is available at http://www.cpc.unc.edu/projects/china/data/questionnaires/C09child_Fin20090710.pdf and the adult questionnaire at http://www.cpc.unc.edu/projects/china/data/questionnaires/C09adult_Fin20090715.pdf/view. Both questionnaires collect detailed information on age, marital status, education, occupation, physical measurements, health, nutrition, physical activity, smoking, alcohol consumption, and media access and usage. When possible, the CHNS interviews each person individually; when not possible, data are obtained from another knowledgeable person in the household. The identity of the informant is recorded. The interview includes a physical exam and health and health service questions. Interviewers measure blood pressure, height, weight, waist and hip circumferences, and inquire about health behaviors (e.g., smoking, alcohol consumption) and daily functioning. The CHNS dietary data collection component is based on three days of 24-hour recall of individual dietary intake, which is recorded in extensive detail to determine consumption of various nutrients (e.g., energy, fat, protein) and total calories. The techniques and training needed to collect these data were adopted from standard U.S. Centers for Disease Control (CDC) and World Health Organization (WHO) procedures for the Cebu Longitudinal Health and Nutrition Survey (Adair & Popkin, 1988; Adair & Popkin, 2001; Cebu Study Team, 1991). Household food inventory changes are collected daily, as are detailed measurements on the recipes used for each dish, the condiments, fats and oils used that day, and some related household food data.

Disordered eating—In the adult and child questionnaires, disordered eating was assessed by five respective screening items from the widely used and validated SCOFF questionnaire (Morgan, Reid, & Lacey, 1999), which were asked of women aged 12–35 years. The SCOFF items are 1) Do you make yourself Sick because you feel uncomfortably full? 2) Do you worry that you have lost Control over how much you eat? 3) Have you recently lost more than 6 kg (One stone) in a three-month period? 4) Do you believe yourself to be Fat when others say you are too thin? 5) Would you say that Food dominates your life? Response options for each item were ‘yes’ and ‘no.’ We began with the Chinese version of the questionnaire published in Leung et al. (2009) back translated it to English and then retranslated it to Chinese, with three mainland Chinese speakers confirming the final version. A dichotomous variable of *screening-detected eating disorder*, the main outcome, was created using the common cut-off of 2+ items endorsed (Hill, Reid, Morgan, & Lacey, 2010). A screening test does not provide or confirm a diagnosis, hence the term “screening-detected eating disorder” is intentionally used; screening instruments usually overestimate the prevalence of a disorder.

Dietary practices—The CHNS surveys and datasets were evaluated for dietary practice variables, and available variables were used in this study. *Food consumed away from home* was included in this study because it may be a proxy variable for low frequency of family mealtimes, which has been linked to disordered eating in previous research (Neumark-Sztainer, Eisenberg, Fulkerson, Story, & Larson, 2008) and is associated with lower dietary quality, at least in Western individuals (Gillis & Bar-Or, 2003). The variable measured the percent of food items consumed away from home over a 3-day period. Food consumed at a

relative's house was also categorized as food consumed at home, as this probably incorporates a family mealtime and similar nutritional quality. *Mealtime skipping at breakfast, lunch, dinner, and total* were assessed, with survey items assessing consumption of these meals over a 3-day period. Breakfast, lunch, and dinner are the main meals consumed each day in China. Scores were the sum of meals skipped, which ranged from 0 to 3 meals skipped per meal category or 0 to 9 total meals skipped. For this study, we used *percent of recommended daily caloric intake* as a measure of total energy intake. This was chosen over absolute energy intake because adolescents were in the dataset, and biological requirements for energy intake depend upon age and maturation stage. These measures were based on average daily energy intake by using the individual's 3-day average, and recommended daily caloric intake was derived from Chinese guidelines with reference values based on sex, age, expected weight, low physical activity for adults, and pregnancy status (Chinese Nutrition Society, 2000). *Dietary fat, protein, and carbohydrate intake* were expressed as percent of overall energy intake (% E). *High fat diet* referred to whether an individual's daily energy intake totaled >30% dietary fat based on the 3-day average, was binary, and has been used previously in CHNS studies (Popkin & Du, 2003),

Covariates and Moderator—Adjustments were made for the potential confounding effects of age, BMI, and urbanization. BMI was computed from anthropometric measures of height and weight. Urbanization was measured by an urbanization index (range 0–120) created and validated for the CHNS (Jones-Smith & Popkin, 2010), and is based on 12 components which are scored out of 10 (i.e., population density, economic activity, distance to traditional markets, number of modern markets, transportation infrastructure, sanitation, communications, housing amenities, education, diversity in education and income, health infrastructure, and social services). These components were established based on community-level information or indicators derived from aggregated household-level data. The urbanization index for respondents is included in the datasets released for research.

