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Association between lifestyle-related, psychosocial factors and obesity among female adolescents in Taiwan

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ABSTRACT

Purpose: To examine a wide range of potential contributors to the risk of obesity in female adolescents.
Design and methods: Data for this study were collected using a cross-sectional design. A group of 175 female adolescents were recruited, and information on their demographic characteristics, lifestyle-related behaviors, and psychosocial factors was collected using a self-administered questionnaire during September 2018 to January 2019. Data were analyzed using SPSS 24.0.
Results: An overestimation of body weight was negatively correlated with overweight in the female adolescents. Age at menarche was negatively correlated with the arisk of overweight. Adolescents who slept for >7 h on weekend nights were less likely to be overweight. Eating more cheese, fish, seafood, and organ meats was negatively correlated with obesity risk. The female adolescents were more likely to become overweight if they ate dinners prepared by family and experienced more disturbances from parents and other family members.
Conclusions: Female adolescents are a unique population affected by obesity. Although incorporating both lifestyle-related behavioral and psychosocial factors in future investigations and developing multicomponent interventions for obesity prevention are crucial, female adolescents should receive the utmost attention from researchers to alleviate the health burden of obesity.
Practice implications: The intertwined nature of obesity-related factors warrants future investigations to elaborate their roles interplaying with the risk of obesity. Multicomponent interventions should be developed, and nurses and health-care providers should target their efforts on obesity prevention for this specific population.

Introduction

Overweight and obesity in children and adolescents are major public health concerns worldwide. The prevalence rates of obesity and severe obesity in children and adolescents have more than tripled and more than quintupled, respectively, since the 1970s in the United States (Leme et al., 2018; Ruiz et al., 2020). Obesity disproportionately affects adolescents. Among the different age groups of children, the prevalence of obesity is the highest among adolescents (Ruiz et al., 2020). According to the 1999–2016 National Health and Nutrition Examination Survey report, up to 41.5% of older adolescents (aged between 16 and 19 years) had obesity (Skinner et al., 2018). In addition, the prevalence rate of severe obesity among children and adolescents aged 2–19 years was 5.6% and that among adolescents aged 16–19 years was 7.7% compared with other age groups of children (1.8% and 5.2% in children aged 2–5 and 6–11 years, respectively) (Hales et al., 2018).

Female adolescents are among the most vulnerable to obesity. Although the rising trend of obesity in the pediatric population has been slowing down, accumulating evidence indicates that the prevalence of high body mass index (BMI) is still increasing among female adolescents (NCD Risk Factor Collaboration, 2017; Ng et al., 2014; Skinner et al., 2018). A study systematically reviewed 1769 studies examining the global trend of the prevalence of pediatric obesity from 1980 to 2013. The results indicated that compared with boys, girls in developing countries not only had a higher prevalence of obesity (8.4% vs. 8.1% in 1980 and 13.4% vs. 12.9% in 2013) but also a wider increase in the prevalence of both obesity and overweight (prevalence increased by 5% in

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girls vs. 4.8% in boys from 1980 to 2013) (Ng et al., 2014). In the United States, the prevalence of obesity was reported to be higher among adolescents than among children in other age groups (12.7%, 20.7%, and 22.2% for the 2–5-year, 6–11-year, and 12–19-year age groups, respectively), and the prevalence rates among male and female adolescents were 22.6% and 21.7% (Stierman et al., 2021).

An elevated BMI during childhood and adolescence is correlated with higher risks of premature mortality and adulthood obesity (Currie et al., 2008). Childhood obesity leads to immediate or long-term health consequences that follow them into adulthood, including cardiovascular disorders, hypertension, stroke, musculoskeletal disorders, diabetes, or some types of cancer (Koplan et al., 2005; Reilly & Kelly, 2011; World Health Organization, 2020a), and even results in premature mortality (Reilly & Kelly, 2011). However, before the long-term health consequences are carried through to adulthood, children and adolescents may develop numerous health problems, including breathing difficulty, hypertension, bone fractures, insulin resistance, early cardiovascular disease markers, and psychological burden (Bleich et al., 2018; World Health Organization, 2020a). Researchers tracing back individuals' weight status from their childhood to adulthood determined that obesity status during adulthood was the most correlated with weight status during adolescence (Goldhaber-Fiebert et al., 2013; Ruiz et al., 2020).

Adolescence is a transitional life stage during which adolescents struggle to gain autonomy and control over all the aspects of daily life. Moreover, adolescence is a crucial period during which individuals cultivate lifestyle-related behaviors that follow into adulthood (Gordon-Larsen et al., 2004). Lifestyle-related and obesogenic behaviors, including the physical activity level, sedentary behaviors, and sleep and dietary patterns, cultivated during adolescence can be retained during adulthood (Costigan et al., 2013). Physical activity levels may decline during the transition from childhood to adolescence (Alberga et al., 2012). Compared with male adolescents, female adolescents are more likely to reduce their physical activity level when they transition from childhood to adolescence. Earlier growth spurts accompanied by alterations in physical appearance due to sexual maturation are potential factors that cause a reduction in girls' physical activity levels (Leech et al., 2014; Nelson et al., 2006). Moreover, shifting focus to seek more recognition and identification from peers may propel adolescents to spend more time on the Internet to connect with their peers online and predispose adolescents to have a more “sedentary-like” lifestyle (Todd et al., 2015). According to the World Health Organization report published in 2020, over four (81%) out of five adolescent girls did not meet the minimal requirement of engaging in >60 min of physical activity 7 days a week (World Health Organization, 2020b). These estimated numbers were even higher than those reported among adults (Hallal et al., 2012). In contrast to that among male adolescents, the prevalence of insufficient physical activity remained unchanged among female adolescents between 2001 and 2016. A pooled analysis of 298 school-based surveys from 146 countries revealed a significant reduction in insufficient in physical activity levels among male adolescents between 2001 and 2016 (from 80.1% to 77.6%), but the same trend was not observed among female adolescents (from 85.1% to 84.7%; Guthold et al., 2020; World Health Organization, 2020b).

A higher prevalence of inadequate physical activity may imply the increased sedentary behavior of adolescents (Kontostoli et al., 2021). Previous studies have reported a considerable inverse relationship between the physical activity level and sedentary behavior among adolescents and indicated that sedentary behavior was correlated with excessive weight gain (Costigan et al., 2013; Pearson et al., 2014). However, a higher level of sedentary behavior was not only associated with weight gain but also numerous adverse health effects, including cardiovascular disease, metabolic disorders, sleep deprivation, unhealthy diet patterns, and psychological disturbances (Alberga et al., 2012; Costigan et al., 2013; Iannotti & Wang, 2013).

