



# Patterns of perceived parenting styles and associations with night eating syndrome symptoms and correlates among Chinese adolescents: a latent profile analysis

Jinbo He<sup>1</sup> · Jianwen Song<sup>1</sup> · Gui Chen<sup>2</sup> · Zhihui Cai<sup>3</sup> · Ruiling Niu<sup>4</sup>

Received: 16 April 2021 / Accepted: 1 July 2021 / Published online: 8 July 2021  
© The Author(s), under exclusive licence to Springer Nature Switzerland AG 2021

## Abstract

**Purpose** This paper aimed to explore the association between the patterns of perceived parenting styles and adolescents' night eating syndrome symptoms and correlates, including sleep quality, weight status, loss of control over eating, and psychological distress.

**Methods** A sample of 455 Chinese adolescents (54.5% females, aged 12–15 years) were included in the current study. Latent Profile Analysis (LPA) was adopted to examine the patterns of perceived parenting styles. The three-step approach was used to explore the differences in night eating syndrome symptoms and correlates between different profiles.

**Results** A four-profile solution was found to fit the data best, and the four profiles were labeled as *positive parenting*, *negative parenting*, *highly engaged parenting*, and *lowly engaged parenting*. Subsequent analyses showed that adolescents across profiles exhibited significant differences in night eating syndrome symptoms and correlates. Specifically, adolescents in the *positive parenting* profile generally had the lowest scores in night eating and its correlates, while those in the *negative parenting* group reported the highest scores in night eating and its correlates.

**Conclusion** Using a person-centered approach (i.e., LPA), the present study identified four distinct patterns of perceived parenting styles in a sample of Chinese adolescents, with night eating and related symptomatology differing across each profile. Future interventions targeting night eating among adolescents may consider the potential influence from the patterns of perceived parenting styles to have a better intervention outcome.

**Level of evidence** Level V, cross-sectional descriptive study

**Keywords** Parenting style · Latent profile analysis · Night eating · Body mass index · Sleep quality · Psychological distress · Loss of control over eating

## Introduction

Stunkard et al. [1] first proposed the definition of “Night Eating Syndrome (NES)” as a condition characterized by morning anorexia, evening hyperphagia, and insomnia. More recent studies further expanded the syndrome's diagnostic criteria by including nocturnal snacking or nighttime awakenings with food intake [2]. Furthermore, NES is now listed in the “Otherwise Specified Feeding and Eating Disorders” section in the fifth version of the *Diagnostic and Statistical Manual of Mental Disorders* (DSM-5) [3]. NES is also considered a sleep disorder characterized by a circadian delay of food intake with insomnia and poor sleep quality [4]. Night eating has also been found to be associated with binge eating/loss of control over eating [5], as well as potentially presenting as a risk factor for weight gain [6]

✉ Gui Chen  
cgwkkk@163.com

<sup>1</sup> School of Humanities and Social Science, Chinese University of Hong Kong, Shenzhen 518172, Guangdong, China

<sup>2</sup> College of Educational Science, Hengyang Normal University, Hengyang 421002, Hunan, China

<sup>3</sup> School of Psychology, Central China Normal University, Wuhan, Hubei, China

<sup>4</sup> School of Mathematics and Statistics, Shandong University of Technology, Zibo, Shandong, China

and a barrier to weight loss [7], especially in obese populations. Cross-sectional studies showed that the incidence of NES was remarkably higher in obese populations than in normal-weight individuals. For example, in a sample of obese persons seeking medical or surgical weight loss, NES prevalence was as high as 64% [8]. Moreover, symptoms of psychological distress (e.g., depression and stress) are consistently associated with NES [7, 9, 10]. Thus, NES has various negative health implications beyond its potential association with obesity.

Eating practices during adolescence are influenced by a multitude of factors [11, 12], but the family environment may be one of the most fundamental ones [13, 14]. Indeed, children's eating behaviors are closely related to their interactions around food, eating, and other related factors [15–17]. In general, positive parent–child interactions around food or eating are protective for healthy eating and against unhealthy eating. For example, parental monitoring of children's dietary intake has been associated with children's healthy eating practices [18]. However, negative child–parent interactions, such as excessive food control and food reward, contribute to the development of unhealthy eating [17]. These child–parent interactions around eating and food, or so-called food-related parenting practices, are commonly guided by general parenting styles [19, 20]. For example, overprotective parents have been found more likely to encourage their children to be involved in meal planning and preparation and give pressure to let their children eat more food; however, authoritarian parents are more likely to attempt to control their children's food intake to decrease or maintain their children's weight [21].

Over the past three decades, numerous studies have explored the effects of specific parenting styles on children's physical and mental development and children's eating behaviors. For example, research has shown that positive parenting styles such as parental warmth and involvement, emotional support, appropriate granting of autonomy, and clear communication are positively associated with healthy eating in children and adolescents [15, 22]. However, dysfunctional parenting styles such as overprotective, controlling, and rejection have been identified as risk factors for developing disordered eating behaviors [23–26].

While there have been a number of studies that explored the link between parenting styles and children's/adolescents' eating behaviors (e.g., binge eating [27]), to the best of our knowledge, none of these studies examined the associations between parenting styles and night eating. Thus, more studies are needed to understand the relationship between parenting styles and children's night eating. Moreover, previous studies on the relationships between parenting styles and eating behaviors primarily used variable-centered approaches [28], which focused on whether specific parenting styles (e.g., overprotection) could predict or be related to certain

eating behaviors [15, 23, 27, 29, 30]. However, parenting styles are multidimensional, and each parenting style is an integrated combination of behaviors; thus, using variable-centered approaches that separate each parenting style and analyze the independent associations with eating behaviors fails to capture the influence from different combinations of parenting styles on eating behaviors.

Due to the limitations of previous studies, the present study aimed to bridge the research gaps using a person-centered approach (i.e., Latent Profile Analysis; LPA) to further the understandings of the link between parenting styles and night eating. Moreover, there have been well-defined/researched correlates of night eating, such as BMI [6], sleep quality [31], loss of control over eating/binge eating [32], and psychological distress [33]. Thus, to have a more comprehensive understanding of the link between parenting styles and night eating, we also examined how different patterns of parenting styles were related to these correlates.