Overweight was a moderator in one set of analyses. For adolescents, overweight was defined as a BMI ≥ 95th age- and sex-specific percentiles developed by Must et al. (1991) and recommended for international use (World Health Organization Expert Committee on Biological Standardization, 1995). For adults, it was defined as a BMI ≥ 23.0, as per WHO recommendations for Asian populations (World Health Organization Expert Consultation, 2004).

Statistical Analysis

Descriptive statistics were used to summarize the prevalence of screening-detected eating disorders and disordered eating among female adolescents and adults. Confidence intervals for proportions were calculated using Wilson's (1927) score interval method with continuity correction.

Analyses of association between dietary practices and disordered eating were carried out with logistic regression, for each predictor separately and both with and without adjustment for covariates. Analyses were stratified by age by conducting analyses separately on the adolescent and adult datasets. Because individuals in this study were nested within

households and provinces, there was the possibility that the independence of observations assumption would be violated, and thus, standard errors yielded through traditional general linear models may be biased. Because only females were selected for the current study and analyses were stratified, clustering at the household (but not provincial level) could largely be ruled out. To account for clustering, logistic regression with the generalized estimating equation (GEE) method was the statistical approach originally chosen. The GEE method was specified with an exchangeable correlation structure which assumes equal correlation among all observations from the same cluster. These models indicated the absence of response correlation at the provincial level, with standard errors approximating those in the models assuming independence. Hence, standard logistic regression as described was used to model responses.

Missingness on predictors and covariates ranged from 0%–7.3% (adult dataset) and 0%–9.7% (adolescent dataset) and were imputed following a multiple imputation then deletion (MID) method (Von Hippel, 2007) with 20 imputed datasets. Logistic regression analyses were performed on each imputed dataset, and results were combined using Rubin's method (1987) by PROC MIANALYZE in SAS 9.3 (SAS Institute, Cary, NC, USA). Analyses were conducted with SAS 9.3 and continuous variables were centered prior to analysis. Given the exploratory nature of the study, there was no correction for multiple comparisons. The Type I error boundary was set at a conventional alpha of 0.05. Since the study used a fixed sample size, rather than being able to plan sample size on the basis of an a priori power analysis, odds ratios (ORs) deviating from one (null association) by 10% or more in adjusted analyses were also noted.

Results

Prevalence of Screening-Detected Eating Disorders and Disordered Eating

The prevalence of screening-detected eating disorders was 7.8% (95% CI: 5.0, 12.2) among adolescents and 6.3% (95% CI: 4.8, 8.2) among adults (see Table 1). The prevalence of disordered eating as represented by responses on the five individual SCOFF items was low among both adolescents and adults.

Dietary Practice Exposures

Dietary practices are summarized in Table 2. The overall prevalence of most exposures was low. Adolescent and adult groups did not eat much food away from home ($M \sim 15\%$) and the majority consumed breakfast, lunch, and dinner each day; hence, skipping meals was relatively uncommon.

Dietary Practice and Disordered Eating Associations

ORs and 95% confidence intervals for exposure-outcome associations are shown for adolescents in Table 3. There were few statistically significant associations. The exceptions were a diet higher in fat, a diet lower in carbohydrates, and skipping lunches; each was associated with higher scores on at least one SCOFF variable. However, these associations no longer remained after adjustment for covariates. Because the study used a fixed sample size, rather than a sample size planned from a priori power analysis, the magnitude of OR

ratios is important to consider. Using a nominal (though arbitrary) criterion of 10% increase or decrease in odds (0.90 OR 1.10 after adjustment), among adolescents, the dietary practices of mealtimes skipped, breakfasts skipped, lunches skipped, dinners skipped, proportion of protein consumed, and (non) high-fat diet, conferred greater risk for disordered eating. For adults (see Table 4), there were significant associations between SCOFF variables and skipping lunch and a diet higher in protein. Only the association involving protein consumption remained after adjustment for covariates. Using the criterion noted (i.e., 0.90 OR 1.10 in adjusted analyses), mealtimes skipped, breakfasts skipped, lunches skipped, dinners skipped, proportion of protein consumed, and high-fat diet variables conferred greater risk for disordered eating among adults.

Interaction between Overweight Status and Dietary Practices with Disordered Eating

Because disordered eating and eating disorders are complex traits influenced by both genetic and environmental factors, not everyone who is exposed to a putative risk factor will develop the disorder. The impact of particular exposures is likely to depend on the presence of other vulnerabilities or conditions. Overweight is a well-established risk factor for body dissatisfaction and disordered eating (Eddy et al., 2007; Goldschmidt, Aspen, Sinton, Tanofsky-Kraff, & Wilfley, 2008). We conducted post hoc analysis examining the moderator effect of overweight status on the relationship between dietary practices on disordered eating. Each model had an overweight status (0=no, 1=yes) main effect term, dietary practice main effect term, and overweight status $\times$ dietary practice interaction term.

