

The associations among unhealthy eating habits, bad eating experiences and depression in Taiwanese youths

PEI-CHEN CHU¹, MEI-HSIN SU¹, HAO-JAN YANG^{2,3}, PO-HSIU KUO^{1,4,*}

Objectives: Depression is prevalent in children and adolescents. We investigated whether unhealthy eating habits and eating preferences are associated with depression in Taiwanese youth. **Methods:** 549 students aged 10-13 years were enrolled from elementary and junior high schools in Taiwan. Using the Center for Epidemiologic Studies Depression Scale, three groups of depression were defined: depression (a score > 21), moderate depression (a score between 15-21) and normal (a score < 15) groups. We assessed irregular meal time, bad eating experiences, unhealthy eating habits and dietary preferences as their eating behaviors. Chi-square or ANOVA was used for group comparisons. Multivariate logistic regression was used to examine the relationship between eating behaviors and depression. **Results:** Unhealthy eating habits were common, ranged from 47.6% (midnight snack eating) to 70.5% (sugared beverages drinking). Taiwanese youth had on average 3.1 times per week of having irregular meal time. Depression group (N=71, 14.4%) reported to have more irregular eating meal time ($p=0.005$), unhealthy eating habits ($p<0.05$ except for snack eating and sugar beverages drinking), and bad eating experiences to influence appetites ($p<0.05$ except for appetite influenced by snack) than moderate depression (N=77, 14.6%) and normal (N=379, 71.9%) groups. The risk of depression or moderate depression increased with higher numbers of unhealthy eating habits (OR_{adj} ranged from 2.17-6.33) and bad eating experiences to influence appetites (OR_{adj} ranged from 1.79-16.5), with the irregular eating behavior subgroup showed a trend for a higher risk on depression. Additionally, students who had less preference for vegetables tended to be more depressed ($p=0.018$). **Conclusions:** Commonly observed unhealthy eating behaviors are associated with higher risk of depression in youths. Interventions toward healthy eating behaviors could be considered as potential promoting strategies to reduce the burden of depression among children and adolescents. (*Taiwan J Public Health*. 2015;34(3):254-267)

Key words: irregular diet, eating behaviors, eating preference, depression

¹ Institute of Epidemiology and Preventive Medicine, National Taiwan University, No. 17, Xu-Zhou Rd., Zhongzheng Dist., Taipei, Taiwan, R.O.C.

² School of Public Health, College of Health Care and Management, Chung Shan Medical University, Taichung, Taiwan, R.O.C.

³ Department of Family and Community Medicine, Chung Shan Medical University Hospital, Taichung, Taiwan, R.O.C.

⁴ Research Center for Genes, Environment and Human Health, College of Public Health, National Taiwan University, Taipei, Taiwan, R.O.C.

* Correspondence author.

E-mail: phkuo@ntu.edu.tw

Received: Nov 13, 2014

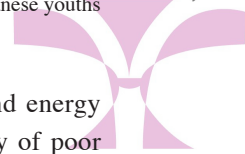
Accepted: Apr 17, 2015

DOI:10.6288/TJPH201534103126



INTRODUCTIONS

Increased prevalence in mental health has coincided with modernization over the past few decades and is associated with unhealthy eating behaviors [1]. Findings from large-scale surveys have shown that three quarters of psychiatric disorders ever occur in adolescence or early adulthood [2], which is the critical stage in human growth. There were more than 22% of adolescents aged 13 to 18 year-old experienced severe impairment and/or distress, and 8.7% had major depressive disorder or dysthymia in the National Comorbidity Survey Replication



study [3]. In Asian populations, similar figures have been reported that depressive mood represents the most prevalent mental health problem among adolescents. Fifteen percent of Chinese junior high school students were found to suffer from depression [4]. In Japan, 14.9% of youths aged 5 to 15 year-old experienced depressive symptoms [5]. Taiwanese children aged 9-12 year-old, 24% reported to suffer from probable depression and 4.2% from clinical depression [6]. With such prevalent mental health issue in youth, many risk factors have been investigated and identified to explain the increasing trend of depression among children and adolescents worldwide [7].

A number of studies have suggested that the dietary pattern could influence on depressive mood. For instance, a Mediterranean dietary pattern was considered to be protective of depressive disorders in a large cohort study with 10,094 adults [8]. Healthy dietary pattern with frequent consumption of vegetables and fruits has shown to be associated with fewer depressive symptoms in elderly women in France [9]. Relatively, there are fewer studies conducted to explore the relationship between dietary pattern and depression in Asian youth. A population-based study in Australia reported that a more Western dietary pattern (i.e. high intakes of red and processed meats, take-out foods and refined foods) was associated with poorer mental health in youngsters aged 13 to 15 year-old [10]. Although dietary pattern varies widely in different cultures and populations [8,9,11], it is generally considered a preference towards eating more vegetables or fruits would reduce the risk for developing depression.