As one previous study conducted in a sample of Chinese high school students found three parenting profiles: positive parenting, mixed parenting, and negative parenting [34], we hypothesized that three types of parenting styles would emerge. Moreover, given that previous findings generally supported that positive parenting styles are protective while negative parenting styles are detrimental, we hypothesized that adolescents in the positive parenting group would have the lowest levels of night eating, weight status, loss of control over eating/binge eating, and psychological distress, but the best sleep quality; on the contrary, those in the negative parenting group would have the highest levels of night eating, weight status, loss of control over eating/binge eating, and psychological distress, but the poorest sleep quality; and for those in the mixed parenting group, their scores of the night eating and correlates would be in the middle.

## Methods

### Participants and procedure

From a large middle school in Wuhan, Hubei (Central China), with the approval of the school administration, three classes of 7th grade, four classes of 8th grade, and two classes of 9th grade were randomly selected. The investigators described the project to the students in the selected classes and invited students to participate. If students agreed, consent forms were sent to their parents for further approval. When parental consent forms were obtained, students were asked to complete a set of questionnaires. Finally, a total of 455 adolescents, aged 12–15 years (Mean = 13.17, SD = 0.90), participated in the survey. According to Tein et al. [35], the sample size of 455 had the adequate statistical power to detect the correct number of classes in LPA.

Of these participants, 44.6% were boys, 54.5% were girls, and 4 did not report their gender. The percentage expected weight for height (%EWH) was calculated based on participant's self-reported height and weight (Mean = 85.32, SD = 14.10). Specific demographic information of the participants is shown in Table 1. In addition, it should be noted that a paper with a different topic has been published based on the same dataset [36].

## Measures

### Perceived parenting styles

The short form of Egna Minnen Beträffande Uppfostran: one's Memories of Upbringing (s-EMBU; [37]) was used to measure adolescent's perceived parenting styles in this study. This measurement was developed based on the early 81-items EMBU and scores appear to be consistent with the original measure. Forms for the mother and father each consist of three subscales: rejection, emotional warmth, and overprotection. Generally, emotional warmth represents an appropriate parenting style, while rejection and overprotection represent dysfunctional parenting styles [38]. The Chinese version of the s-EMBU for each parent form has

19 items [37] with a four-point Likert-type scale: 1: No, never; 2: Yes, occasionally; 3: Yes, often; 4: Yes, always. The Chinese version of the s-EMBU has been shown to have adequate psychometric characteristics such as reliability and construct validity [37]. In this study, father's rejection, emotional warmth, and overprotection had a Cronbach's  $\alpha$  of 0.82, 0.86, 0.64, while mother's rejection, emotional warmth, and overprotection had a Cronbach's  $\alpha$  of 0.81, 0.86, 0.70.

### Night eating

The Night eating Questionnaire (NEQ) [39, 40] was used to assess the severity of the Night Eating Syndrome. The NEQ consists of 13 items evaluating four factors: morning anorexia, evening hyperphagia, mood/sleep, and nocturnal snacking. Participants responded on a 5-point Likert-type scale, and in this study, the total score was calculated by summing the scores of the four subscales. According to Allison et al. [40], a total score of 25 (high sensitivity) or 30 (high specificity) indicates the appearance of the night eating syndrome. Good psychometric properties were revealed for the Chinese version of the NEQ among Chinese samples [39, 41]. The simplified Chinese version of NEQ [39] was used; however, as the NEQ uses an item-skipping response format, the Cronbach's  $\alpha$  of the NEQ was not calculated.

**Table 1** Descriptive statistics for the total sample ( $n=455$ )

	% (n)/Mean $\pm$ SD	Min–max
Gender (1 = boy; 2 = girl)	44.6% (203)	1 ~ 2
Age (years)	13.17 $\pm$ 0.90	12 ~ 15
%EWH	85.32 $\pm$ 14.10	58.82 ~ 158.73
Father's education	2.34 $\pm$ 1.00	1 ~ 5
Mother's education	2.28 $\pm$ 0.98	1 ~ 5
s-EMBU		
Father's rejection	10.86 $\pm$ 4.28	6 ~ 24
Father's emotional warm	17.89 $\pm$ 5.49	7 ~ 28
Father's overprotection	17.34 $\pm$ 4.21	8 ~ 32
Mother's rejection	11.30 $\pm$ 4.24	6 ~ 24
Mother's emotional warmth	18.60 $\pm$ 5.46	7 ~ 28
Mother's overprotection	18.63 $\pm$ 4.70	8 ~ 32
NEQ		
Night eating	13.97 $\pm$ 5.62	3 ~ 37
C-LOCES-B		
LOC eating	13.10 $\pm$ 5.91	7 ~ 35
PSQI		
Sleep quality	5.25 $\pm$ 2.85	0 ~ 17
K10		
Psychological distress	22.52 $\pm$ 7.59	10 ~ 49

%EWH Percentage expected weight for height, s-EMBU The short form of Egna Minnen Beträffande Uppfostran, NEQ Night Eating Questionnaire, C-LOCES-B Chinese version of the Loss of Control Over Eating Scale-Brief, PSQI Pittsburgh sleep quality index, K10 Kessler Psychological Distress Scale

### Loss of control over eating

Loss of control (LOC) over eating was assessed via the Loss of Control Overeating Scale-Brief (LOCES-B; [42, 43]). The LOCES-B comprises seven items rated on a 5-point Likert scale ranging from "never" to "always." Previous studies suggested the LOCES-B comprises a single factor structure and had sound psychometric properties [42, 43]. In this study, the Chinese version of the LOCES-B [42] was used, and it had a Cronbach's  $\alpha$  of 0.89 in the current sample.

### Sleep quality

Participant's sleep quality was assessed with the self-report section of the Pittsburgh Sleep Quality Index (PSQI; [44]), a brief validated questionnaire consisting of 19 items to indicate sleep quality over the past month. The 19 items are combined to form seven component scores, including subjective sleep quality (item 6), sleep latency (items 2 and 5a), sleep duration (item 4), habitual sleep efficiency (items 1, 3, and 4), sleep disturbance (items 5b-j), sleep medication use (item 7), and daytime dysfunction (items 8 and 9). Each component score can range from 0 to 3. The seven component scores are summed to yield a global score ranging from 0 to 21, with higher scores indicating inferior sleep

quality. The psychometric characteristics of the PSQI are well documented in Western and Chinese clinical and non-clinical samples [45–48].