The prevalence of overweight was 7% ($n = 19$) in the adolescent sample and 26% ($n = 251$) in the adult sample. Due to anticipated problems with model convergence in the adolescent dataset with small cell counts, analyses were run for adults only. Items 2, 4, and 5 of SCOFF and the screening-detected eating disorder variable had sufficient cell counts to be able to be modeled without estimation problems. The post hoc investigations among adults (see Table 1 in online supplementary material) revealed the following significant interactions with overweight status (OW) in adjusted analyses: OW $\times$ breakfasts skipped on belief in fatness (OR = 0.61, 95% CI: 0.39, 0.96) and OW $\times$ % recommended daily caloric intake on belief in fatness (OR = 1.03, 95% CI: 1.01, 1.04). The expected logits suggested that skipping breakfasts and higher recommended daily caloric intake were associated with a higher risk of disordered eating among overweight than non-overweight women.

Discussion

This present CHNS study had two objectives: (1) to capture the baseline prevalence of screening-detected eating disorders among CHNS participants in China; and (2) to provide an exploratory investigation of the association between dietary practices and disordered eating amongst the general population. The prevalence estimates suggested a lower prevalence of screening-detected eating disorders than in developed countries. There was limited support for the role of dietary practices in disordered eating at the general population level. Despite these findings we are cautious to rule out involvement; further exploration should be undertaken if exposures (i.e., meal skipping) increase substantively in China.

This study estimated the prevalence of disordered eating among female adolescents and women in China as reflected in the CHNS. The main outcome was detection of a possible case of eating disorder as identified by the SCOFF. In this sample, 7.8% of female adolescents and 6.3% of women in the CHNS had a screening-detected eating disorder. These estimates are relatively lower than has been observed in other parts of the world with the SCOFF instrument: 13.5% in a female undergraduate sample in France (Garcia et al., 2010), 13.5% among female college students in the US (Eisenberg, Nicklett, Roeder, & Kirz, 2011), 21.0% in a female adult general practice sample in France (Baudet et al., 2013), 21.7% of mixed sex nationally representative 14–17 years olds in Germany (Herpetz-Dahlmann et al., 2008), 24.3% of a predominantly female college student sample in the United Kingdom (Perry et al., 2002), and 26.9% of an adolescent mixed sex sample in Hong Kong (Leung et al., 2009). Comparisons are limited, since convenience sampling was mostly used in the comparison studies rather than random sampling. However, the sizeable differences suggest a lower prevalence of screening-detected eating disorders in China compared to other countries.

The role of dietary practices in the onset and maintenance of eating disorders has had cursory attention, with theoretical models concentrating, to date, on explanations involving cognitive-behavioral mechanisms, personality, genetics, neurocircuitry, and sociocultural appearance ideals. There is limited evidence from human and animal studies that dietary practices such as lower family mealtime frequency (Fulkerson et al., 2006; Neumark-Sztainer et al., 2008), skipping meals (Ledoux, Choquet, & Manfredi, 1993; Patton, Selzer, Coffey, Carlin, & Wolfe, 1999), fast food intake (among overweight males) (Neumark-Sztainer, Wall, Story, & Sherwood, 2009; Neumark-Sztainer et al., 2007), a higher proportion of one's daily energy needs from fat (among obese women) (Reeves et al., 2001; Wilson et al., 2012), and palatable foods (Hagan, Chandler, Wauford, Rybak, & Oswald, 2003; Lennerz et al., 2013) may play a role in disordered eating. It is not well understood whether meaningful associations exist at a general population level or only in the context of vulnerability factors for eating disorders (i.e., depression, overweight/obesity). In the present study, the only statistically significant association at the general population level was an association between higher proportion of protein intake and disordered eating among women. Socioeconomic status has been linked to disordered eating in some studies (Wardle et al., 2004) and would also explain higher protein consumption. Due to the low prevalence of positive responses on the SCOFF and dietary practice exposures, it is possible there was inadequate statistical power to detect effects if they existed. In a US study on obesity among adult residents in Massachusetts, 30% of meals were eaten away from home (Ma et al., 2003), a more than two-fold higher proportion than in the CHNS. Skipping meals was also uncommon, yet is an established risk factor for disordered eating in Western samples (Patton et al., 1999) and for risk for obesity in Asian regions (Horikawa et al., 2011), replicating Western research. At a given sample size, the effects of more common exposures are more easily detected than the effects of rare exposures. Based on the magnitude of ORs (adjusted OR deviating 10% or more from one), skipping mealtimes, skipping breakfasts, skipping lunches, skipping dinners, a diet high in fat, and a higher proportion of protein intake conferred increased risk for disordered eating among adolescents (OR = 1.10), and among adolescents and adults, although these associations in both samples were not consistent

among SCOFF variables as indicated by some ORs > 0.90 . However, the results also suggest that meal skipping and a high-fat diet may be implicated in disordered eating in the Chinese population. Although, eating pathology may in turn be driving these behaviors and be responsible for the associations.