A high intake of high-quality foods (nutrient-dense foods) and a low intake or the avoidance of low-quality foods (foods with empty calories instead of required nutrients) is recommended for preventing pediatric obesity (Rosi et al., 2019; US Department of Agriculture and US Department of Health and Human Services, 2020). However, because children gain more autonomy regarding their food preferences when they become adolescents, they are more likely to eat low-quality, energy-dense, or highly processed foods with attractive flavors or appearances, such as fried or fast food, soft drinks, sweetened beverages, and packaged snacks (Alberga et al., 2012; Moreno et al., 2010; Todd et al., 2015; Trübswasser et al., 2021). Studies have investigated the quality of food consumed by adolescents and evaluated adherence to the Dietary Guidelines for Americans by using Healthy Eating-Index 2015 (HEI-2015); the results revealed that adolescent scores for healthy eating were the lowest among all age groups and approximately 10 points lower than those of younger children (Ruiz et al., 2020; US Department of Agriculture and US Department of Health and Human Services, 2020).

Adolescents are more likely to skip meals or consume take-out food rather than meals prepared by family because they attempt to keep up with their classmates and have busy after-school schedules. Having fewer opportunities to eat family meals was associated with a poorer quality of diet and a higher risk of obesity (Berge et al., 2015; Gillman et al., 2000). In particular, increased attention should be focused on the quality and pattern of diet consumed by female adolescents because of their transition into the childbearing age (Alberga et al., 2012). Overweight status among women of childbearing age may cause intergenerational weight gain and compromise the health status of their offspring (Oken, 2009). Moreover, adolescent girls are more prone to risk their own health by adopting unhealthy diet-related practices to control weight because of their distorted perception regarding body weight and dissatisfaction with their own body image (Voelker et al., 2015).

Adolescence is among the most stressful life stages accompanied by pressure aggregating from multiple aspects of life (De Vriendt et al., 2011). Adolescents not only experience physical transformation resulting from sexual maturation but also are overwhelmed by the increasing level of psychological stress caused by an expanding spectrum of social connections, ranging from family to community. According to the literature, stress is associated with obesity; stress may increase serum cortisol levels and interfere with several metabolic-related molecules (e.g., insulin and leptin) to facilitate adiposity accumulation (Pervanidou & Chrousos, 2011; Wilson & Sato, 2014). Adolescents experiencing excessive stress are more prone to develop depression or low self-worth, which interrupt their daily activities due to altered obesogenic behaviors or habits. Thus, adolescents may become more immobile, have decreased physical activity levels, experience sleep disturbances, and engage in emotional eating (Mannan et al., 2016; Rajan & Menon, 2017).

The perception regarding overweight may cause additional psychological stress or burden on adolescents (Armstrong et al., 2013; Pervanidou & Chrousos, 2011). Although increasing individuals' awareness regarding overweight may drive them to lose weight through lifestyle modifications (Fredrickson et al., 2015; Hsu et al., 2016; Richmond et al., 2021), a systematic review reported that the perception of overweight among adolescents increased the risk of future weight gain (Haynes et al., 2018). Compared with male adolescents, female adolescents were more obsessed with the perception of overweight. In addition, unlike their male counterparts who are prone to underestimate their body weight, female adolescents are more likely to overestimate their body size and thus engage in unhealthy weight control behavior (Dalton 3rd et al., 2014; Hsu et al., 2016; Kim & So, 2014). Therefore, the overestimation of body weight instead of the perception of overweight may be a more favorable indicator of the relationship between overweight status and weight perception among female adolescents (Park, 2011b).

In summary, adolescents with an excessive level of stress may be more likely to become overweight or obese through various stress-

related physiological alterations, including an increase in cortisol secretion; the modification of obesogenic behaviors, including the physical activity level and dietary habits; and the adoption of unhealthy weight control strategies that may increase the risk of future weight gain. In particular, female adolescents are the most affected due to their overestimation of body weight. Moreover, the prevalence of overweight is the highest in female adolescents among pediatric populations (Herva et al., 2006; Marmorstein et al., 2014; Rajan & Menon, 2017). Psychosocial stress- and lifestyle-related behavioral factors can increase the risk of obesity in female adolescents.

Therefore, this study specifically focused on female adolescents who are the most stressed (psychological distress from weight overestimation and other psychosocial aspects) and most overweight (compared with other pediatric age groups). The study investigated the association of lifestyle- and psychosocial-related behavioral factors with obesity risk among female adolescents. We attempted to gain more in-depth knowledge regarding obesity and its potential risk factors in female adolescents by considering a broader spectrum of contributing factors, namely lifestyle-related behaviors (e.g., dietary patterns, physical activity level, and sleep habits); weight overestimation; and psychosocial stress resulting from friends, school, and family.

Methods

Design and recruitment

This cross-sectional study examined the contribution of various factors to the risk of obesity in female adolescents. We recruited students from a junior high school located in northern Taiwan by using the convenience sampling method. Included participants were (a) girls, (b) junior high school students, and (c) capable of providing informed consent and the consent of one parent for those under 20 years old. Exclusion criteria were being unable to provide signed informed consent or complete the questionnaire themselves. A total of 221 female adolescents were invited to participate in this study. Finally, 177 of them (80.1%) agreed to participate, and two of them were excluded due to the lack of accuracy in questionnaire responses. The final study sample consisted of 175 participants. We estimated the required sample size by using G* Power and determined that at least 98 participants should be included in our study to ensure a power of at least 0.80 with a medium effect size and an alpha value of 0.05.

Data collection

All data were collected using a self-administered questionnaire directly distributed by the primary researcher. The data collection period was from September 2018 to January 2019. Each adolescent participant spent approximately 10–15 min to complete the questionnaire.

Weight overestimation

The BMI of all the participants was calculated as self-reported weight in kilograms divided by the square of height in centimeters. We divided the adolescents into two groups, namely normal weight and overweight, to compare their demographic characteristics and lifestyle-related behaviors. Overweight status was determined by their calculated BMI based on the age- and sex-specific cutoff point in accordance with the national guideline proposed by the Health Promotion Administration (HPA) in Taiwan. Furthermore, we evaluated the discrepancy in weight status between self-reported perceived weight status and weight status determined by calculated BMI. The adolescents' perceived weight status was determined by asking the following question: "What do you think regarding your body weight?" The responses to this question were underweight, normal weight, overweight, or obese. Weight status determined based on the calculated BMI was categorized into underweight, normal weight, overweight, or obese categories in accordance with cutoff points for different weight groups suggested by the HPA in Taiwan.

Lifestyle-related behavior questionnaire

This questionnaire was developed to determine the adolescents' daily lifestyle–related behaviors, namely physical activity, sedentary behavior, and sleep habits. Items in this scale were adopted from a questionnaire concerning overall well-being and its relationship with nutritional status in children and adolescents employed in a nationwide research project called "Nutrition and Health Survey (NAHSIT)" that has been conducted by the HPA and Ministry of Health and Welfare in Taiwan since 1993. This nationwide project is periodically conducted every 4 years, and a significant amount of data has been generated using this scale. Many studies have reported the reliability and validity of this questionnaire.