### Psychological distress

Kessler Psychological Distress Scale (K10) was used to assess the participants' psychological distress. The K10 includes 10 self-report items for assessing psychological distress [49]. Each item is rated on a 5-point Likert scale ranging from “none of the time” to “all of the time.” Summing the 10 items results in a total score and a higher total score indicates a greater level of psychological distress. A number of studies showed good psychometric properties of the K10 for assessing psychological distress [49–51]. In this study, the Chinese version of the K10 was used [52]. The Cronbach's  $\alpha$  of K10 in the current sample was 0.90.

### Demographic information

Information regarding the age, sex, mother's and father's education background, height, and weight were collected by a self-report questionnaire. Options for parent's education levels were as follows: primary school or below, junior high school, high school, college, and master's degree or above.

### Statistical analysis

Based on the procedures of conducting latent profile analysis (LPA; [53]), there were two main steps for the data analysis used in the current study. The first main step included exploring the latent profiles of parenting styles, with the six dimensions of s-EMBU being the indicators of LPA. In addition, for ease of interpretation, in line with He et al. [54], the indicators were standardized before being subjected to LPA. Moreover, to estimate model parameters, as recommended in He and Fan [53], we used Mplus version 8.3 [55] to conduct LPA with the robust maximum likelihood estimation (MLR) and a large number of starting values (500 random starting value sets, 200 best solutions). To identify the best fitting model, we tested models by starting a model with one class

and adding one more class until the best was identified. The following fit indicators were used for evaluating the fitness of each model: Akaike Information Criterion (AIC), Bayesian Information Criterion (BIC), Sample Size Adjustment BIC (SABIC), Bootstrapped Likelihood Ratio Test (BLRT), Lo Mendell–Rubin Adjusted Likelihood Ratio Test (LMRT) and Entropy. Among the fit indicators, the smaller the values of AIC, BIC, and SABIC, the better the degree of fitting of the model to the data, while a larger value of the entropy suggests the higher accuracy of the classification is. BLRT and LMRT are used to compare the differences between classes. Specifically, for  $k$ -class and  $k-1$  class models, if the BLRT and the LMRT have significant  $p$  values, then  $k$ -class models are better fitting models than  $k-1$  class models. In the three-step approach [56], after determining the optimal profile model, we used the BCH method to explore further whether there were any profile differences in participants' night eating and related symptoms, including BMI, loss of control over eating, sleep quality, and psychological distress. In addition, for interpreting group differences, Cohen's  $d$  was used, for which values of 0.2, 0.5, and 0.8 were considered small, medium, and large, respectively [57].

## Results

### Descriptive statistics

Table 1 describes the participant's demographic information and the scores of variables used in the current study. In particular, based on the total scores of the NEQ, 19 participants had a night eating syndrome with a cutoff point of 25, while 4 participants had a night eating syndrome with a cutoff point of 30.

### Latent profile analysis of perceived parenting styles

Table 2 shows the values of the fit indicators for each LPA model. The results showed that the values of AIC, BIC, and SABIC decreased with the increase of the latent profiles, suggesting that the 5-profile solution had the best fit.

**Table 2** Fit indices and class proportions for 1- to 5-profile models

Classes	LL	AIC	BIC	SABIC	LMRT $p$ value	BLRT $p$ value	Entropy	Mixing ratio
1	− 3755.77	7535.53	7584.98	7546.89	–	–	–	–
2	− 3491.43	7020.86	7099.14	7038.85	<0.001	<0.001	0.85	0.77/0.23
3	− 3349.29	6750.57	6857.70	6775.18	<0.001	<0.001	0.82	0.43/0.35/0.22
4	− 3269.81	6605.62	6741.59	6636.86	<0.05	<0.001	0.86	0.42/0.31/0.20/0.07
5	− 3211.64	6503.28	6668.09	6541.14	>0.05	<0.001	0.85	0.09/0.15/0.32/0.38/0.06

LL the log likelihood, AIC the Aikake information criterion, BIC the Bayesian information criterion, SABIC the sample-size adjusted BIC, LMRT the Lo-Mendell-Rubin adjusted likelihood ratio test

However, the  $p$  value of LMRT was larger than 0.05, indicating that the 5-profile solution was not significantly superior to the 4-profile solution. Therefore, considering that the 4-profile solution was parsimonious, could be interpreted easily, and had the highest entropy value, we chose the 4-profile solution as the best model.