Dietary practices may interact with other vulnerability factors (i.e., sex, psychosocial, personality, neurobiology, genetic predisposition) to increase the likelihood of disordered eating. In an animal model of binge eating, the combination of palatable food intake, stress, and dietary restriction increased susceptibility to binge eating, and is a model with good clinical validity (Hagan et al., 2003). Likewise media exposure, a sociocultural factor, has been found to exert stronger effects in the context of higher internalization of the Western thin body ideal and poor body image (Becker, 2004; Levine & Murnen, 2009), with minimal effect otherwise. In the present study, dietary practices did not generally interact with overweight status (i.e., a risk factor for disordered eating) to increase the likelihood of disordered eating, except in two instances. Given the study was exploratory, the positive findings needs to be treated cautiously. More complex models with combinations of risk factors may be worthwhile exploring in the future.

Several study limitations warrant consideration. Endorsement of disordered eating and some exposures were low, meaning that some analyses were likely to be underpowered. Prevalence estimates are representative at the provincial level but not at the national level, thus while estimates aggregated across provinces are indicative of baseline level of disordered eating in the CHNS, they are not nationally representative of China. The SCOFF has limitations; it was designed to screen for anorexia nervosa and bulimia nervosa and may not be as effective in screening for other specified or unspecified eating disorders, which comprise a preponderant share of eating disorder cases. As with other lay-administered screening measures, the SCOFF overestimates the prevalence of eating disorders (Hill et al., 2010) and lacks the validity of structured diagnostic interviews. The dietary data were based on three-day 24-hour recall, which may be subject to reporting and memory bias. Meal location data only specified whether food items were consumed at home, in general, the data were not fine-grained enough to discern whether meals were consumed as part of a family mealtime. Disordered eating data were only collected among females aged 12–35 years, therefore, the results of the present study cannot be generalized to males or females in midlife and beyond.

China is on a crest of modernization and the rapid sociocultural change may be able to illuminate important insights into the role of sociocultural factors in eating disorders and disordered eating. Presently, CHNS data indicate that screening-detected eating disorders may be lower in prevalence in China (with the exception Hong Kong) than the prevalence observed in developed countries, although more directly comparable data are needed. Yet, it is expected that the sociocultural changes taking place will coincide with a rise in disordered eating and eating disorders, as has been observed for obesity. Given dietary practices are interlinked with key factors in eating disorders, such as weight and appetite regulation, they deserve attention. Elucidating the sociocultural mechanisms of risk transmission will shed direct light on the etiology of eating disorders and inform health promotion and prevention efforts.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

Acknowledgments

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References

- Adair L, Popkin B. Birth weight, maturity and proportionality in filipino infants. *Human Biology*. 1988; 60:319–339. [PubMed: 3371970]
- Adair L, Popkin BM. The cebu longitudinal health and nutrition survey: History and major contributions of the project. *Philippine Quarterly of Culture and Society*. 2001; 29:5–37.
- Baudet M, Montastier E, Mesthe P, Oustric S, Lepage B, Ritz P. The scoff score: A screening tool for eating disorders in family practice. *e-SPEN Journal*. 2013; 8(3):e86–e89.
- Becker AE. Television, disordered eating, and young women in fiji: Negotiating body image and identity during rapid social change. *Culture, Medicine and Psychiatry*. 2004; 28(4):533–559.
- Becker AE, Burwell RA, Herzog DB, Hamburg P, Gilman SE. Eating behaviours and attitudes following prolonged exposure to television among ethnic fijian adolescent girls. *The British Journal of Psychiatry*. 2002; 180(6):509–514. [PubMed: 12042229]
- Cebu Study Team. Underlying and proximate determinants of child health: The cebu longitudinal health and nutrition study. *American Journal of Epidemiology*. 1991; 133:185–201. [PubMed: 1985447]
- Chinese Nutrition Society. Chinese dietary reference intakes. Beijing: China Light Industry Press; 2000.
- Eddy KT, Tanofsky-Kraff M, Thompson-Brenner H, Herzog DB, Brown TA, Ludwig DS. Eating disorder pathology among overweight treatment-seeking youth: Clinical correlates and cross-sectional risk modeling. *Behaviour Research and Therapy*. 2007; 45(10):2360–2371. [PubMed: 17509523]
- Eisenberg D, Nicklett EJ, Roeder K, Kirz NE. Eating disorder symptoms among college students: Prevalence, persistence, correlates, and treatment-seeking. *Journal of American College Health*. 2011; 59(8):700–707. [PubMed: 21950250]
- Fulkerson JA, Story M, Mellin A, Leffert N, Neumark-Sztainer D, French SA. Family dinner meal frequency and adolescent development: Relationships with developmental assets and high-risk behaviors. *Journal of Adolescent Health*. 2006; 39(3):337–345. [PubMed: 16919794]
- Garcia FD, Grigioni S, Chelali S, Meyrignac G, Thibaut F, Dechelotte P. Validation of the french version of scoff questionnaire for screening of eating disorders among adults. *World Journal of Biological Psychiatry*. 2010; 11(7):888–893. [PubMed: 20509759]
- Gillis LJ, Bar-Or O. Food away from home, sugar-sweetened drink consumption and juvenile obesity. *Journal of the American College of Nutrition*. 2003; 22(6):539–545. [PubMed: 14684760]
- Goldschmidt AB, Aspen VP, Sinton MM, Tanofsky-Kraff M, Wilfley DE. Disordered eating attitudes and behaviors in overweight youth. *Obesity*. 2008; 16(2):257–264. [PubMed: 18239631]
- Hagan MM, Chandler PC, Wauford PK, Rybak RJ, Oswald KD. The role of palatable food and hunger as trigger factors in an animal model of stress induced binge eating. *International Journal of Eating Disorders*. 2003; 34(2):183–197. [PubMed: 12898554]
- Herpetz-Dahlmann B, Wille DPN, Hölling DPH, Vloet TD, Ravens-Sieberer U. the BELLA study group. Disordered eating behaviour and attitudes, associated psychopathology and health-related