In addition to dietary pattern, eating habits and experiences are other relevant factors that were reported to be associated with depressive mood. Birch et al. addressed the importance of eating behaviors which could be influenced

by food preferences, food intake, and energy regulation in children [12]. A variety of poor eating behaviors, such as irregular eating, skipping meals, eating unhealthy snacks, or drinking sweetened beverages can indirectly lead to adverse health consequences, including glucose fluctuation, lipid accumulation and obesity [13,14]. In a prospective study with 3,040 Australian adolescents, a composite diet score was created by combining eating behaviors and food consumption [15]. A higher diet score is an indication of a more healthy diet behavior which representing a habit with more days eating breakfast, higher frequency of vegetables and fruits consumption, and less frequency of consumption of after school snacks (such as biscuits, potato chips and fried foods). Their results showed that low diet scores at baseline were predictive of poor mental health status at 2 years of follow-up [15]. In addition, one cross-sectional study with samples of early adulthood (on average of 20 years old) in Mexico reported associations between several eating behaviors and depression. Individuals who had difficulty in keeping mealtime, stopping eating, constantly feeling hungry, binge eating or snack eating reported to have increased risk for depression [16]. Another large study using adult samples in Finland found that consumption of more sweet energy dense food was associated with more depressive symptoms [17]. The above observations suggest that studying the influence of eating behaviors on emotional distress and a systematic assessment for unhealthy eating behaviors among youth is highly desirable.

Comparing to recording dietary content to allocate detailed dietary patterns, it may be more reliable to assess eating behaviors in adolescents. A recent health survey by the Health Promotion Administration in Taiwan reported that about a quarter of youth didn't eat breakfast every day, and at least 20% of

youths eat lunch or dinner at irregular time or skipping the meals [18]. Other study conducted by Lazarevich et al. specifically addressed the risk of irregular mealtime for depression[16]. Another cross-sectional study, which collected 4,734 middle and high school students, reported that more meal-skipping times (including breakfast, lunch and dinner) were significantly correlated with higher depression level [19]. It is apparent that unhealthy eating behaviors are prevalent and are important risk factors to be considered in the Western world as well as in Asian societies [1,15]. Therefore, this present study is to explore whether unhealthy eating behaviors and experiences have adverse impacts on increasing the risk for depression among Taiwanese youth.

The collected data in our study were depression scale and several eating related variables, including diet at regular time, eating behaviors (including unhealthy eating habits and bad eating experiences to influence appetites), and dietary preferences in children and adolescents. We first aimed to evaluate the prevalence of unhealthy eating behaviors among youths aged 10 to 13 year-old in Taiwan. Secondly, we investigated the associations between depression and eating behaviors and dietary preference. And lastly, a join effect of eating behaviors and diet at regular time on depression was examined.

MATERIALS AND METHODS

Participants

Our study was approved by the Institutional Review Board of National Taiwan University Hospital. We enrolled 5th grade students in elementary schools, and 7th grade from junior high schools. Reasons for selecting students from 5th and 7th grades are because of their capabilities to fill out and complete the study questionnaires. Eight administrative

areas within the five cities in Taiwan, two in north (New Taipei and Taipei cities), and three in central Taiwan (Taichung, Changhua and Nantou cities) were used for stratified cluster sampling to recruit students from elementary and junior high schools. In total, 1386 students were ascertained in the sampling list from selected schools, 825 (59.52%) refused to participate or absent on the day of our survey. Therefore, only 561 students who returned the survey questionnaires, including 265 boys and 296 girls were our study population. Among them, 12 students (2.1%) gave incomplete responses in the questionnaire and thus were excluded in the analysis. We found no gender and age differences in participated and non-participated students ($p>0.05$).

Measurements

The CES-D (Center for Epidemiologic Studies Depression Scale) was used to assess depressive mood in our study [20]. The CES-D consists of 20 items with a four-point rating scale ranging from “0” (never or few) to “3” (usually). A cut-off of 21 was considered as depression, and a score less than 15 was defined as in the normal range. Thus, we classified students into three groups, depression, moderate depression, and normal groups. The sensitivity and specificity of CES-D had been validated previously in 2,465 young adolescents with good sensitivity of 0.85 and specificity of 0.77 [21]. The Chinese version of the CES-D in Taiwanese adolescents was tested to have good psychometric properties [22], including excellent one-week test-retest reliability (intra-class correlation reliability = 0.93) and good internal consistency (Cronbach’s $\alpha=0.90$). In our study, the internal consistency of the CES-D among the participating youths was also good (Cronbach’s $\alpha=0.90$).

Questions related to eating behaviors and dietary preferences were assessed using a

questionnaire modified from a survey conducted by the Bureau of Health Promotion in Taiwan in 2009. The questionnaire comprised items asking about diet at regular meal time, dietary preference and eating behaviors (unhealthy eating habits and bad eating experiences to influence appetites); these four main eating related categories were employed. Furthermore, we defined a regular meal time should be before 8:00 a.m. for breakfast, 13:00 p.m. for lunch and 19:00 p.m. for dinner in school students. If a meal is consumed later than the designated time, it was considered as eating at irregular meal time. Data on each of the 21 meal time during one typical week in the most recent month were collected, and the average frequency of the meals eaten at regular time in a week was calculated, which could range from 0-21. Moreover, we used the median (18 meals) as a cut-off to define students as having regular meal or irregular meal groups.

Eating behaviors consisted of two parts, unhealthy eating habits and bad eating experiences to influence appetites. Unhealthy eating habits included items related to imbalance diet (extreme vs non-extreme), snack eating, midnight eating and sugared beverages drinking, which were dichotomized into yes or no in the analysis. Bad eating experiences to influence appetites asked the frequency of eating related experiences a student had in the recent one month, including normal meals replaced by snacks, appetites influenced by snacks, appetites influenced by emotional disruption, and appetites influenced by sleep disturbance. Frequency of these bad eating experiences to influence appetites was designated as always, sometimes, or seldom/never. The answers of always and sometimes were then aggregated to represent having bad eating behaviors, while the answer of seldom/never was considered as not having bad eating behaviors.