A total of 13 items were incorporated into the lifestyle-related behavior questionnaire, and of these, three items focused on the physical activity level, three items on sedentary behavior, four items on sleep-related habits, and three items on food preparation by family or themselves. Among the three questions used to determine the physical activity level, the first was a self-reported question regarding the frequency of using any public transportation (buses, MRT, or school buses) or a ride by family members while travelling between home and school during the past week. The second question determined the frequency of engaging in any vigorous exercise lasting at least 30 min in the preceding week. The participants were required to select either of the following responses for this question: "zero" (almost none), "1" (once a week), "2" (two days a week), "3" (three days a week), "4" (four days a week), "5" (five days a week), "6" (six days a week), and "7" (seven days a week). The third question determined the type of exercise that the participants engaged in, and they were required to select one type of exercise from a list of vigorous exercises commonly performed by adolescents.

Three items pertaining to sedentary behavior were incorporated to determine whether the participants watched the television, played with hand phones or tablets, or used the computer for >2 h during the preceding week. The scoring system used for determining the frequency of sedentary behavior was similar to that adopted for measuring the physical activity level, with the respondents being required to select a box with scores from zero to seven.

Four items were included to examine the sleep habits of the participants. One item evaluated the waking and sleeping times of the participants separately, and the average daily sleep duration of the participants was calculated as the time lag between their waking and sleeping times. To determine the difference in sleep patterns between weekdays and weekends, the adolescents were asked to report their night sleep hours during weekdays and weekends, respectively, by checking one of the following boxes "less than 3 hours," "3 to 5 hours," "5 to 7 hours," "7 to 9 hours," or "more than 9 hours." Three more questions on food preparations were included to determine whether adolescents' breakfast, lunch, or dinner was prepared by their family or themselves.

Food frequency questionnaire

The Food Frequency Questionnaire (FFQ) has been adopted in numerous obesity-related studies due to its adequate reliability and validity when compared with other relevant food intake measurements, including the 24-h diet recall or 7-day food diary. The 30-item Chinese version of the FFQ adopted in this study incorporates various food categories commonly observed in Taiwan, and these categories are designated as high- or low-quality foods, including fruits, vegetables, milk, meat, yogurt, pork, poultry, beef, fish, soy products, soy milks, eggs, ice cream, fried foods, high-fat and sugary foods, instant noodles, high-fat snacks, sugar or sweetened drinks, shaved ice desserts, candy and

chocolates, high-fat or oily foods, and sugary snacks. The participants were asked to assign a score to each food on a 7-point Likert-type, ranging from "0" (did not eat) to "7" (ate every day), to determine its intake frequency during the past week.

The original scale's content validity was reported to be between 0.77 and 0.95. In addition, its Cronbach's alpha value was between 0.74 and 0.77 in previous studies and 0.84 in this study. After item analysis was conducted using the data set from this study, one item (breakfast) was excluded due to the insufficient loading of interitem correlation (<0.30). Seven different factors were determined using factor analysis: "vegetables, juices, and eggs" (FFQ 1, 3 items), "milk, yogurt, and yogurt drinks" (FFQ 2, 3 items), "meats and fried foods" (FFQ 3, 5 items), "cheese, fish, seafood, and organ meats" (FFQ 4, 4 items), "soy milks, soy bean products, and nutritional supplements" (FFQ 5, 3 items), "flavored ice products and sweetened drinks" (FFQ 6, 3 items), and "desserts, high-oil snacks, instant noodles, cookies, or sweets" (FFQ 7, 6 items; Table 4).

Stressor rating scale

The Stressor Rating Scale (SRS) was adopted from a previous study on stress management and stressors perceived among young adolescents. The original scale consisted of 38 items under three categories: school stressors (12 items), home stressors (13 items), and friendship stressors (13 items). A 5-point Likert-type scale was used to determine the level of stress perceived for each stressor, with scores of 1 (no stress), 2 (slight amount of stress), 3 (moderate amount of stress), 4 (a lot of stress), and 5 (extremely high stress). The Chinese version of this scale consisting of 30 items was used to measure the level of stress in pediatric populations in Taiwan. This study also adopted this Chinese version to evaluate stress perceived by our study population. The Cronbach's alpha value was 0.96 for the version adopted by Gau and Liu (2013) and 0.94 for this study. After item analysis was conducted using the data set from this study, three items were excluded before performing factor analysis due to the insufficient loading of interitem correlation (<0.30). Six stress factors were determined through confirmatory factor analysis: "fear of being neglected or ridiculed" (SRS 1, 3 items), "fear of not keeping up with others in school" (SRS 2, 7 items), "disturbances from parents and other family members" (SRS 3, 4 items), "insecurity" (SRS 4, 5 items), "being betrayed or losing a friend" (SRS 5, 3 items), and "difficulties in building a sustainable friendship" (SRS 6, 5 items; Table 5).

Information on demographic factors, namely age, school year, number of siblings, family or personal history of asthma or other chronic illness, and age at menarche, was collected using a self-administered questionnaire.

Data analysis

Before data analysis was conducted, the collected data were first entered into SPSS (version 24.0). Because this study evaluated differences in characteristics between the normal weight and overweight groups, we further categorized them into two subgroups and created a binary outcome variable (normal weight vs. overweight) in accordance with their calculated BMI matching with the value suggested by the HPA and Ministry of Health and Welfare in Taiwan. In addition, we used LISREL 9.2 software (Scientific Software International, Inc., Lincolnwood, IL, USA) to perform factor analyses, namely exploratory factor analysis by using the principal factor estimation method and confirmatory factor analysis for items collected using the FFQ and SRS.

In univariate analysis, the unadjusted effect of each potential contributing factor, namely demographic variables, weight perception, lifestyle-related factors, food frequency, and stress level, on the binary outcome was examined using the Wilcoxon rank-sum test, chi-square test, and Fisher's exact test as appropriate for the data type. Next, multivariate analysis was conducted using a fitted logistic regression model to estimate the adjusted effects of contributing factors, namely demographic variables, weight perception, lifestyle-related factors, food frequency, and stress level, on the binary outcome (normal weight vs. overweight). The stepwise forward method was adopted to include independent variables into the final model. The selection of an independent variable was based on the result generated from the univariate analysis. Both the Nagelkerke R^2 and Hosmer–Lemeshow goodness-of-fit (GOF) test were employed to determine the GOF of the fitted logistic regression model. The significance level of independent variables incorporated in the final model was set as $p < .05$.

Validity, reliability, and rigor

All the scales and questionnaires adopted in this study exhibited high validity and reliability with Cronbach's alpha values ranging from 0.74 to 0.96. In addition, all data were collected and processed by the primary researcher to ensure the validity and authenticity of study findings.