- quality of life: Results of the bella study. *European Child and Adolescent Psychiatry*. 2008; 17(1): 82–91.
- Hill LS, Reid F, Morgan JF, Lacey JH. Scoff, the development of an eating disorder screening questionnaire. *International Journal of Eating Disorders*. 2010; 43(4):344–351. [PubMed: 19343793]
- Horikawa C, Kodama S, Yachi Y, Heianza Y, Hirasawa R, Ibe Y, Sone H. Skipping breakfast and prevalence of overweight and obesity in asian and pacific regions: A meta-analysis. *Preventive Medicine*. 2011; 53(4):260–267. [PubMed: 21925535]
- Jones-Smith JC, Popkin BM. Understanding community context and adult health changes in china: Development of an urbanicity scale. *Social Science and Medicine*. 2010; 71(8):1436–1446. [PubMed: 20810197]
- Ledoux S, Choquet M, Manfredi R. Associated factors for self-reported binge eating among male and female adolescents. *Journal of Adolescence*. 1993; 16(1):75–91. [PubMed: 8496470]
- Lee S. How abnormal is the desire for slimness? A survey of eating attitudes and behaviour among chinese undergraduates in hong kong. *Psychological Medicine*. 1993; 23:437–451. [PubMed: 8332660]
- Lee S, Lee A. Disordered eating in three communities of china: A comparative study of female high school students in hong kong, shenzhen, and rural hunan. *International Journal of Eating Disorders*. 2000; 27(3):317–327. [PubMed: 10694718]
- Lennerz BS, Alsop DC, Holsen LM, Stern E, Rojas R, Ebbeling CB, Ludwig DS. Effects of dietary glycemic index on brain regions related to reward and craving in men. *American Journal of Clinical Nutrition*. 2013; 98(3):641–647. [PubMed: 23803881]
- Leung SF, Lee KL, Lee SM, Leung SC, Hung WS, Lee WL, Wong HK. Psychometric properties of the scoff questionnaire (chinese version) for screening eating disorders in hong kong secondary school students: A cross-sectional study. *International Journal of Nursing Studies*. 2009; 46(2): 239–247. [PubMed: 18945428]
- Levine MP, Murnen SK. Everybody knows that mass media are/are not [pick one] a cause of eating disorders”: A critical review of evidence for a causal link between media, negative body image, and disordered eating in females. *Journal of Social and Clinical Psychology*. 2009; 28(1):9–42.
- Ma Y, Bertone ER, Stanek EJ, Reed GW, Hebert JR, Cohen NL, Ockene IS. Association between eating patterns and obesity in a free-living us adult population. *American Journal of Epidemiology*. 2003; 158(1):85–92. [PubMed: 12835290]
- Morgan J, Reid F, Lacey J. The scoff questionnaire: Assessment of a new screening tool for eating disorders. *BMJ*. 1999; 319:1467–1468. [PubMed: 10582927]
- Must A, Dallal GE, Dietz WH. Reference data for obesity: 85th and 95th percentiles of body mass index (wt/ht²) and triceps skinfold thickness. *American Journal of Clinical Nutrition*. 1991; 53(4): 839–846. [PubMed: 2008861]
- Neumark-Sztainer D, Eisenberg ME, Fulkerson JA, Story M, Larson NI. Family meals and disordered eating in adolescents: Longitudinal findings from project eat. *Archives of Pediatrics and Adolescent Medicine*. 2008; 162(1):17–22. [PubMed: 18180407]
- Neumark-Sztainer D, Wall M, Story M, Sherwood NE. Five-year longitudinal predictive factors for disordered eating in a population-based sample of overweight adolescents: Implications for prevention and treatment. *International Journal of Eating Disorders*. 2009; 42(7):664–672. [PubMed: 19642214]
- Neumark-Sztainer DR, Wall MM, Haines JI, Story MT, Sherwood NE, van den Berg PA. Shared risk and protective factors for overweight and disordered eating in adolescents. *American Journal of Preventive Medicine*. 2007; 33(5):359–369. e353. [PubMed: 17950400]
- Patton G, Selzer R, Coffey C, Carlin J, Wolfe R. Onset of adolescent eating disorders: Population based cohort study over 3 years. *BMJ*. 1999; 318(7186):765–768. [PubMed: 10082698]
- Perry L, Morgan J, Reid F, Brunton J, O'Brien A, Luck A, Lacey H. Screening for symptoms of eating disorders: Reliability of the scoff screening tool with written compared to oral delivery. *International Journal of Eating Disorders*. 2002; 32(4):466–472. [PubMed: 12386911]