Items for dietary preference were classified according to food categories, these include grains, vegetables, fruits, dairy, meat, seafood, and nuts with a three-level liker-scale (liking, so-so and disliking). The answers of so-so and disliking were aggregated together to be compared with liking. Subjects who could not eat a specific food category (e.g. due to allergy) or never eaten were coded as missing for such question.

Statistical analysis

Participants with more than 3 missing items in CES-D were excluded from analysis (N=22, 4.0%). For those with missing items less than 3, the values of missing items were replaced by the means. Descriptive data comparisons among the three groups (depression, moderate depression, and normal) were performed by chi-square or ANOVA test whenever it was suited, including demographic variables, meal at regular time, dietary preference and eating behaviors.

For investigating the relationship between eating behaviors and depression, we compared students who were in the depression (71, 13.5%) versus normal (379, 71.9%) groups, and moderate depression (77, 17.6%) versus normal groups. We also adjusted school grade and city district in the regression models. We used multivariate logistic regression to obtain odds ratios (OR) with 95% confidence interval (CI) to explore the effects of eating behaviors on depression. Because there were four items each for the two eating behaviors: unhealthy eating habits and bad eating experiences to influence appetites, accumulated behavior numbers were obtained (ranged from none to 'three or above') and a dose-response analysis was performed to evaluate the effect of eating behaviors on depression. In addition to main effects of eating behaviors, we further considered the influence

of eating meal at regular/irregular time and the interaction terms of regular meal time and numbers of eating behaviors were added in the regression models with the adjustment of grade, gender and district.

The combined information of “imbalanced diet” in the category of unhealthy eating habits and “dietary preference” allowed us to explore more detailed relationships between the two. Thus, polychoric correlation and chi-square test were used to examine the associations among dietary preference, imbalanced diet and depression in all participants. Furthermore, we used multivariate logistic regression to explore the effects of dietary preference on depression while adjusting for grade, gender and district.

RESULTS

Five hundred forty nine students (260 boys, 289 girls) provided complete questionnaire data. Table 1 presented demographic characteristics of these participants by gender. This study population consisted of higher proportion of 5th grade (75%) students and from cities in the central Taiwan (65%). Boys and girls showed no

significant differences in grade and district. We found 14.4% of the total students were in the depression group, and the proportion was similar among boys and girls.

Results of the comparisons between the depression, moderate depression, and normal groups are shown in Table 2. The three groups were not differed in gender and district. We observed that higher depressive levels were associated with irregular meal time ($p=0.021$); in particular, the depressed group had less regular meal time than normal group ($p=0.0001$). For unhealthy eating habits, the three groups were differed in numbers of unhealthy eating habits ($p=0.0001$), with the depression group having more extreme imbalanced diet ($p=0.005$), higher chance to consume midnight snacks ($p=0.013$) and sugared beverages drinking ($p=0.021$) than the other groups. For bad eating experiences to influence appetites, the three groups were also differed in numbers of bad eating experiences to influence appetites ($p=0.0001$), with the depressed group having higher frequency on normal meal replaced ($p<0.0001$), and appetite influenced by emotion ($p<0.0001$) and sleep ($p<0.0001$).

Table 1. Demographic characteristics and CES-D results of students by genders

Variable	Boy N=260 N, (%)	Girl N=289 N, (%)	Total N=549 N, (%)
Grade			
5 th (10-11 years)	198 (48.4)	211 (51.6)	409 (74.5)
7 th (12-13 years)	62 (44.3)	78 (55.7)	140 (25.5)
District			
Northern	85 (46.2)	99 (53.8)	184 (34.9)
Central	175 (47.9)	190 (52.1)	365 (65.1)
CES-D ^a			
Normal	178 (71.8)	201 (72.0)	379 (71.9)
Moderate depression	40 (16.1)	37 (13.3)	77 (14.6)
Depression	30 (12.1)	41 (14.7)	71 (14.4)

^a Depression group had CES-D score > 21; moderate group had CES-D score 15-21; normal group had CES-D score < 15.

Table 2. Demographic characteristics and eating related variables in the three subgroups