Ethical approval

This study was approved by the institutional review board of an academic medical center affiliated with the school. All eligible students willing to participate in this study were contacted by the principal investigator and asked to sign consent forms after they were explained the details of the study protocol. At least one of their legal guardians was contacted through telephone to ensure that their guardians were fully informed regarding the study, and the guardians were required to provide signed consent forms.

Results

A total of 175 participants were included in this study. All of them were female adolescents, with a mean age of 17.9 (SD = ±1.5) years and the ages ranging from 15.1 to 19.8 years. Of the total participants, 78.3% and 21.7% had normal weight and overweight, respectively. In terms of the school year, the majority of the participants were from a high grade (70.9%, $N = 124$), and remaining were from a low-grade (29.1%, $N = 51$). The mean age at menarche was 12.2 (SD = ±1.1) years, and the age range was 10 to 15 years. Although the school year did not significantly differ between the normal weight and overweight groups, the age at menarche significantly differed between the groups. The overweight group tended to be younger at their menarche (Table 1).

Lifestyle-related behaviors in overweight versus normal-weight adolescents

In terms of lifestyle-related behaviors, the female adolescents usually opted public transportation to travel between school and home for 2.6 (SD = ±2.6) days per week. In addition, they usually engaged in vigorous exercises for 1.4 (SD = ±1.4) days in a week. However, up to 30.3% of them did not regularly engage in any vigorous exercise; 22.3% of them did engage in regular exercise, such as running, walking, and hiking; and 15.4% of them played ball games on a regular basis. In terms of their sedentary behavior, on average, the female adolescents spent 1.7 (SD = ±2.4) days per week in watching TV for >2 h on each day. They used a hand phone or tablet and a computer for 3.5 (SD = ±2.8) and 5.9 (SD = ±1.9) days every week, respectively, for >2 h per day. However, no significant differences in the frequency of the aforementioned lifestyle-related or sedentary behaviors were noted between the overweight and normal weight groups.

The participants in both the normal weight and overweight groups compensated for their night sleep by sleeping more during weekends. The average sleep duration in our participants hours was 6.6 h (SD = ±1.2 h). We adopted 7 h as the cutoff point and separated the participants into two subgroups: those with a sleep duration of >7 h and those with a sleep duration of ≤7 h. We observed a borderline significant

Table 1
Characteristics of participants.

Characteristic	N	Total	Normal[a] (Calculated-BMI)	Overweight[b] (Calculated-BMI)	*p*-value
N(%)	175	175	137(78.3%)	38(21.7%)	
Total		Mean ± SE(%)	Mean ± SE(%)	Mean ± SE(%)	
Age		17.9 ± 1.5	17.9 ± 1.4	17.8 ± 1.6	0.87
School year					
Low-grade (1st–2nd years)	51	29.1%	*N* = 39 (76.5%)	N = 12 (23.5%)	0.71
High-grade (3rd–5th years)	124	70.9%	*N* = 98 (79.0%)	*N* = 26 (21.0%)	
Age of Menarche		12.2 ± 1.1	12.3 ± 1.1	11.7 ± 1.0	0.00*
Weight perception					
Overestimation of body weight (yes/no)		50/125 (28.6%/71.4%)	45/92 (32.8%/67.2%)	5/33 (13.2%/86.8%)	0.02*
Lifestyle-related behaviors					
Public transportation of family ride to school (days/per wk)		2.6 ± 2.6	2.7 ± 2.6	2.2 ± 2.4	0.26
Vigorous exercise (days/per wk)		1.4 ± 1.4	1.3 ± 1.5	1.6 ± 1.3	0.30
Exercise categories					0.44
No regular exercise		30.3%	29.9%	31.6%	
Running, walking, or hiking		15.4%	15.3%	15.8%	
Ball games		22.3%	23.4%	18.4%	
TV watching (days/per wk)		1.7 ± 2.4	1.6 ± 2.3	2.2 ± 2.7	0.20
Computer usage (days/per wk)		3.5 ± 2.8	3.4 ± 2.8	4.1 ± 2.9	0.18
HP/tablet usage (days/per wk)		5.9 ± 1.9	5.9 ± 1.9	6.0 ± 2.0	0.73
Night sleep time (hrs.)		6.6 ± 1.2	6.6 ± 1.3	6.7 ± 1.0	0.45
Weekdays night sleep time		24/151	19/118	5/33	0.91
≥7 h/per night (yes/no)		(13.7%/86.3%)	(13.9%/86.1%)	(13.2%/86.8%)	
Weekends night sleep time		146/29	118/19	28/10	0.07
≥7 h/per night (yes/no)		(83.4%/16.6%)	(86.1%/13.9%)	(73.7%/26.3%)	
Afternoon nap (yes/no)		55/120	47/90	8/30	0.12
		(31.4%/68.6%)	(34.3%/65.7%)	(21.1%/78.9%)	
Food preparations					
Breakfast prepared by family (yes/no)		11/164	8/129	3/35	0.64
		(6.3%/93.7%)	(5.8%/94.2%)	(7.9%/92.1%)	
Lunch prepared by family (yes/no)		10/165	6/131	4/34	0.15
		(5.7%/94.3%)	(4.4%/95.6%)	(10.5%/89.5%)	
Dinner prepared by family (yes/no)		33/142	21/116	12/26	0.02*
		(18.9%/81.1%)	(15.3%/84.7%)	(31.6%/68.4%)	

[a] Normal: including normal-weight and underweight female adolescents.
[b] Overweight: including overweight and obese female adolescents.

difference between the groups; the normal weight group slept more during weekends compared with the overweight group ($p = .07$). Furthermore, a significantly higher proportion of the adolescents in the overweight group than in the normal weight group ate dinner prepared by family ($p = .02$; Table 1).

Discrepancies between perceived and BMI-determined weight status

We observed that 6.9%, 52.6%, 29.1%, and 11.4% of the adolescents subjectively perceived their weight status as underweight, normal weight, overweight, and obese, respectively, in the same group. Furthermore, 13.7%, 64.6%, 13.7%, and 8.0% of the adolescents were underweight, normal weight, overweight, and obese, respectively, based on their calculated BMI (Table 2). In the BMI-determined underweight group, the discrepancy between perceived weight status and the BMI-determined weight category was the highest when compared with other weight groups. Only 45.8% of the adolescents in the underweight group correctly recognized that they were underweight, whereas 50% of them perceived themselves as normal weight; one female adolescent believed that she was overweight. The accuracy of weight perception in this group increased with their body weight. The agreement between perceived weight status and the BMI-determined weight category was 70.8% for normal weight, 79.2% for overweight, and 85.7% for obese (Table 2).

Table 2
Comparison between Perceived Weight Status and BMI-determined Weight Category.