- Popkin BM, Du S. Dynamics of the nutrition transition toward the animal foods sector in china and its implications: A worried perspective. *Journal of Nutrition*. 2003; 133(11):3898S–3906S. [PubMed: 14672288]
- Popkin BM, Du S, Zhai F, Zhang B. Cohort profile: The china health and nutrition survey—monitoring and understanding socio-economic and health change in china, 1989–2011. *International Journal of Epidemiology*. 2010; 39(6):1435–1440. [PubMed: 19887509]
- Reeves RS, McPherson R, Nichaman MZ, Harrist RB, Foreyt JP, Goodrick GK. Nutrient intake of obese female binge eaters. *Journal of the American Dietetic Association*. 2001; 101(2):209–215. [PubMed: 11271694]
- Rubin, DB. Multiple imputation for nonresponse in surveys. New York: Wiley; 1987.
- Von Hippel PT. Regression with missing ys: An improved strategy for analyzing multiply imputed data. *Sociological Methodology*. 2007; 37(1):83–117.
- Wang Y, Mi J, Shan X, Wang QJ, Ge K. Is china facing an obesity epidemic and the consequences? The trends in obesity and chronic disease in china. *International Journal of Obesity*. 2007; 31(1): 177–188. [PubMed: 16652128]
- Wardle J, Robb KA, Johnson F, Griffith J, Brunner E, Power C, Tové M. Socioeconomic variation in attitudes to eating and weight in female adolescents. *Health Psychology*. 2004; 23(3):275. [PubMed: 15099168]
- Wilson EB. Probable inference, the law of succession, and statistical inference. *Journal of the American Statistical Association*. 1927; 22(158):209–212.
- Wilson PL, O'Connor DP, Kaplan CD, Bode S, Mama SK, Lee RE. Relationship of fruit, vegetable, and fat consumption to binge eating symptoms in african american and hispanic or latina women. *Eating Behaviors*. 2012; 13(2):179–182. [PubMed: 22365808]
- World Health Organization Expert Committee on Biological Standardization. Physical status: The use and interpretation of anthropometry: Report of a who expert committee. World Health Organization; 1995.
- World Health Organization Expert Consultation. Appropriate body-mass index for asian populations and its implications for policy and intervention strategies. *Lancet*. 2004; 363(9403):157. [PubMed: 14726171]

Prevalence (95% CI) of disordered eating outcomes among female adolescents (12–17 years) and women (18–35 years) in the China Health and Nutrition Survey (CHNS) 2009 wave.

TABLE 1

Disordered eating	Adolescents (<i>n</i> = 256)	Adults (<i>n</i> = 853)
Make yourself sick because you feel uncomfortably full?	1.6 (0.5, 4.2)	0.6 (0.2, 1.4)
Worry that you have lost control over how much you eat?	8.2 (5.3, 12.4)	6.7 (5.1, 8.6)
Recently lost > 6.35kg in a 3-month period?	0.0 (0.0, 1.8)	1.6 (0.9, 2.8)
Believe yourself to be fat when others say you are too thin?	11.3 (7.8, 16.0)	10.0 (8.1, 12.2)
Would you say that food dominates your life?	10.5 (7.2, 15.1)	7.4 (5.8, 9.4)
Screening-detected eating disorder	7.8 (5.0, 12.0)	6.3 (4.8, 8.2)

Note. Prevalences were derived from available data.

TABLE 2
Distribution of dietary practices among females in the China Health and Nutrition Survey (CHNS) 2009 wave.