		Normal	Moderate depression	Depression	
Variable		N=379	N=77	N=71	p-value
		N, (%)	N, (%)	N, (%)	
Gender	Boy	178 (46.9)	40 (51.9)	30 (42.3)	0.291
	Girl	201 (53.0)	37 (48.1)	41 (57.7)	
Grade	5th (10-11 years)	286 (75.5)	47 (63.5)	53 (74.5)	0.049
	7th (12-13 years)	89 (23.5)	27 (36.5)	18 (25.4)	
District	Northern	125 (32.9)	21 (27.3)	28 (39.4)	0.710
	Central	254 (67.0)	56 (72.7)	43 (60.6)	
Meal at regular time (meal per week, mean \pm SD)		18.5 \pm 2.8	17.1 \pm 2.0	16.4 \pm 3.9	0.021
<i>Unhealthy eating habits</i>					
None or One of them		172 (45.7)	19 (24.7)	10 (14.1)	0.001
Two of them		100 (26.6)	32 (41.6)	30 (42.3)	
Three of them or above		104 (27.7)	26 (33.8)	31 (43.7)	
Imbalanced diet					
extreme		20 (5.4)	9 (12.0)	9 (12.9)	0.005
non extreme		348 (94.6)	68 (88.0)	61 (87.1)	
Midnight snack					
yes		164 (44.4)	40 (52.0)	44 (63.8)	0.013
no		205 (55.6)	37 (48.0)	25 (36.2)	
Snack eating					
yes		214 (57.9)	54 (69.9)	46 (68.7)	0.117
no		150 (40.7)	23 (31.1)	21 (31.3)	
Sugar beverages drinking					
yes		253 (66.8)	56 (72.4)	58 (84.1)	0.021
no		121 (31.9)	21 (27.6)	11 (15.9)	
<i>Bad eating experiences to influence appetites</i>					
None		341 (90.2)	41 (53.2)	31 (43.7)	0.001
One of them		23 (6.1)	19 (24.8)	14 (19.7)	
Two of them		8 (2.1)	11 (14.3)	17 (23.9)	
Three of them or above		6 (1.6)	6 (7.8)	9 (12.7)	
Normal meal replaced by snack and drinking					
not usually		370 (97.6)	73 (94.8)	63 (88.7)	<0.0001
usually		8 (2.1)	4 (5.2)	8 (11.3)	
Appetite influenced by snack					
not usually		358 (94.5)	72 (93.5)	62 (87.3)	0.057
usually		19 (5.0)	5 (6.5)	9 (12.7)	
Appetite influenced by emotion					
not usually		363 (95.8)	72 (93.5)	47 (66.2)	<0.0001
usually		14 (3.7)	5 (6.5)	24 (33.8)	
Appetite influenced by sleep					
not usually		371 (97.9)	69 (89.6)	61 (85.9)	<0.0001
usually		7 (1.8)	8 (10.4)	10 (14.1)	

Results of the effects of eating behaviors and their interaction terms with regular diet on depression are listed in Table 3. For unhealthy eating habits, students who had regular meal time and had no unhealthy eating habits were treated as the reference group. For bad eating experiences to influence appetites, students who had regular meal time and had no bad eating experiences to influence appetite were treated as the reference group. We found that the risk of depression among youth was increased with higher numbers of unhealthy eating habits (ORs ranged from 2.26 to 6.33) and bad eating experiences to influence appetites (ORs ranged from 1.82 to 16.5) regardless of having regular

meal time or not. Similar trend was found for the comparison between moderate depression and normal groups. The risk of moderate depression among youth was increased with higher numbers of unhealthy eating habits (ORs ranged from 2.17 to 5.34) and bad eating experiences to influence appetites (ORs ranged from 1.79 to 15.3) regardless of having regular meal time or not. Moreover, the risk of depression was slightly but not significantly increased when students had irregular meal time compared with those who have regular meal time.

Correlations between dietary preference and imbalanced diet are displayed in

Table 3. The effects of numbers of unhealthy eating behaviors on depression using multivariate logistic regression models

Variable	Regular eating OR _{adj} (95% CI)	Irregular eating OR _{adj} (95% CI)
<i>Depression vs. normal</i>		
Unhealthy eating habits (N)		
None or One of them (182) ^a	1.00	2.26 (1.3-4.00)
Two of them (130)	3.90 (1.7-9.0)	6.16 (3.0-13.1)
Three of them or above (135)	4.07 (1.8-9.1)	6.33 (3.1-13.2)
Bad eating experiences to influence appetites (N)		
None (372)	1.00	1.82 (1.0-3.30)
One of them (37)	6.41 (3.0-13.5)	8.23 (4.0-16.6)
Two of them (25)	8.72 (2.8-27.7)	10.5 (3.8-31.0)
Three of them or above (15)	14.7 (3.3-65.6)	16.5 (4.3-68.9)
<i>Moderate Depression vs. normal</i>		
Unhealthy eating habits (N)		
None or One of them (191) ^a	1.00	2.17 (1.3-3.02)
Two of them (132)	3.50 (1.2-8.1)	5.09 (3.1-9.1)
Three of them or above (130)	3.67 (1.8-7.2)	5.34 (3.2-10.6)
Bad eating experiences to influence appetites (N)		
None (382)	1.00	1.79 (1.2-3.28)
One of them (42)	7.01 (3.1-14.7)	8.44 (4.2-17.6)
Two of them (19)	8.58 (3.8-22.7)	11.1 (4.9-28.1)
Three of them or above (12)	12.7 (4.7-50.6)	15.3 (6.3-61.9)

Note: Regression models included the main effects of unhealthy eating behaviors and their interaction terms with irregular eating while adjusted for grade, gender and district. All of the testing terms were significant.

^a For unhealthy eating habits, due to very few subjects in the category of “none”, we combined the two lower categories as having none or one unhealthy eating habits.

OR_{adj}: adjusted odds ratios.

Table 4. Imbalanced diet had significantly negative correlations with dietary preference of vegetables ($p<0.0001$), fruits and nuts ($p<0.05$). We also examined the correlations of food preference with depression. We found that the preference of eating vegetables was also negatively correlated with depression (correlation coefficient= -0.17, $p=0.018$) in Table 4. Results of regression models showed that adolescents who like to eat vegetables had reduced risk for depression ($OR=0.40$, 95% $CI=0.16-1.02$), though the effect did not reach statistical significance ($p=0.055$).