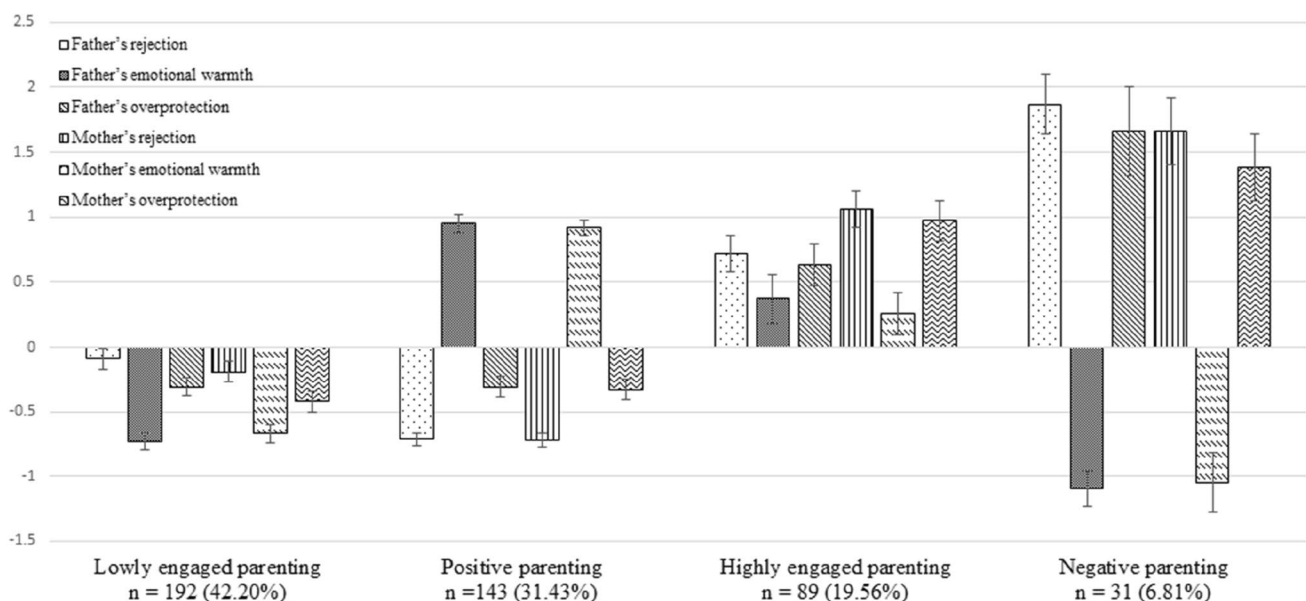
### Characteristics of the profiles

Figure 1 and Table 3 graphically and numerically show the characteristics of the four selected parenting style patterns. Specifically, profile 1 (42.20% of the participants) had the lower scores in all indicators, indicating that parents of the participants in this profile were less likely to engage in their children's lives; thus, profile 1 was labeled as *lowly engaged parenting*. Profile 2 (31.43% of the participants) had higher scores in the positive parenting style (i.e., emotional warmth)

and lower scores in the negative parenting styles (i.e., rejection and overprotection), so it was labeled as *positive parenting*. The characteristics of profile 3 (19.56% of the participants) were contrary to those of profile 1, with all scores being higher than average, indicating that the parents of the participants in this profile were very likely to engage in their children's life; therefore, this profile was named as *highly engaged parenting*. The last profile, profile 4 (6.81% of the participants), was labeled as *negative parenting* because it was featured by lower scores in the positive parenting style and higher scores in the negative parenting styles.

### Profiles differences on night eating syndrome symptoms and correlates

With the three-step approach, we further examined whether or not the participants in each profile differed in



**Fig. 1** Description of the selected LPA profiles of the lowly engaged parenting, positive parenting, highly engaged parenting and negative parenting

**Table 3** Descriptive statistics for the four latent profiles

	Lowly engaged parenting	Positive parenting	Highly engaged parenting	Negative parenting
	42.20% (n = 192)	31.43% (n = 143)	19.56% (n = 89)	6.81% (n = 31)
	Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD
Father's rejection	-0.09 ± 0.08	-0.71 ± 0.05	0.72 ± 0.14	1.87 ± 0.23
Father's emotional warmth	-0.73 ± 0.06	0.95 ± 0.07	0.37 ± 0.19	-1.09 ± 0.14
Father's overprotection	-0.31 ± 0.07	-0.31 ± 0.08	0.63 ± 0.16	1.66 ± 0.34
Mother's rejection	-0.19 ± 0.08	-0.72 ± 0.05	1.06 ± 0.14	1.66 ± 0.26
Mother's emotional warmth	-0.67 ± 0.07	0.92 ± 0.06	0.26 ± 0.16	-1.05 ± 0.23
Mother's overprotection	-0.42 ± 0.08	-0.33 ± 0.08	0.97 ± 0.16	1.38 ± 0.26



night eating and its correlates. As shown in Table 4, participants in different profiles had statistically significant differences in all covariates collected in the current study.

Specifically, for night eating, there were significant differences among the four potential profiles ( $\chi^2 = 33.11$ ,  $p < 0.01$ ), with participants in the *negative parenting* group showing the highest level of the night eating symptoms, followed by those in the *low engaged parenting* and *highly engaged parenting* group; while participants in the *positive parenting* had the lowest level of the night eating symptoms (e.g., Cohen's  $d$  for the comparison of *positive parenting* vs. *negative parenting* was 1.12, a large effect size). As for %EWH, significant differences were revealed across the four parenting style patterns ( $\chi^2 = 8.83$ ,  $p < 0.05$ ), and participants in the *positive parenting* profile reported the highest %EWH, but it was not significantly different from the scores from participants in the *negative parenting*. For the correlate of LOC eating, there were also significant differences found ( $\chi^2 = 17.23$ ,  $p < 0.01$ ) with participants in the *positive parenting* group describing the lowest level of LOC eating (e.g., Cohen's  $d$  for the comparison of *positive parenting* vs. *negative parenting* was 0.67, a medium effect size). Moreover, sleep quality also significantly differed across profiles ( $\chi^2 = 16.99$ ,  $p < 0.01$ ), and participants in the *positive parenting* showing the best sleep quality, followed by those in the *low and highly engaged parenting* groups, while participants in the *negative parenting* group had the poorest sleep quality (e.g., Cohen's  $d$  for the comparison of *positive parenting* vs. *negative parenting* was 0.95, a large effect size). Finally, there were also significant differences among the four profiles regarding psychological distress ( $\chi^2 = 74.62$ ,  $p < 0.01$ ), with participants in the *negative parenting* group showed the highest level of psychological distress, followed by those in the *low and highly engaged parenting* profiles, while participants in the *positive parenting* had the lowest level of psychological distress (e.g., Cohen's  $d$  for the comparison of *positive*

*parenting* vs. *negative parenting* was 1.92, a large effect size).

## Discussion

To the best of our knowledge, the current study was the first study to evaluate associations between parenting style patterns and night eating among adolescents. Specifically, using a person-centered approach (i.e., LPA), we explored how different patterns of perceived parenting styles were related to adolescent's night eating syndrome symptoms and correlates. The results of LPA showed four distinct profiles of perceived parenting styles, namely *low engaged parenting* pattern (low appropriate and low dysfunctional), *positive parenting* pattern (high appropriate and low dysfunctional), *highly engaged parenting* pattern (high appropriate and high dysfunctional), and *negative parenting* pattern (low appropriate and high dysfunctional). Subsequent analyses indicated that adolescents in these profiles significantly differed in night eating syndrome symptoms and correlates (i.e., sleep quality, psychological distress, and %EWH). Specifically, while parenting style profiles including more appropriate parenting were less likely to be characterized by night eating syndrome symptoms and correlates, profiles including dysfunctional parenting styles were more likely to exhibit night eating and related symptomatology.