BMI-determined Weight Category (N/%)	Perceived Weight Status (N/%)				
	Underweight	Normal	Overweight	Obese	Total
Underweight	11/45.8%	12/50.0%	1/4.2%	0	24/**13.7%***
Normal	1/0.9%	80/70.8%	29/25.7%	3/2.7%	113/**64.6%***
Overweight	0	0	19/79.2%	5/20.8%	24/**13.7%***
Obese	0	0	2/14.3%	12/85.7%	14/**8.0%***
Total	12/*6.9%*	92/*52.6%*	51/*29.1%*	20/*11.4%*	175

Among the 175 participants, 53 (28.6%) failed to recognize their weight status based on their calculated BMI. Furthermore, the majority of them overestimated their weight categories (94.3% vs. 5.7%, Table 3). Up to 64.0% of the participants who overestimated their own body weight status were categorized as having normal weight based on their calculated BMI. Only 10% of the participants who overestimated their own body weight status were actually overweight based on their calculated BMI. The remaining participants who overestimated their own body weight status (26%) belonged to the "underweight" group based on their calculated BMI (Table 3).

Comparison of overweight adolescent and normal-weight adolescent dietary patterns

Table 4 lists the intake frequencies of the seven food categories among the participants in this study. The intake frequency ranged

Table 3
Percentage of overestimations or underestimations of one's weight status.

Perceiving w't Calculated-BMI	N/% in total	*UW*	*NM*	*OW*	*OB*	n/% in subgroup
Correct	122/69.7%					
UW		11				11
NM			80			80
OW				19		19
OB					12	12
Overestimate	50/28.6%					50/94.3%
UW			12	1		13/26%
NM				29	3	32/64%
OW					5	5/10%
Underestimate	3/1.7%					3/5.7%
NM		1				1/33.3%
OB				2		2/66.7%

UW: Underweight; NM: Normal weight; OW: Overweight; OB: Obese.

from 1.1 (SD = ±0.9) days per week for "cheese, fish, seafood, and organ meats" (FFQ 4) to 4.0 (SD = ±1.3) days per week for "vegetables, juices, and eggs" (FFQ 1). The overweight group significantly ate less food from the FFQ 4 category (cheese, fish, seafood, and organ meats) than did the normal group ($p = .04$). In addition, the discrepancy was even more significant when comparing the frequency of fish intake between different weight categories; the overweight group significantly ate less fish than did the normal group ($p = .02$).

Comparison of overweight adolescent and normal-weight adolescent stress levels

Among the six items included in the SRS, "fear of not keeping up with others in school" (SRS 2) had the highest total score (2.9 ± 0.9; Table 5); however, the score difference between the normal-weight and overweight groups was nonsignificant. The score of the factor "disturbances from parents and other family members" (SRS 3) differed significantly between the groups; the overweight group perceived significantly more stress from disturbances from parents and other family members than did the normal-weight group ($p = .03$). The scores of the following singular stress items differed significantly between the overweight and normal-weight groups: "fear of being ridiculed" (S7; $p = .01$), "fear of not knowing what to do after graduation" (S10; $p = .02$), "not having an adequate number of friends" (S22; $p = .02$), "having a friend talk about me behind my back" (S25; $p = .04$), and "not knowing how to make friends" (S29; $p = .04$; detailed results presented in Table 5).

Table 6 presents the results of the final model generated using logistic regression analysis. Both the index of Nagelkerke R^2 (0.29) and the p value of the Hosmer–Lemeshow GOF ($p = .67$) represented a good model fitting result. The overestimation of body weight was negatively correlated with overweight or obesity in the female adolescents in our study (odds ratio [OR]: 0.26, 95% confidence interval [CI]: 0.09–0.82). Age at menarche was negatively correlated with the risk of obesity or overweight (OR: 0.57, 95% CI: 0.14–0.98). In addition, the female adolescents who slept >7 h during nights on weekends were less likely to be obese or overweight (OR: 0.35, 95% CI: 0.13–0.93). By contrast, the adolescents who ate dinners prepared by family were more likely to be overweight or obese compared with those who were unable to eat family-prepared dinners (OR: 2.59, 95% CI: 0.99–6.82); however, this difference was only borderline significant ($p = .054$). Eating food items from the FFQ4 category (cheese, fish, seafood, and organ meats) was negatively correlated with the risk of overweight or obesity (OR: 0.54, 95% CI: 0.32–0.90). Although our univariate analysis revealed significant differences in the scores of the five stress items (S7, S10, S22, S25, and S29) between the overweight and normal-weight groups, the final regression model indicated that SRS 3 was the only significant stress factor associated with obesity. The adolescents who had a higher stress level from SRS3 (disturbances from parents and other family

Table 4
Food frequency questionnaire.

Factor	Item	Total	Normal	Overweight	p-value
FFQ 1		4.0 ± 1.3	4.0 ± 1.3	4.0 ± 1.1	0.83
Vegetables	F1	5.2 ± 1.8	5.2 ± 1.8	5.2 ± 2.0	0.85
Juices	F2	2.2 ± 2.0	2.3 ± 2.0	2.2 ± 2.0	0.81
Eggs	F16	4.6 ± 1.9	4.6 ± 1.9	4.5 ± 1.9	0.72
FFQ 2		1.3 ± 1.1	1.3 ± 1.1	1.3 ± 1.2	0.81
Milk	F3	1.9 ± 1.8	1.9 ± 1.8	2.1 ± 1.9	0.50
Yogurt	F4	0.9 ± 1.3	0.8 ± 1.3	1.0 ± 1.5	0.40
Yogurt drinks	F5	1.0 ± 1.3	1.1 ± 1.3	0.8 ± 1.3	0.25
FFQ 3		3.2 ± 1.2	3.2 ± 1.2	3.2 ± 1.2	0.85
Meats or fishes (poultry meats, pork, beef, and seafood)	F7	5.5 ± 1.8	5.5 ± 1.7	5.4 ± 1.9	0.85
Poultry meat	F8	3.6 ± 2.1	3.6 ± 2.0	3.7 ± 2.3	0.71
Pork	F9	3.1 ± 1.8	3.2 ± 1.8	3.0 ± 2.0	0.67
Beef	F10	1.8 ± 1.6	1.8 ± 1.7	1.8 ± 1.5	0.80
Fried foods (hamburgers, pizza, French fries, fried chickens)	F17	1.9 ± 1.3	1.9 ± 1.4	1.8 ± 1.1	0.79
FFQ 4		1.1 ± 0.9	1.2 ± 1.0	0.9 ± 0.8	0.04*
Cheese	F6	1.3 ± 1.5	1.4 ± 1.5	1.1 ± 1.4	0.37
Fish	F11	1.5 ± 1.4	1.6 ± 1.5	1.0 ± 1.1	0.02*
Seafood	F12	1.2 ± 1.3	1.3 ± 1.4	0.9 ± 1.1	0.17
Organ meats	F13	0.6 ± 1.1	0.7 ± 1.1	0.4 ± 0.9	0.15
FFQ 5		1.2 ± 1.1	1.3 ± 1.1	1.2 ± 1.1	0.71
Soy milks	F14	1.2 ± 1.6	1.2 ± 1.6	1.1 ± 1.4	0.85
Soy bean products	F15	1.8 ± 1.6	1.9 ± 1.6	1.7 ± 1.6	0.51
Nutritional supplements	F28	0.8 ± 1.7	0.8 ± 1.6	0.8 ± 1.8	0.96
FFQ 6		1.4 ± 1.1	1.5 ± 1.1	1.4 ± 1.1	0.70
Ice cream, sundae, ice cream bar	F18	0.7 ± 1.1	0.7 ± 1.0	0.7 ± 1.1	0.92
Sweetened drinks	F23	3.0 ± 2.1	3.0 ± 2.1	2.7 ± 1.9	0.40
Popsicle, smoothie, shaved ice	F24	0.7 ± 1.1	0.6 ± 1.0	0.7 ± 1.2	0.55
FFQ 7		2.2 ± 1.3	2.3 ± 1.3	2.0 ± 1.2	0.19
Disserts (cakes, pies, or western-style breads)	F19	2.1 ± 1.8	2.2 ± 1.8	1.9 ± 1.9	0.47
High-oil snacks (chips, rice crackers, corn flakes)	F20	1.8 ± 1.6	1.9 ± 1.7	1.3 ± 1.4	0.08
Instant noodles	F21	1.1 ± 1.3	1.1 ± 1.4	1.0 ± 1.1	0.51
Cookies	F22	2.7 ± 1.9	2.7 ± 1.9	2.5 ± 1.8	0.63
Sweets or chocolates	F25	2.6 ± 2.0	2.6 ± 2.0	2.5 ± 2.1	0.87
Snacks	F27	3.2 ± 2.1	3.3 ± 2.1	2.6 ± 1.7	0.04*