DISCUSSIONS

Our current study investigates the relationship between unhealthy eating behaviors and depression. We found that one out of seven students is classified in the depression group, and unhealthy eating behaviors are quite common in youth in Taiwan. They exhibited on average 3.1 times per week of having irregular meal time, and about half reported unhealthy eating habits (including midnight snack eating, snack eating and sugar beverage drinking). Comparing with normal group, depression students have more irregular meal time, unhealthy eating habits, and bad eating

experiences to influence appetites. With such an irregular eating behavior further demonstrates a trend toward higher risk for depression when combining with other unhealthy eating behaviors. Students who have less preference for vegetables also tend to be more depressed.

Depression is an important mental health issue in youths worldwide. In the present study, the CES-D was used to define depression group and 14.4% of young students fell into the depression group. The Nutrition and Health Survey among 1,126 junior high school students in Taiwan in 2010 reported that 10.6% students were found to have moderate or severe emotional disturbances using the Brief Symptom Rating Scale [23]. Despite of different assessment tools, it is fair to say that the prevalence of depression has not been decreased in the past few years in Taiwan. Therefore, to search for an easy, feasible and accessible strategy to prevent youth from developing depression at early ages is important and critical. Thus, in young children and adolescents, exploring the relationship between eating behaviors and depression may provide clues to design new prevention and intervention strategies for reducing the risk of developing depression.

Table 4. The relationships between dietary preferences, imbalanced diet and depression

Variable	Imbalanced Diet		Depression		
	Polychoric correlation	p-value	Polychoric correlation	p-value	OR_{adj} (95% CI)
Grains	-0.059	0.291	-0.031	0.363	NA
Vegetables	-0.460	<.0001	-0.169	0.018	0.40 (0.16-1.02)
Fruits	-0.196	0.035	-0.046	0.710	1.59 (0.19-14.3)
Dairy	-0.061	0.290	-0.018	0.423	0.47 (0.17-1.28)
Meat	0.128	0.888	-0.046	0.710	0.77 (0.30-1.96)
Seafood	-0.030	0.390	-0.082	0.169	0.56 (0.24-1.32)
Nuts	-0.214	0.016	-0.096	0.882	1.52 (0.72-3.13)

Note: The number of disliking grains is too small to estimate its effect on depression.

The effects (OR_{adj}) of dietary preference on depression were analyzed using logistic regression models while adjusted for grade, gender and district.

Poor eating behaviors are found to be common in youths. In Taiwan, high percentage of youths of 12-17 year-old had irregular meal time [18], i.e. 18.7% for breakfast, 9.5% for lunch and 17.9% for dinner. Increased prevalence of not eating breakfast has been observed from 2001 to 2009 in Taiwan [24,25]. Among elementary students, the percentage was 0.2% in year 2001, but rose to 0.9% in 2009. It is even higher (2.6%) among older adolescents. In our study, we found that irregular eating behavior is a popular phenomenon. Students answered to have on average 3.1 meals per week (ranged from 1 to 8.5) eating at irregular time. Furthermore, youths in the depression and moderate depression groups had more frequent irregular diet than normal group ($p=0.0021$). A similar finding is also reported among Korean students that irregular diet exhibited an increased risk ($OR=2.44$, 95% $CI=1.00-5.93$, $p=0.04$) for depression [26]. Irregular diet has been suggested to cause blood glucose imbalance, which may indirectly resulted as adverse effects on emotion [27]. Therefore, to promote a healthy dietary behavior with eating at regular time and no skipping meals may be an important step for depression prevention in youths.

Other unhealthy eating behaviors are also found to be associated with depression in our study, such as snack eating and sugared beverages drinking. In year 2001, 56.0% elementary school students in Taiwan have habits of midnight snack eating according to the Nutrition and Health Survey [24]. The current study found that 63.8% of depressed group has midnight snack eating habits compared with 44.4% in the normal group ($p=0.003$). This finding is similar to results reported in China that surveyed 5,003 adolescents aged 11-16 years [28]. They found that adolescents in the highest tertile of dietary pattern scores (with snack eating) had more serious psychological

symptoms ($OR=1.64$; 95 % $CI=1.30-2.06$). A study in Mexico with individuals of early adulthood also reported that frequent snack eating significantly increased the risk for depression ($OR=2.09$; 95% $CI=1.42-3.09$) [16]. Similar adverse effect is observed for sugared beverages drinking. We found that the prevalence of sugared beverages drinking was 84.1% in depression group, 72.4% in moderate depression group versus 66.8% in the normal group ($p=0.021$). Even in elder adults, drinking sweetened-beverages is also associated with higher depression risk ($OR=1.30$; 95% $CI=1.17-1.44$) in 263,925 US adults with mean age of 61.3 years [29].

One of the explanations for the influences of unhealthy eating behaviors on depression is through appetites fluctuations. The habit of snack eating or sugared beverages drinking might have impacts on appetites for regular meals. Bad eating experiences to influence appetites (such as appetite influenced by snacks and normal meal replaced) also seem to have cumulative effects on the risk of depression (Table 3). Students in either of the moderate depression or depression group have exhibited higher proportion of reporting bad eating experiences than those in the normal group. Changes in appetites and poor diet quality are in relation to the risk of depression. Kuczmarski et al. observed that poor diet quality had significant effect on depression in adults in the African-American and Caucasian populations [30]. Changes in appetite is considered one of the common symptoms in the diagnostic criteria of depression in children and adolescents [31], which is often characterized by increased or diminished food intake, and is in relation to a decline in diet quality [32]. Therefore, maintaining good eating behaviors and good diet quality may be important indicators for depression prevention.