	Adolescents (N = 259)	Adults (N = 979)
Percent of food eaten away from home, <i>M (SD)</i>	15.32 (26.72)	11.80 (22.52)
Total mealtimes skipped, <i>M (SD)</i>	1.83 (2.66)	1.55 (2.32)
Breakfasts skipped		
None	69.0%	71.9%
1	3.1%	8.4%
2	6.6%	5.1%
3	21.2%	14.6%
Lunches skipped		
None	72.6%	71.1%
1	5.3%	7.4%
2	5.3%	4.9%
3	16.8%	16.6%
Dinners skipped		
None	85.0%	87.0%
1	2.2%	5.5%
2	7.1%	2.8%
3	5.7%	4.7%
Percent of recommended caloric intake, <i>M (SD)</i>	72.99 (22.72)	93.49 (29.95)
Macronutrients (percent of overall energy intake), <i>M (SD)</i>		
Fat	28.63 (11.23)	31.00 (11.06)
Protein	13.02 (2.94)	12.94 (3.09)
Carbohydrate	58.31 (11.67)	56.00 (11.04)
High proportion of fat intake (> 30% of overall energy intake)	45.6%	52.7%

Note. Total mealtimes skipped covers nine mealtimes (breakfast, lunch, dinner) over three consecutive days.

Odds ratios and 95% confidence intervals from logistic regression models predicting the probability of disordered eating among Chinese female adolescents (12–17 years): before and after adjustment for age, BMI, and urbanization.

TABLE 3

Exposures	Outcomes OR (95% CI)									
	Make yourself sick because you feel uncomfortably full?		Worry that you have lost control over how much you eat?		Recently lost > 6.35kg in a 3- month period? [†]		Believe yourself to be fat when others say you are too thin?		Would you say that food dominates your life?	
	Unadjusted	Adjusted	Unadjusted	Adjusted	Unadjusted	Adjusted	Unadjusted	Adjusted	Unadjusted	Adjusted
Percent of food eaten away from home	1.01 (0.98,1.04)	1.00 (0.97,1.04)	1.00 (0.98,1.02)	1.00 (0.98,1.02)	-	-	1.00 (0.99,1.02)	1.00 (0.99,1.02)	1.01 (0.99,1.02)	1.01 (1.00,1.02)
Mealtimes skipped	1.05 (0.75,1.47)	0.97 (0.68,1.40)	0.99 (0.83,1.17)	0.99 (0.82,1.18)	-	-	1.02 (0.88,1.17)	1.00 (0.86,1.15)	1.12 (0.98,1.28)	1.10 (0.96,1.26)
Breakfasts skipped	0.95 (0.42,2.14)	0.81 (0.34,1.88)	1.02 (0.71,1.45)	1.04 (0.72,1.49)	-	-	1.15 (0.86,1.54)	1.12 (0.83,1.51)	1.17 (0.87,1.58)	1.13 (0.83,1.54)
Lunches skipped	1.05 (0.47,2.38)	0.93 (0.39,2.19)	0.92 (0.61,1.37)	0.89 (0.59,1.36)	-	-	0.90 (0.63,1.28)	0.85 (0.59,1.23)	1.36 (1.01,1.83)	1.31 (0.96,1.79)
Dinners skipped	1.48 (0.63,3.47)	1.24 (0.50,3.08)	0.97 (0.57,1.66)	0.99 (0.56,1.73)	-	-	1.04 (0.67,1.62)	0.98 (0.62,1.55)	1.25 (0.83,1.86)	1.15 (0.76,1.76)
% RDCI	1.03 (0.99,1.06)	1.04 (0.99,1.09)	1.01 (0.99,1.03)	1.00 (0.98,1.02)	-	-	1.01 (0.99,1.03)	1.01 (0.99,1.03)	0.98 (0.97,1.00)	0.98 (0.96,1.00)
% E from fat	1.02 (0.93,1.12)	1.00 (0.91,1.10)	1.05 (1.00,1.09)	1.04 (0.99,1.09)	-	-	1.01 (0.97,1.04)	1.00 (0.96,1.04)	1.00 (0.96,1.04)	0.99 (0.95,1.03)
% E from protein	1.21 (0.91,1.61)	1.17 (0.83,1.64)	1.05 (0.91,1.21)	0.99 (0.85,1.16)	-	-	1.00 (0.88,1.14)	0.95 (0.83,1.09)	1.11 (0.98,1.26)	1.07 (0.93,1.22)
% E from carbohydrate	0.96 (0.89,1.06)	1.00 (0.91,1.10)	0.96 (0.92,0.99)	0.96 (0.92,1.00)	-	-	0.99 (0.96,1.03)	1.01 (0.97,1.05)	0.99 (0.96,1.03)	1.01 (0.97,1.05)
High-fat (< 30% E) diet	1.14 (0.16,8.13)	0.82 (0.10,6.54)	1.57 (0.64,3.84)	1.16 (0.44,3.05)	-	-	0.67 (0.30,1.47)	0.51 (0.22,1.19)	0.90 (0.40,2.00)	0.74 (0.32,1.74)
										0.69 (0.24,1.99)

Note. E = energy intake. OR = odds ratio. RDCI = recommended daily caloric intake. Significance ($p < 0.05$) is shown (bolded). The reference group does not have the outcome.