Table 5
Stress rating scale.

Factor	Item	Total	Normal	Overweight	p-value
SRS 1: Fear of being neglected or ridiculed		1.6 ± 0.8	1.5 ± 0.8	1.8 ± 0.8	0.06
Fear of not getting selected for a team, cheerleading, or other group	S6	1.5 ± 1.0	1.5 ± 1.0	1.6 ± 0.9	0.91
Fear of being ridiculed	S7	1.9 ± 1.2	1.8 ± 1.2	2.4 ± 1.3	0.01*
Having so little supervision that it is easy to get in trouble	S16	1.3 ± 0.7	1.3 ± 0.6	1.5 ± 0.8	0.15
SRS 2: Fear of not keeping up with others in school		2.9 ± 0.9	2.8 ± 0.9	3.0 ± 1.0	0.40
A particular teacher	S1	2.3 ± 1.2	2.3 ± 1.3	2.3 ± 1.1	0.68
A certain subject	S3	3.2 ± 1.2	3.2 ± 1.2	3.3 ± 1.1	0.43
Feeling less smart than others	S4	2.9 ± 1.3	2.9 ± 1.3	3.0 ± 1.5	0.62
Worry about failing	S5	3.1 ± 1.3	3.1 ± 1.3	3.2 ± 1.3	0.60
Fear of not living up to parents' or teachers' expectations	S8	2.9 ± 1.3	2.8 ± 1.3	3.0 ± 1.4	0.60
Fear of not getting into a good high school or college	S9	2.9 ± 1.4	3.0 ± 1.3	2.8 ± 1.4	0.47
Fear of not knowing what to do after graduation	S10	2.7 ± 1.3	2.6 ± 1.3	3.2 ± 1.2	0.02*
SRS 3: Disturbances from parents and other family members		1.4 ± 0.7	1.3 ± 0.6	1.7 ± 0.9	0.03*
Fear of parents' divorcing or remarrying	S11	1.5 ± 1.0	1.4 ± 0.9	1.8 ± 1.2	0.05
Other family member's hurting me	S13	1.3 ± 0.8	1.2 ± 0.6	1.6 ± 1.2	0.08
Fighting between parents	S18	1.5 ± 1.0	1.4 ± 0.8	1.7 ± 1.2	0.17
Having a friend my parents dislike or disapprove	S27	1.5 ± 0.9	1.4 ± 0.9	1.7 ± 0.9	0.05
SRS 4: Insecurity		1.9 ± 0.9	1.9 ± 0.8	2.1 ± 1.0	0.14
Not having enough clothes or other supplies	S14	2.2 ± 1.3	2.1 ± 1.3	2.4 ± 1.3	0.21
Not getting enough attention	S15	1.8 ± 1.1	1.7 ± 1.1	2.0 ± 1.2	0.30
Not getting enough affection or love	S17	1.6 ± 1.0	1.6 ± 1.0	1.7 ± 1.0	0.47
Illness of family members or self	S19	2.2 ± 1.1	2.1 ± 1.1	2.3 ± 1.3	0.33
Not knowing how to stand up for my rights	S30	2.0 ± 1.2	1.9 ± 1.2	2.2 ± 1.3	0.19
SRS 5: Being betrayed or losing a friend		2.0 ± 1.1	1.9 ± 1.1	2.4 ± 1.3	0.05
Losing a friend	S21	2.1 ± 1.3	2.0 ± 1.2	2.4 ± 1.3	0.06
Having a friend lie to me	S24	2.0 ± 1.2	1.9 ± 1.2	2.3 ± 1.4	0.11
Having a friend talk about me behind my back	S25	2.0 ± 1.2	1.9 ± 1.1	2.4 ± 1.4	0.04*
SRS 6 Difficulties in building a sustainable friendship		1.7 ± 0.8	1.7 ± 0.8	1.9 ± 0.8	0.08
Bully	S2	1.4 ± 0.8	1.4 ± 0.8	3.2 ± 1.2	0.55
Not having an adequate number of friends	S22	1.7 ± 1.0	1.6 ± 1.0	2.0 ± 1.0	0.02*
Having a friend reject me	S23	1.6 ± 1.0	1.6 ± 0.9	1.7 ± 1.0	0.43
Feeling unaccepted or disliked	S26	2.0 ± 1.2	1.9 ± 1.2	2.2 ± 1.2	0.21
Not knowing how to make friends	S29	1.9 ± 1.2	1.8 ± 1.2	2.3 ± 1.3	0.04*

members) were more prone to being obese or overweight (OR: 2.22, 95% CI: 1.28–3.86). We established a conceptual framework (Fig. 1) to demonstrate the correlations between each of the aforementioned factors and their contributions to obesity risk among our recruited female adolescents.

Discussion

To our knowledge, this is the first study to determine the contribution of a wide spectrum of factors, namely lifestyle-related behaviors, psychosocial stress, and weight overestimation, to the risk of overweight and obesity only in female adolescents. On the basis of weight status determined by the calculated BMI, the prevalence of overweight (21.7%) in the female adolescents in this study is comparable to that reported in a previous study (the prevalence was 13.7% and 8.0% for overweight and obesity, respectively) (Ni et al., 2019; Park, 2011a). Furthermore, the weight perception of 69.7% of the female adolescents in our study was in accordance with their body weight status based on their calculated BMI. This finding is in agreement with that reported by Khambalia et al. (2012); they indicated that nearly a third of adolescents did not perceive their body weight correctly and either underestimated or overestimated their body sizes (Khambalia et al., 2012).