To assess food intake and dietary pattern,

food frequency questionnaire is a commonly used tool in the literature. However, it is relatively difficult to assess food intake in adolescents and only a limited number of validation studies are conducted for such assessment [33,34]. In the present study, alternatively, we used dietary preference to represent the tendency of imbalanced diet and consumption of specific food items. Past studies found that the consumption of high intake of fast food and processed pastries were associated with depression [35]. Verger et al. reported that low consumption of fruits and vegetables was associated with an increased risk of depressive disorders [36]. Another study in 3,040 Australian adolescents (aged 11-18 years) found that balance diet and regular eating were correlated with better mental health status [15]. Diet quality is also reported to be associated with internalizing disorders [37]. A large prospective study in 3,757 Canadian youths assessed diet quality to include nutrient intake and dietary habits found that children with greater diet variety and better diet quality exhibit lower rates of internalizing disorders during follow-up (incidence rate ratio= 0.45) [37]. Findings in our study are in concert with these previous investigations that imbalance diet increased the risk of depression. In adults, depressive symptoms are also negatively correlated with the consumption of more vegetables/fruits and non-sweet food [17]. In addition, students who dislike eating vegetables showed 2.5-fold increase for the risk of depression. Even among older adults, results in a prospective study using CES-D to assess depression showed that people who consumed vegetarian diets had healthier mood states [38]. A possible explanation points to specific nutrients in certain food items. The common dietary components in vegetables are vitamin B6, B12 and folate [39], which are found to be negatively correlated with

depressive symptoms [40,41].

In summary, the current study provided empirical evidence and showed that regular diet (eating meal at regular time) and healthy eating behaviors are associated with reduced risk of depression in youths, regardless the magnitude of depression levels. Promoting healthy eating behaviors may be one of the actionable exercises for children and adolescents to maintain healthy mental status, the behavior modification could be such as eating meals at regular time, less sugared beverages and eating more vegetables. With the ever growing modernity and high density of convenience stores in most of the major cities in Taiwan [42] as well as big cities in other countries, it's very convenient for youths to buy and consume sugared beverages and snacks. Government agencies should pay more attention on nutrition education in schools and shall target on enhancing children's awareness on healthy food choices, such as daily recommended intake and nutrition labelling [43]. On the other hand, the advertisement of sugared beverages and snacks in public media need to be monitored or restricted [44]. A campaign for improving healthy eating behaviors in youth can be recommended for reducing the risk of developing depression.

There are several limitations in interpreting the results of this study. First, participation rate is not high (around 40%) in our study. Although there are no significant differences in gender and age distributions between participated and non-participated students, we cannot be sure whether the non-participants have the same distributions of depression and eating behaviors as the participants. Second, we assessed depression using self-report questionnaire rather than clinical diagnosis. Our results may not be generalizable to clinical patients with major depressive disorder. Third, we did not use any

validated tools for the assessment of eating related behaviors. Detailed consumptions of food portions are not available in the current study. It is not easy to gather data in youths regarding the frequency of eating behaviors and the consumptions of specific food items without a food frequency questionnaire and 24 hours food recall. A more comprehensive questionnaire for dietary pattern and eating behaviors that are tailored for children and adolescents in future study might better elucidate their relationships with depression.

ACKNOWLEDGEMENTS

This research was supported by Ministry of Science and Technology (NSC101-2314-B-002-184- MY3) grant to Dr. P-H Kuo (PI) and Ministry of Science and Technology (NSC99-2511-S-040- 004-MY3) grant to Dr. H-J Yang. We would like to especially thank all subjects who agree to participate in this study. We also thank SS Huang who assisted for data collection and Dr. MM Lee who assisted for English editing.