[†]Too few cases with the outcome.

TABLE 4

Odds ratios and 95% confidence intervals from logistic regression models predicting the probability of disordered eating among Chinese women (18–35 years): before and after adjustment for age, BMI, and urbanization.

Exposures	Outcomes OR (95% CI)									
	Make yourself sick because you feel uncomfortably full?		Worry that you have lost control over how much you eat?		Recently lost > 6.35kg in a 3-month period?		Believe yourself to be fat when others say you are too thin?		Would you say that food dominates your life?	
	Unadjusted	Adjusted	Unadjusted	Adjusted	Unadjusted	Adjusted	Unadjusted	Adjusted	Unadjusted	Adjusted
Percent of food eaten away from home	1.07 (0.99,1.04)	1.02 (0.99,1.04)	1.01 (0.99,1.02)	1.00 (0.99,1.02)	0.98 (0.94,1.02)	1.00 (0.99,1.01)	1.00 (0.99,1.01)	1.00 (0.99,1.01)	1.01 (0.99,1.02)	1.00 (0.99,1.02)
Mealtimes skipped	1.01 (0.70,1.47)	1.04 (0.71,1.52)	1.07 (0.97,1.19)	1.07 (0.96,1.19)	0.82 (0.58,1.16)	0.82 (0.58,1.17)	1.07 (0.98,1.18)	1.05 (0.95,1.16)	1.09 (0.98,1.21)	1.07 (0.96,1.20)
Breakfasts skipped	0.57 (0.14,2.32)	0.60 (0.15,2.38)	1.24 (0.99,1.54)	1.24 (0.98,1.55)	0.96 (0.57,1.61)	0.99 (0.58,1.68)	1.18 (0.98,1.43)	1.16 (0.93,1.44)	1.26 (1.01,1.58)	1.24 (0.98,1.57)
Lunches skipped	1.09 (0.53,2.24)	1.14 (0.55,2.36)	1.09 (0.87,1.36)	1.06 (0.85,1.34)	0.39 (0.10,1.53)	0.38 (0.09,1.54)	1.10 (0.91,1.32)	1.02 (0.82,1.27)	1.08 (0.85,1.35)	1.04 (0.82,1.31)
Dinners skipped	1.53 (0.67,3.47)	1.62 (0.71,3.74)	1.06 (0.74,1.51)	1.04 (0.73,1.50)	0.79 (0.30,2.07)	0.82 (0.31,2.17)	1.12 (0.84,1.49)	1.21 (0.90,1.62)	1.16 (0.83,1.62)	1.12 (0.80,1.59)
% RDCI	1.00 (0.97,1.03)	1.00 (0.97,1.03)	1.00 (0.99,1.01)	1.00 (0.99,1.01)	1.01 (0.99,1.02)	1.00 (0.99,1.00)	1.00 (0.99,1.00)	1.00 (0.99,1.01)	1.00 (0.99,1.01)	1.00 (0.99,1.01)
% E from fat	0.95 (0.87,1.04)	0.95 (0.86,1.04)	1.00 (0.98,1.03)	1.00 (0.97,1.02)	1.00 (0.95,1.05)	1.00 (0.97,1.02)	0.99 (0.97,1.01)	0.99 (0.96,1.01)	0.99 (0.96,1.02)	0.98 (0.95,1.01)
% E from protein	1.16 (0.92,1.47)	1.17 (0.92,1.49)	1.11 (1.02,1.20)	1.10 (1.01,1.19)	1.03 (0.86,1.22)	1.03 (0.86,1.22)	1.06 (0.99,1.14)	1.15 (1.07,1.24)	1.12 (1.04,1.21)	1.11 (1.03,1.21)
% E from carbohydrate	1.03 (0.95,1.12)	1.04 (0.95,1.13)	0.99 (0.96,1.01)	0.99 (0.97,1.02)	1.00 (0.95,1.05)	1.00 (0.95,1.05)	1.00 (0.98,1.02)	1.00 (0.97,1.03)	1.00 (0.97,1.02)	1.01 (0.98,1.04)
High-fat (> 30% E) diet	0.23 (0.03,2.02)	0.22 (0.02,2.02)	1.13 (0.65,1.94)	1.11 (0.63,1.96)	1.41 (0.46,4.33)	1.63 (0.50,5.29)	0.89 (0.56,1.41)	1.17 (0.69,1.97)	0.95 (0.55,1.63)	0.82 (0.47,1.44)

Note. E = energy intake. OR = odds ratio. RDCI = recommended daily caloric intake. Significance ($p < 0.05$) is shown (bolded). The reference group does not have the outcome.