Table 6
Logistic regression analysis of overweight status.

Predictors	B	SE	Odds ratio	95%CI	*p*
Overestimation of body weight	−1.34	0.58	0.26	[0.09,0.82]	0.021
Age of Menarche	−0.57	0.21	0.57	[0.14,0.98]	0.044
Weekends night sleep time >7 h/per night	−1.04	0.50	0.35	[0.13,0.93]	0.035
Dinner prepared by family	0.95	0.49	2.59	[0.99,6.82]	0.054
FFQ 4 *Cheese, fish, seafood, and organ meats*	−0.62	0.26	0.54	[0.32,0.90]	0.018
SRS 3 *Disturbances from parents and other family members*	0.80	0.28	2.22	[1.28,3.86]	0.005

In our study, we observed that the overestimation of body weight was negatively associated with overweight. In their systematic review, Haynes et al. (2018) reported that the overweight perception among children and adolescents was positively correlated with future weight gain. However, studies included in the systematic review have mainly focused on the perception of overweight instead of the overestimation of body weight (Haynes et al., 2018). In addition, a positive relationship between excessive weight gain and the overweight perception was noted only in the normal weight group; this relationship may not be observed in other participants with different weight statuses such as underweight or overweight (Cuypers et al., 2012; Klein et al., 2008; Sutin & Terracciano, 2015). The use of a more inclusive definition of weight overestimation instead of focusing only on the overweight perception may help gain in-depth knowledge regarding adolescents' weight perception and its relationship with obesity in this population (Cuypers et al., 2012; Duong & Roberts, 2014; Klein et al., 2008). A longitudinal study conducted by Liechty and Lee (2015) reported that weight overestimation was negatively correlated with overweight or obesity among female adolescents; this finding is similar to that of our study. However, due to the cross-sectional nature of this study, we could not infer a causal relationship between weight overestimation and the risk of future weight gain, as indicated by Liechty and Lee (2015). Their findings still supported our observation of a negative correlation between the overestimation of body weight and BMI in the female adolescents (Liechty & Lee, 2015).

Obesity is correlated with an earlier onset of puberty (Jasik & Lustig, 2008). In our participants, a negative relationship was noted between the risk of overweight and age at menarche. The later the female

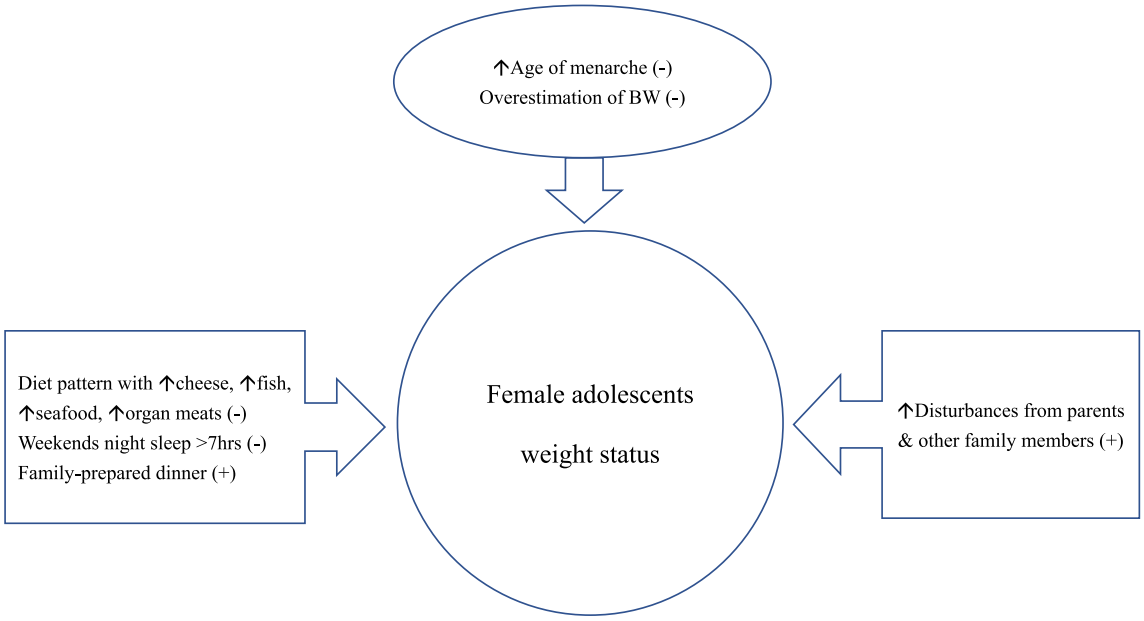

Fig. 1. Factors associated with the risk of obesity among female adolescents.

adolescents experienced their menarche, the lower their risk of excessive body weight. Although many lifestyle-related behaviors did not exhibit significant relationships with the odds of being overweight in the final model, we observed a significant inverse relationship between the total night sleep hours on weekends and the risk of overweight in the female adolescents. The Sleep Health Foundation (SHF) recommends that individuals aged 18 to 25 years should sleep 7 to 9 h per night (Hirshkowitz et al., 2015). Because the majority of our participants were high-grade students (70.9%, Table 1), their ideal night sleep hours should not be <7 h. However, only 13.7% of our participants had 7 h of sleep on weekdays, and 83.4% of them slept for >7 h at nights on weekends. Insufficient night sleep is a risk factor for obesity in adolescents and children (Fatima et al., 2015). Our study indicated that the adolescents who failed to have adequate night sleep even during weekends had a higher risk of overweight than did their counterparts.

Although previous studies have consistently reported a positive relationship between family meals and high dietary quality among youth, the protective effect of family meals on pediatric obesity remains undetermined (Glanz et al., 2021). In our study, a marginally positive association was noted between dinner preparations by family and the risk of obesity in the female adolescents ($p = .054$). In our study, we asked the adolescents regarding food preparations instead of the frequency of having dinners with their family (Fulkerson et al., 2014). Moreover, having dinner prepared by family may not be associated with the consumption of healthy foods but instead may result in the intake of more energy-dense foods if family members are used to buying processed or ready-to-serve meals from restaurants or supermarkets instead of cooking at home (Fulkerson et al., 2008; Neumark-Sztainer et al., 2003, 2014). Rollins et al. (2010) indicated that the protective effect of family meals on the risk of obesity may differ among children with varying racial, socioeconomic, and individual characteristics. Although more frequent family meals appeared to be protective of obesity in non-Hispanic Caucasian and non-Hispanic African American boys, it was linked to a higher risk of obesity in a group of Hispanic boys living in households with low educational levels. In addition, the protective effect of family meals appeared to be only limited in boys because no significant relationship was noted between the frequency of family meals and the risk of obesity in non-Hispanic African American girls or Hispanic girls from households with low education levels (Fulkerson et al., 2014; Rollins et al., 2010; Valdés et al., 2013). However, the related finding of our study may warrant further investigation because it may shed light on an opposite direction for the relationship between family meals and the risk of adolescent obesity. Moreover, future studies should investigate whether sex moderates the protective effect of family meals on childhood obesity.