REFERENCES

1. Hourii D, Nam EW, Choe EH, Min LZ, Matsumoto K. The mental health of adolescent school children: a comparison among Japan, Korea, and China. *Glob Health Promot* 2012;**19**:32-41. doi:10.1177/1757975912453183.
2. Kessler RC, Berglund P, Demler O, Jin R, Merikangas KR, Walters EE. Lifetime prevalence and age-of-onset distributions of DSM-IV disorders in the National Comorbidity Survey Replication. *Arch Gen Psychiatry* 2005;**62**:593-602. doi:10.1001/archpsyc.62.6.593.
3. Merikangas KR, He JP, Burstein M, et al. Lifetime prevalence of mental disorders in U.S. adolescents: results from the National Comorbidity Survey Replication--Adolescent Supplement (NCS-A). *J Am Acad Child Adolesc Psychiatry* 2010;**49**:980-9. doi:10.1016/j.jaac.2010.05.017.
4. People's Daily Online. Survey highlights youth depression. Available at: http://english.peopledaily.com.cn/200606/09/eng20060609_272442.html. Accessed June 9, 2014.
5. Denda K, Kako Y, Kitagawa N, Koyama T. Assessment of depressive symptoms in Japanese school children and adolescents using the Birlleson Depression Self-Rating Scale. *Int J Psychiatry Med* 2006;**36**:231-41. doi:10.2190/3YCX-H0MT-49DK-C61Q.
6. Chang KP, Chen MJ, Lien TC. A survey study of the prevalence of child depression in Taiwan. *Tai Dong Da Xue Jiao Yu Xue Bao* 2007;**18**:29-72. [In Chinese: English abstract]
7. Lopresti AL, Hood SD, Drummond PD. A review of lifestyle factors that contribute to important pathways associated with major depression: diet, sleep and exercise. *J Affect Disord* 2013;**15**:12-27. doi:10.1016/j.jad.2013.01.014.
8. Sánchez-Villegas A, Delgado-Rodríguez M, Alonso A, et al. Association of the Mediterranean dietary pattern with the incidence of depression: the Seguimiento Universidad de Navarra/University of Navarra follow-up (SUN) cohort. *Arch Gen Psychiatry* 2009;**66**:1090-8. doi:10.1001/archgenpsychiatry.2009.129.
9. Samieri C, Jutand MA, Féart C, Capuron L, Letenneur L, Barberger-Gateau P. Dietary patterns derived by hybrid clustering method in older people: association with cognition, mood, and self-rated health. *J Am Diet Assoc* 2008;**108**:1461-71. doi:10.1016/j.jada.2008.06.437.
10. Oddy WH, Robinson M, Ambrosini GL, et al. The association between dietary patterns and mental health in early adolescence. *Prev Med* 2009;**49**:39-44. doi:10.1016/j.ypmed.2009.05.009.
11. Nanri A, Kimura Y, Matsushita Y, et al. Dietary patterns and depressive symptoms among Japanese men and women. *Eur J Clin Nutr* 2010;**64**:832-9. doi:10.1038/ejcn.2010.86.
12. Birch LL, Fisher JO. Development of eating behaviors among children and adolescents. *Pediatrics* 1998;**101**:539-49.
13. Reilly JJ, Armstrong J, Dorosty AR, et al. Early life risk factors for obesity in childhood: cohort study. *BMJ* 2005;**330**:1357. doi:10.1136/bmj.38470.670903.E0.
14. Flegal KM, Carroll MD, Ogden CL, Curtin LR. Prevalence and trends in obesity among US adults, 1999-2008. *JAMA* 2010;**303**:235-41. doi:10.1001/jama.2009.2014.
15. Jacka FN, Kremer PJ, Berk M, et al. A prospective study of diet quality and mental health in adolescents.

- PLoS One 2011;**6**:e24805. doi:10.1371/journal.pone.0024805.
16. Lazarevich I, Irigoyen-Camacho ME, Velázquez-Alva Mdel C. Obesity, eating behaviour and mental health among university students in Mexico city. *Nutr Hosp* 2013;**28**:1892-9. doi:10.3305/nutr.hosp.v28in06.6873.
 17. Konttinen H, Männistö S, Sarlio-Lähteenkorva S, Silventoinen K, Haukka A. Emotional eating, depressive symptoms and self-reported food consumption. A population-based study. *Appetite* 2010;**54**:473-9. doi:10.1016/j.appet.2010.01.014.
 18. Health Promotion Administration, Ministry of Health and Welfare, R.O.C. (Taiwan). Health Interview in Taiwan. Taipei: Health Promotion Administration, Ministry of Health and Welfare, R.O.C. (Taiwan), 2009. [In Chinese]
 19. Fulkerson JA, Sherwood NE, Perry CL, Neumark-Sztainer D, Story M. Depressive symptoms and adolescent eating and health behaviors: a multifaceted view in a population-based sample. *Prev Med* 2004;**38**:865-75. doi:10.1016/j.ypmed.2003.12.028.
 20. Radloff LS. The CES-D scale. A self-report depression scale for research in the general population. *Physiol Meas* 1977;**1**:385-401. doi:10.1177/014662167700100306.
 21. Garrison CZ, Addy CL, Jackson KL, McKeown RE, Waller JL. The CES-D as a screen for depression and other psychiatric disorders in adolescents. *J Am Acad Child Adolesc Psychiatry* 1991;**30**:636-41. doi:10.1097/00004583-199107000-00017.
 22. Yang HJ, Soong WT, Kuo PH, Chang HL, Chen WJ. Using the CES-D in a two-phase survey for depressive disorders among nonreferred adolescents in Taipei: a stratum-specific likelihood ratio analysis. *J Affect Disord* 2004;**82**:419-30. doi:10.1016/j.jad.2004.04.008.
 23. Ministry of Health and Welfare, R.O.C. (Taiwan). The Report of 2010-2011 National and Health Survey in Taiwan. Taipei: Ministry of Health and Welfare, R.O.C. (Taiwan), 2012. [In Chinese]
 24. Ministry of Health and Welfare, R.O.C. (Taiwan). The Report of 2001-2002 National and Health Survey in Taiwan. Taipei: Ministry of Health and Welfare, R.O.C. (Taiwan), 2003. [In Chinese]
 25. Ministry of Health and Welfare, R.O.C. (Taiwan). The Report of 2005-2008 National and Health Survey in Taiwan. Taipei: Ministry of Health and Welfare, R.O.C. (Taiwan), 2009. [In Chinese]
 26. Jeong Y, Kim JY, Ryu JS, Lee KE, Ha EH, Park H. The associations between social support, health-related behaviors, socioeconomic status and depression in medical students. *Epidemiol Health* 2010;**32**:e2010009. doi:10.4178/epih/e2010009.
 27. Farshchi HR, Taylor MA, Macdonald IA. Regular meal frequency creates more appropriate insulin sensitivity and lipid profiles compared with irregular meal frequency in healthy lean women. *Eur J Clin Nutr* 2004;**58**:1071-7. doi:10.1038/sj.ejcn.1601935.
 28. Weng TT, Hao JH, Qian QW, et al. Is there any relationship between dietary patterns and depression and anxiety in Chinese adolescents? *Public Health Nutr* 2012;**15**:673-82. doi:10.1017/S1368980011003077.
 29. Guo X, Park Y, Freedman ND, et al. Sweetened beverages, coffee, and tea and depression risk among older US adults. *PLoS One* 2014;**17**:e94715. doi:10.1371/journal.pone.0094715.
 30. Kuczmarski MF, Cremer Sees A, Hotchkiss L, Cotugna N, Evans MK, Zonderman AB. Higher Healthy Eating Index-2005 scores associated with reduced symptoms of depression in an urban population: findings from the Healthy Aging in Neighborhoods of Diversity Across the Life Span (HANDLS) study. *J Am Diet Assoc* 2010;**110**:383-9. doi:10.1016/j.jada.2009.11.025.
 31. Maughan B, Collishaw S, Stringaris A. Depression in childhood and adolescence. *J Can Acad Child Adolesc Psychiatry* 2013;**22**:35-40.
 32. Appelhans BM, Whited MC, Schneider KL, et al. Depression severity, diet quality, and physical activity in women with obesity and depression. *J Acad Nutr Diet* 2012;**112**:693-8. doi:10.1016/j.jand.2012.02.006.
 33. Rockett HR, Berkey CS, Colditz GA. Evaluation of dietary assessment tools in adolescents. *Curr Opin Clin Nutr Metab Care* 2003;**6**:557-62. doi:10.1097/00075197-200309000-00009.
 34. Cullen KW, Watson K, Zakeri I. Relative reliability and validity of the Block Kids Questionnaire among youth aged 10 to 17 years. *J Am Diet Assoc* 2008;**108**:862-6. doi:10.1016/j.jada.2008.02.015.
 35. Sánchez-Villegas A, Toledo E, de Irala J, Ruiz-Canela M, Pla-Vidal J, Martínez-González MA. Fast-food and commercial baked goods consumption and the risk of depression. *Public Health Nutr* 2012;**15**:424-32. doi:10.1017/S1368980011001856.
 36. Verger P, Lions C, Ventelou B. Is depression associated with health risk-related behaviour clusters in adults? *Eur J Public Health* 2009;**19**:618-24. doi:10.1093/eurpub/ckp057.
 37. McMartin SE, Kuhle S, Colman I, Kirk SF, Veugelaers