The four emergent parenting style profiles are generally in line with the findings from a previous study by Wu et al. [34] who revealed three patterns of parenting styles for a group of Chinese adolescents: positive parenting, mixed parenting, and negative parenting. The patterns of *positive parenting* and *negative parenting* in our study completely corresponded with the two patterns in Wu et al. [34]. However, in our study, we also found two types of mixed parenting (i.e., lowly engaged and highly engaged parenting). The generally consistent finding on the patterns of parenting styles may

**Table 4** Profile differences on BMIz, night eating, LOC eating, sleep quality and psychological distress

	Lowly engaged parenting	Positive parenting	Highly engaged parenting	Negative parenting	Approximate $\chi^2$
	42.20% ( $n = 192$ )	31.43% ( $n = 143$ )	19.56% ( $n = 89$ )	6.81% ( $n = 31$ )	
	Mean (SE)	Mean (SE)	Mean (SE)	Mean (SE)	
Night eating	14.56 (0.44)a	12.06 (0.41)b	14.61 (0.65)a	17.98 (1.25)c	33.11**
%EWH	84.09 (0.99)a	88.22 (1.28)b	83.46 (1.39)a	83.39 (2.48)a,b	8.83*
LOC eating	13.08 (0.44)a	11.78 (0.43)b	14.56 (0.69)a	15.41 (1.21)a	17.23**
Sleep quality	5.40 (0.22)a	4.69 (0.23)b	4.97 (0.34)a,b	7.52 (0.71)c	16.99**
Psychological distress	23.09 (0.53)a	19.21 (0.51)b	23.39 (0.80)a	32.10 (1.66)c	74.62**

Subscripts (a, b, c, d) that differ represent significant pairwise differences between the profiles

%EWH Percentage expected weight for height, LOC eating Loss of control over eating

\* $p < 0.05$ , \*\* $p < 0.01$

indicate that these sub-types of perceived parenting styles of Chinese adolescents are relatively stable, supporting the generalizability of findings based on these profiles.

We further investigated whether night eating syndrome symptoms and correlates differed across parenting style profiles. Results showed that adolescents in four parenting style patterns were significantly different in night eating syndrome symptoms and correlates. Specifically, adolescents in the profile of *positive parenting* (characterized by low rejection, low overprotection, but high emotional warmth) showed the least night eating syndrome symptoms, while adolescents in the profile of *negative parenting* (characterized by high rejection, high overprotection, but low emotional warmth) had the most night eating syndrome symptoms. Our finding is concordant with previous literature, which shows that dysfunctional parenting practices (e.g., rejection and overprotection) are associated with disordered eating symptoms (e.g., body dissatisfaction, drive for thinness, bulimia, emotional eating; [58–60]), while appropriate parenting practices (e.g., emotional warmth) are protective factors for disordered eating behaviors [61]. Thus, our finding suggests that parenting style patterns may be an important contributing factor in the development of night eating syndrome.

Furthermore, we also found that adolescents in the *positive parenting* group had the lowest LOC eating, sleep quality, and psychological distress scores. In contrast, those in the *negative parenting* group presented the highest scores in sleep quality and psychological distress. Those in the two mixed pattern profiles were in the middle. These results align with previous literature that parenting styles have comprehensive effects on adolescents' physical and mental health [22, 62–64]. Furthermore, these findings suggest that different parenting style patterns may also have comprehensive effects on adolescent's night eating. The pattern of positive parenting may decrease the likelihood of night eating and reduce the risks of night eating by lowering the correlates of night eating.

To our knowledge, this study firstly investigated the potential effects of different patterns of perceived parenting styles on adolescent's night eating and related symptomatology. Based on the findings of the current study as well as the fact that parenting styles influence adolescents in both states (e.g., mood [65]) and traits (e.g., personality [66]), and within the context of transdiagnostic approaches to understanding eating disorders [67], we proposed that parenting style might influence night eating behaviors via promoting the risk factors of both general eating disorders (e.g., psychological distress) as well as the specific risk factors for night eating syndrome (e.g., sleep quality). However, this should be confirmed in future studies. Additionally, based on the current study's findings, the examination of parenting practices may be an important area to examine when exploring risk factors for the development

of night eating behaviors. For example, parental consultation and discussions about how parenting styles influence the relationship with their children may be included as a part of the treatment of night eating for adolescents. Similar to Gerards et al. [68], interventions targeting at night eating [69] may benefit from also including strategies for addressing dysfunctional parenting styles.

Several limitations should be taken into consideration. First, the sample in this study was limited to one high school, so the results may not be generalizable to adolescents in other developmental stages, regions, countries, and cultures. Future research may consider similar studies with large, diverse, population-based samples or samples from other cultures. Second, the participants of the current study were recruited via convenience sampling method, so the scores of the data (e.g., NEQ scores) might not be comparable to the norms. Third, the current study used a cross-sectional design to explore the relationships between the patterns of parenting style and night eating and its correlates; thus, the causal relationships between the patterns of parenting styles and night eating or correlates cannot be guaranteed. Future studies may consider using longitudinal designs to explore the casual relations of these variables. Finally, it should be noted that the parenting styles measured in the current study were "perceived parenting styles" by adolescents. Thus, future studies are encouraged to confirm the findings in the current study by measuring parenting styles directly from parents.

## Conclusion

Using a person-centered approach (i.e., LPA), the present study identified four distinct patterns of parenting styles in a sample of Chinese adolescents, with night eating and related symptomatology differing across each profile. Future studies about exploring the risk/protective factors of night eating syndrome among adolescents should consider the potential influence of different patterns of perceived parenting styles.

## What is already known on this subject?

Parenting styles are related to adolescents' eating behaviors (e.g., binge eating). However, previous studies mainly used a variable-centered approach (e.g., linear regression analysis) to research the topic, and little research has been conducted on the relationship between parenting styles and night eating.

## What does this study add?

Using a person-centered approach (i.e., Latent Profile Analysis), the present study examined the associations between parenting styles and adolescents' night eating syndrome symptoms and correlates. Latent profile analysis identified four different patterns of parenting styles (i.e., *positive parenting*, *negative parenting*, *highly engaged parenting*, and *lowly engaged parenting*), and distinct patterns of parenting styles exhibited significant differences in night eating syndrome symptoms and correlates.

**Acknowledgements** Many thanks to Dr. Marita Cooper (Eating Disorders Program, Department of Psychiatry and Behavioral Sciences, Johns Hopkins University) for her help with language editing.

**Author contributions** J.H. led the study design and drafted the manuscript. J.S. helped draft and revise the manuscript. G.C. performed the statistical analysis and helped draft the manuscript. Z.C. helped draft the manuscript. R.N. helped perform the statistical analysis and draft the manuscript. All authors read and approved the final manuscript.