The female adolescents who ate less food from the FFQ 4 category had a higher risk of overweight in our study. The results of univariate analysis (Table 4) revealed a significant difference in the frequency of fish intake between the overweight and normal weight groups. This result is in accordance with that of a previous study indicating that a traditional Chinese diet consisting of fish and seafood was negatively correlated with the risk of obesity among children and adolescents (Zhen et al., 2018). Although the protective effects of the consumption of cheese or organ meats on the risk of obesity remains undetermined, both of them are high-quality foods containing rich micronutrients with bioavailable effects essential for women of reproductive age (FAO, 2021; Mozaffarian, 2016). Our study indicated that female adolescents may experience both obesity and malnutrition if they eat less amounts of fish, seafood, cheese, and organ meats enriched with micronutrients essential for preparing them into their childbearing age (Alberga et al., 2012). In addition, the intake of low-quality foods would result in the consumption of a higher quantity of food, thus increasing the risk of obesity (Mozaffarian, 2016). Because female adolescents are expected to enter their childbearing age, researchers should focus more attention to this group in terms of their diet quality and obesity risk to prevent weight gain in the next generation, that is, their offspring.

Although we noted significant differences among the five stress items (S7, S10, S22, S25, and S29) between the overweight and normal weight groups in univariate analysis, the only significant stress factor correlated with obesity in the final regression model was SRS 3 (disturbances from parents and other family members). In the original SRS, those five stress items exhibiting a significant discrepancy between the overweight and normal weight groups appeared to be more centered on school performance and peer relationship (Table 5). By contrast, SRS 3 is more family oriented and concerned with stress caused by parents and other family members. Any discordance between one family subsystem, such as conflicts between couples, may exert

negative effects on other family subsystems, including parent–child or siblings' relationships; therefore, those four stress items were clustered within one factor. S11 and S18 were correlated with marital conflicts, and S13 and S27 indicated the discordance between adolescents and parents or between adolescents and other family members (Blodgett Salafia et al., 2014). Marital conflict, separation, or divorce between parents was observed to be correlated with a higher BMI among the adolescents. Thus, marital dissolution is not only detrimental to children's psychological well-being but also harmful for their physical health and can lead to childhood obesity (Biehl et al., 2014; Goisis et al., 2019; Yannakoulia et al., 2008). Children experiencing conflicts between parents were more prone to becoming overweight or obese (Goisis et al., 2019). Moreover, preadolescents in divorced families were more likely to consume sugar-sweetened beverages and skip breakfasts compared with their counterparts in married families (Mauskopf et al., 2015).

Conflicts between parents and adolescents appear to be a unique source of stress associated with obesity (Darling et al., 2019). Although peer relationships are crucial during adolescence, parental refusal or rejection was more significantly correlated with emotional eating among adolescents compared with peer rejection (Vandewalle et al., 2017). When disturbed by conflicts with parents, adolescents tend to engage in a more stress-induced and obesogenic eating pattern and experience excessive weight gain (Dimitratos et al., 2022). By contrast, a solid parent–adolescent relationship may interrupt the negative effects of marital dysfunction even under stress from discordance between parents. Adolescents who had a better mother–child or father–child relationship engaged in fewer disorderly eating practices (Blodgett Salafia et al., 2014). The results of previous studies support our finding that stress generated from different family subsystems (father–mother, father–adolescent, mother–adolescent, or adolescent–other family members) may be aggregated or clustered and exert negative effects by increasing the risk of obesity among adolescents.

Limitations

Although this study provides rich information regarding a wide range of correlates contributing to the risk of obesity in the female adolescents, it has some limitations that must be addressed. First, the cross-sectional nature of this study prevented us from determining the causal relationship between risk factors and the risk of obesity in our study population. Second, adolescents' height and weight were self-reported instead of being measured in our study; this may raise additional concern while interpreting our findings. However, self-reported height and weight have been found to be highly correlated with objectively measured height and weight in community samples (Pursey et al., 2014). Moreover, self-reported height and weight have been observed to be well correlated with measured height and weight among adolescents (Berge et al., 2015; Himes et al., 2005). Furthermore, the prevalence of overweight and obesity observed in our study is in accordance with those reported in previous studies (Ni et al., 2019; Park, 2011a). The accuracy of self-reported height and weight in female adolescents was higher than that in their male counterparts (Dalton 3rd et al., 2014). Because all the participants in this study were nursing students, they may more precisely predict their anthropometric measurements. Third, all the participants were from the same college located in northern Taiwan; this may prevent the generalization of study findings to other populations. However, the uniqueness of our study, such as the inclusion of a unique set of risk and protective factors correlated with the risk of obesity in an exclusive group of female adolescents, is irreplaceable and might be beneficial for future research in this specific population.

Prospective practice and research implications

An extensive range of correlates, including demographic factors, lifestyle-related behaviors, weight overestimation, and psychosocial stressors, were associated with obesity risk among the participants, who were exclusively female adolescents. The intertwined nature of obesity-related factors warrants future investigations to elaborate their association with obesity risk. Moreover, multicomponent interventions should be developed, and nurses and health-care providers should focus their obesity prevention efforts on this specific population. Future studies may benefit from adopting a theoretical framework such as ecological systems theory to confirm the effectiveness of interventions for this specific population (Bronfenbrenner, 1979). The multifaceted nature of the ecological model may inform the design of interventions for obesity prevention among female adolescents (Davison & Birch, 2001).

Conclusion

This study determined factors correlated with the risk of obesity in the female adolescents. The female adolescents who overestimated their body weight; had a later onset of menarche; slept more during weekends; and ate more cheese, fish, sea food, and organ meats were less likely to be overweight. Furthermore, the female adolescents who more frequently ate family-prepared dinners and experienced stress from their parents and family members were more likely to be overweight. Future studies incorporating both lifestyle-related behavioral and psychosocial factors while examining potential contributors to obesity risk are warranted. Although this study supports the adoption of multicomponent interventions for obesity prevention, the intertwined nature of obesity-related factors warrants future investigations to elaborate their roles interplaying with the risk of obesity. Female adolescents, being the most affected group with the highest prevalence of obesity, should receive the utmost attention from nurses and health-care providers to alleviate the health burden caused by obesity.

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Declaration of Competing Interest

The authors have no conflicts of interest to disclose.

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