**Funding** This research was partially supported by the Presidential Fund of the Chinese University of Hong Kong, Shenzhen, to Jinbo He (Grant Number: PF.01.001428) and the Shenzhen 2020 Education Science Planning Issues (Grant Number: ybfz20058). This research was also supported by the National Social Science Foundation of China on Education Research Project for Young Scholars (CLA160199) to Gui Chen (Grant Number: CLA160199).

**Data availability** The datasets used during the current study are available from the corresponding author on reasonable request.

## Declarations

**Conflict of interest** All authors declare that they have no conflict of interest.

**Ethical approval** The current study was approved by the institutional review boards of the Chinese University of Hong Kong, Shenzhen, and Central China Normal University.

**Consent to participant** All participants and their custodians have given their consent to participate.

**Consent to publication** Not applicable.

## References

- Stunkard AJ, Grace WJ, Wolff HG (1955) The night-eating syndrome; a pattern of food intake among certain obese patients. *Am J Med* 19(1):78–86. [https://doi.org/10.1016/0002-9343\(55\)90276-x](https://doi.org/10.1016/0002-9343(55)90276-x)
- Allison KC, Lundgren JD, O'Reardon JP, Geliebter A, Gluck ME, Vinai P, Mitchell JE, Schenck CH, Howell MJ, Crow SJ, Engel S, Latzer Y, Tzischinsky O, Mahowald MW, Stunkard AJ (2010) Proposed diagnostic criteria for night eating syndrome. *Int J Eat Disord* 43(3):241–247. <https://doi.org/10.1002/eat.20693>
- American Psychiatric Association (2013) Diagnostic and statistical manual of mental disorders: DSM-5. American Psychiatric Association, Washington, DC
- Howell MJ, Schenck CH, Crow SJ (2009) A review of nighttime eating disorders. *Sleep Med Rev* 13(1):23–34. <https://doi.org/10.1016/j.smrv.2008.07.005>
- Royal S, Wnuk S, Warwick K, Hawa R, Sockalingam S (2015) Night eating and loss of control over eating in bariatric surgery candidates. *J Clin Psychol Med Settings* 22(1):14–19. <https://doi.org/10.1007/s10880-014-9411-6>
- Gallant AR, Lundgren J, Drapeau V (2012) The night-eating syndrome and obesity. *Obes Rev* 13(6):528–536. <https://doi.org/10.1111/j.1467-789X.2011.00975.x>
- Gluck ME, Geliebter A, Satov T (2001) Night eating syndrome is associated with depression, low self-esteem, reduced daytime hunger, and less weight loss in obese outpatients. *Obes Res* 9(4):264–267. <https://doi.org/10.1038/oby.2001.31>
- de Zwaan M, Burgard MA, Schenck CH, Mitchell JE (2003) Night time eating: a review of the literature. *Eur Eat Disord Rev* 11(1):7–24. <https://doi.org/10.1002/erv.501>
- Lundgren JD, Allison KC, O'Reardon JP, Stunkard AJ (2008) A descriptive study of non-obese persons with night eating syndrome and a weight-matched comparison group. *Eat Behav* 9(3):343–351. <https://doi.org/10.1016/j.eatbeh.2007.12.004>
- Napolitano MA, Head S, Babyak MA, Blumenthal JA (2001) Binge eating disorder and night eating syndrome: psychological and behavioral characteristics. *Int J Eat Disord* 30(2):193–203. <https://doi.org/10.1002/eat.1072>
- Booth SL, Sallis JF, Ritenbaugh C, Hill JO, Birch LL, Frank LD, Glanz K, Himmelgreen DA, Mudd M, Popkin BM, Rickard KA, St Jeor S, Hays NP (2001) Environmental and societal factors affect food choice and physical activity: rationale, influences, and leverage points. *Nutr Rev* 59(3):S21–36. <https://doi.org/10.1111/j.1753-4887.2001.tb06983.x>
- Neumark-Sztainer D, Story M, Perry C, Casey MA (1999) Factors influencing food choices of adolescents: findings from focus-group discussions with adolescents. *J Am Diet Assoc* 99(8):929–937. [https://doi.org/10.1016/S0002-8223\(99\)00222-9](https://doi.org/10.1016/S0002-8223(99)00222-9)
- Davison KK, Birch LL (2001) Childhood overweight: a contextual model and recommendations for future research. *Obes Rev* 2(3):159–171. <https://doi.org/10.1046/j.1467-789x.2001.00036.x>
- Savage JS, Fisher JO, Birch LL (2007) Parental influence on eating behavior: conception to adolescence. *J Law Med Ethics* 35(1):22–34. <https://doi.org/10.1111/j.1748-720X.2007.00111.x>
- Arredondo EM, Elder JP, Ayala GX, Campbell N, Baquero B, Duerksen S (2006) Is parenting style related to children's healthy eating and physical activity in Latino families? *Health Educ Res* 21(6):862–871. <https://doi.org/10.1093/her/cyl110>
- Berge JM, Wall M, Bauer KW, Neumark-Sztainer D (2010) Parenting characteristics in the home environment and adolescent overweight: a latent class analysis. *Obesity (Silver Spring)* 18(4):818–825. <https://doi.org/10.1038/oby.2009.324>
- Faith MS, Scanlon KS, Birch LL, Francis LA, Sherry B (2004) Parent-child feeding strategies and their relationships to child eating and weight status. *Obes Res* 12(11):1711–1722. <https://doi.org/10.1038/oby.2004.212>
- Honajee K, Mahomood FM, Subraty AH, Ramasawmy D (2012) Is Parenting style and sociodemographic status of parents related to children's healthy eating activity in a multicultural society like mauritius? *Asian J Clin Nutr* 4(4):151–159. <https://doi.org/10.3923/ajcn.2012.151.159>
- Abar B, Carter KL, Winsler A (2009) The effects of maternal parenting style and religious commitment on self-regulation, academic achievement, and risk behavior among African-American parochial college students. *J Adolescence* 32(2):259–273. <https://doi.org/10.1016/j.adolescence.2008.03.008>



20. Bertalanffy LV (1952) Theoretical models in biology and psychology. In: Klein GS (ed) Krech D. Theoretical models and personality theory. Duke University Press, pp 24–38. <https://doi.org/10.1037/10803-002>
21. van der Horst K, Sleddens EFC (2017) Parenting styles, feeding styles and food-related parenting practices in relation to toddler's eating styles: a cluster-analytic approach. *PLoS ONE* 12(5):e0178149. <https://doi.org/10.1371/journal.pone.0178149>
22. Newman K, Harrison L, Dashiff C, Davies S (2008) Relationships between parenting styles and risk behaviors in adolescent health: an integrative literature review. *Rev Lat Am Enfermagem* 16(1):142–150. <https://doi.org/10.1590/s0104-11692008000100022>
23. Enten RS, Golan M (2009) Parenting styles and eating disorder pathology. *Appetite* 52(3):784–787. <https://doi.org/10.1016/j.appet.2009.02.013>
24. Kaufman RY (2015) Effects of emotion socialization and parenting style on eating disorder symptomology. Oklahoma State University.
25. Tata P, Fox J, Cooper J (2001) An investigation into the influence of gender and parenting styles on excessive exercise and disordered eating. *Eur Eat Disord Rev* 9(3):194–206. <https://doi.org/10.1002/erv.394>
26. Zubatsky M, Berge J, Neumark-Sztainer D (2015) Longitudinal associations between parenting style and adolescent disordered eating behaviors. *Eat Weight Disord* 20(2):187–194. <https://doi.org/10.1007/s40519-014-0154-z>
27. Tetzlaff A, Hilbert A (2014) The role of the family in childhood and adolescent binge eating—a systematic review. *Z Kinder Jugendpsychiatr Psychother* 42(1):61–70. <https://doi.org/10.1024/1422-4917/a000270>
28. Howard MC, Hoffman ME (2017) Variable-centered, person-centered, and person-specific approaches. *Organ Res Methods* 21(4):846–876. <https://doi.org/10.1177/1094428117744021>
29. Barnes SP, Brown KM, McDermott RJ, Bryant CA, Kromrey J (2013) Perceived parenting style and the eating practices of college freshmen. *Am J Health Educ* 43(1):8–17. <https://doi.org/10.1080/19325037.2012.10599213>
30. Haycraft E, Blissett J (2010) Eating disorder symptoms and parenting styles. *Appetite* 54(1):221–224. <https://doi.org/10.1016/j.appet.2009.11.009>
31. Rosewall JK, Gleaves DH, Latner JD (2018) Psychopathology factors that affect the relationship between body size and body dissatisfaction and the relationship between body dissatisfaction and eating pathology. *Front Psychol* 9:2768. <https://doi.org/10.3389/fpsyg.2018.02768>
32. Stunkard AJ, Allison KC (2003) Two forms of disordered eating in obesity: binge eating and night eating. *Int J Obes Relat Metab Disord* 27(1):1–12. <https://doi.org/10.1038/sj.ijo.0802186>
33. He J, Huang F, Yan J, Wu W, Cai Z, Fan X (2018) Prevalence, demographic correlates, and association with psychological distress of night eating syndrome among Chinese college students. *Psychol Health Med* 23(5):578–584. <https://doi.org/10.1080/13548506.2017.1400669>
34. Wu P, Ma S, Fang Z, Xu B, Liu H (2016) The latent classes of parenting style: an application of latent profile analysis. *Stud Psychol Behav* 14(4):523
35. Tein JY, Cox S, Cham H (2013) Statistical power to detect the correct number of classes in latent profile analysis. *Struct Equ Modeling* 20(4):640–657. <https://doi.org/10.1080/10705511.2013.824781>
36. Chen G, He J, Cai Z, Fan X (2020) Perceived parenting styles and body appreciation among Chinese adolescents: exploring the mediating roles of dispositional mindfulness and self-compassion. *Child Youth Serv Rev* 119:105698. <https://doi.org/10.1016/j.childyouth.2020.105698>
37. Li Z, Wang L, Zhang L (2012) Exploratory and confirmatory factor analysis of a short-form of the EMBU among Chinese adolescents. *Psychol Rep* 110(1):263–275. <https://doi.org/10.2466/02.08.09.21.PR0.110.1.263-275>
38. Xu J, Ni S, Ran M, Zhang C (2017) The relationship between parenting styles and adolescents' social anxiety in migrant families: a study in Guangdong. *China Front Psychol* 8:626. <https://doi.org/10.3389/fpsyg.2017.00626>
39. He J, Ji F, Zhang X, Fan X (2019) Psychometric properties and gender invariance of the simplified Chinese version of Night Eating Questionnaire in a large sample of mainland Chinese college students. *Eat Weight Disord* 24(1):57–66. <https://doi.org/10.1007/s40519-018-0553-7>
40. Allison KC, Lundgren JD, O'Reardon JP, Martino NS, Sarwer DB, Wadden TA, Crosby RD, Engel SG, Stunkard AJ (2008) The Night Eating Questionnaire (NEQ): psychometric properties of a measure of severity of the Night Eating Syndrome. *Eat Behav* 9(1):62–72. <https://doi.org/10.1016/j.eatbeh.2007.03.007>
41. Tu CY, Tseng MM, Chang CH, Lin CC (2017) Comparative validity of the Internet and paper-and-pencil versions of the Night Eating Questionnaire. *Compr Psychiatry* 75:53–61. <https://doi.org/10.1016/j.comppsy.2017.03.001>
42. He J, Latner JD, Wu W, Fan X (2018) Measuring loss of control over eating in a Chinese context: psychometric properties of the full and brief Chinese version of the loss of control over eating scale. *Curr Psychol* 40(2):665–674. <https://doi.org/10.1007/s12144-018-9976-6>
43. Latner JD, Mond JM, Kelly MC, Haynes SN, Hay PJ (2014) The Loss of Control Over Eating Scale: development and psychometric evaluation. *Int J Eat Disord* 47(6):647–659. <https://doi.org/10.1002/eat.22296>
44. Buysse DJ, Reynolds CF 3rd, Monk TH, Berman SR, Kupfer DJ (1989) The Pittsburgh Sleep Quality Index: a new instrument for psychiatric practice and research. *Psychiatry Res* 28(2):193–213. [https://doi.org/10.1016/0165-1781\(89\)90047-4](https://doi.org/10.1016/0165-1781(89)90047-4)
45. Backhaus J, Junghanns K, Broocks A, Riemann D, Hohagen F (2002) Test-retest reliability and validity of the Pittsburgh Sleep Quality Index in primary insomnia. *J Psychosom Res* 53(3):737–740. [https://doi.org/10.1016/s0022-3999\(02\)00330-6](https://doi.org/10.1016/s0022-3999(02)00330-6)
46. Guo S, Sun W, Liu C, Wu S (2016) Structural validity of the pittsburgh sleep quality index in Chinese undergraduate students. *Front Psychol* 7:1126. <https://doi.org/10.3389/fpsyg.2016.01126>
47. Shi S, Xiong D, Yan Q (2013) Sleep quality among college students and associated factors. *Chin J Sch Health* 34(12):1462–1464
48. Tsai PS, Wang SY, Wang MY, Su CT, Yang TT, Huang CJ, Fang SC (2005) Psychometric evaluation of the Chinese version of the Pittsburgh Sleep Quality Index (CPSQI) in primary insomnia and control subjects. *Qual Life Res* 14(8):1943–1952. <https://doi.org/10.1007/s11136-005-4346-x>
49. Andrews G, Slade T (2001) Interpreting scores on the Kessler psychological distress scale (K10). *Aust N Z J Public Health* 25(6):494–497. <https://doi.org/10.1111/j.1467-842x.2001.tb00310.x>
50. Bu XQ, You LM, Li Y, Liu K, Zheng J, Yan TB, Chen SX, Zhang LF (2017) Psychometric properties of the kessler 10 scale in Chinese parents of children with cancer. *Cancer Nurs* 40(4):297–304. <https://doi.org/10.1097/NCC.0000000000000392>
51. Fassaert T, De Wit MA, Tuinebreijer WC, Wouters H, Verhoeff AP, Beekman AT, Dekker J (2009) Psychometric properties of an interviewer-administered version of the Kessler Psychological Distress scale (K10) among Dutch, Moroccan and Turkish respondents. *Int J Methods Psychiatr Res* 18(3):159–168. <https://doi.org/10.1002/mpr.288>
52. Zhou C, Chu J, Wang T, Peng Q, He J, Zheng W, Liu D, Wang X, Ma H, Xu L (2008) Reliability and validity of 10-item Kessler

- scale (K10) Chinese version in evaluation of mental health status of Chinese population. *Chin J Clin Psychol* 16(6):627–629
53. He J, Fan X (2019) Latent class analysis. In: V. Zeigler-Hill, Shackelford TK (Eds) *Encyclopedia of personality and individual differences*, pp 1–4. [https://doi.org/10.1007/978-3-319-28099-8\\_2313-1](https://doi.org/10.1007/978-3-319-28099-8_2313-1)
  54. He J, Chen X, Fan X, Cai Z, Hao S (2018) Profiles of parent and peer attachments of adolescents and associations with psychological outcomes. *Child Youth Serv Rev* 94:163–172. <https://doi.org/10.1016/j.childyouth.2018.10.001>
  55. Asparouhov T, Muthén B (2019) Latent variable interactions using maximum-likelihood and Bayesian estimation for single- and two-level models. *Mplus Web Notes* (23). <http://www.statmodel.com/examples/webnotes/webnote%2023.pdf>
  56. Asparouhov T, Muthén B (2014) Auxiliary variables in mixture modeling: three-step approaches using mplus. *Struct Equ Model* 21(3):329–341. <https://doi.org/10.1080/10705511.2014.915181>
  57. Cohen J (1992) A power primer. *Psychol Bull* 112(1):155–159. <https://doi.org/10.1037//0033-2909.112.1.155>
  58. Herraiz-Serrano C, Rodriguez-Cano T, Beato-Fernandez L, Latorre-Postigo JM, Rojo-Moreno L, Vaz-Leal FJ (2015) Parental rearing and eating psychopathology. *Actas Esp Psiquiatr* 43(3):91–98
  59. Jones C, Harris G, Leung N (2005) Parental rearing behaviours and eating disorders: the moderating role of core beliefs. *Eat Behav* 6(4):355–364. <https://doi.org/10.1016/j.eatbeh.2005.05.002>
  60. Vandewalle J, Moens E, Debeuf T, Braet C (2018) Parental rejection as a predictor of emotional eating after inpatient weight loss treatment for youngsters. *Behav Change* 35(4):217–227. <https://doi.org/10.1017/bec.2018.21>
  61. Esparon J, Yellowlees AJ (1992) Perceived parental rearing practices and eating disorders. *Br Rev Bulim Anorex Nerv* 6(1):39–45
  62. Eun JD, Paksarian D, He JP, Merikangas KR (2018) Parenting style and mental disorders in a nationally representative sample of US adolescents. *Soc Psychiatry Psychiatr Epidemiol* 53(1):11–20. <https://doi.org/10.1007/s00127-017-1435-4>
  63. Khodabakhsh MR, Kiani F, Ahmedbookani S (2014) Psychological well-being and parenting styles as predictors of mental health among students: Implication for health promotion. *Int J Pediatr* 2(3):39–46
  64. Lennon JC, Hoekstra SJ (2019) Effects of perceived parenting styles and mental health on drinking behaviors. *J Subst Use* 25(1):20–27. <https://doi.org/10.1080/14659891.2019.1657512>
  65. Milevsky A, Schlechter M, Netter S, Keehn D (2006) Maternal and paternal parenting styles in adolescents: associations with self-esteem, depression and life-satisfaction. *J Child Fam Stud* 16(1):39–47. <https://doi.org/10.1007/s10826-006-9066-5>
  66. Schofield TJ, Conger RD, Donnellan MB, Jochem R, Widaman KF, Conger KJ (2012) Parent personality and positive parenting as predictors of positive adolescent personality development over time. *Merrill-Palmer Q* (Wayne State University Press) 58(2):255. <https://doi.org/10.1353/2Fmpq.2012.0008>
  67. Wade TD, Bergin JL, Martin NG, Gillespie NA, Fairburn CG (2006) A transdiagnostic approach to understanding eating disorders. *J Nerv Ment Dis* 194(7):510–517. <https://doi.org/10.1097/01.nmd.0000225067.42191.b0>
  68. Gerards SM, Dagnelie PC, Jansen MW, van der Goot LO, de Vries NK, Sanders MR, Kremers SP (2012) Lifestyle Triple P: a parenting intervention for childhood obesity. *BMC Public Health* 12(1):267. <https://doi.org/10.1186/1471-2458-12-267>
  69. Khatib I, Zhabotynsky V, Gilbert J, Taylor G An intervention to reduce night eating among UNC-CH undergraduate students. University of North Carolina.

**Publisher's Note** Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.