- PJ. Diet quality and mental health in subsequent years among Canadian youth. *Public Health Nutr* 2012;**15**:2253-8. doi:10.1017/S1368980012000535.
38. Merete C, Falcon LM, Tucker KL. Vitamin B6 is associated with depression symptomatology in Massachusetts elders. *J Am Coll Nutr* 2008;**7**:421-7. doi:10.1080/07315724.2008.10719720.
39. Lee JE, Chan AT. Fruit, vegetables, and folate: cultivating the evidence for cancer prevention. *Gastroenterology* 2011;**141**:16-20. doi:10.1053/j.gastro.2011.05.020.
40. Kim JM, Stewart R, Kim SW, Yang SJ, Shin IS, Yoon JS. Predictive value of folate, vitamin B12 and homocysteine levels in late-life depression. *Br J Psychiatry* 2008;**192**:268-74. doi:10.1192/bjp.bp.107.039511.
41. Skarupski KA, Tangney C, Li H, Ouyang B, Evans DA, Morris MC. Longitudinal association of vitamin B-6, folate and vitamin B-12 with depressive symptoms among older adults over time. *Am J Clin Nutr* 2010;**92**:330-5. doi:10.3945/ajcn.2010.29413.
42. Lin HC, Tang TC, Yen JY, et al. Depression and its association with self-esteem, family, peer and school factors in a population of 9586 adolescents in southern Taiwan. *Psychiatry Clin Neurosci* 2008;**62**:412-20. doi:10.1111/j.1440-1819.2008.01820.x.
43. Graham DJ, Laska MN. Nutrition label use partially mediates the relationship between attitude toward healthy eating and overall dietary quality among college students. *J Acad Nutr Diet* 2012;**112**:414-8. doi:10.1016/j.jada.2011.08.047.
44. Lee SK, Nam SY, Yoon BJ, Chung SJ. Impact of national policy banning TV advertisement on high-energy/low-nutrient foods. *FASEB J* 2013;**27**:221-4.

台灣學童不健康飲食習慣、不良飲食經驗與憂鬱關聯性之探討

褚霈貞¹ 蘇美心¹ 楊浩然^{2,3} 郭柏秀^{1,4,*}

目標：探討不健康飲食行為與飲食偏好之於兒童與青少年的憂鬱情況相關性。**方法：**本研究以台灣北部及中部549位10-13歲的國中小學童為研究樣本。採用生活調適問卷(Center for Epidemiologic Studies Depression Scale)，針對學童進行憂鬱情況分析，研究對象將分為憂鬱(分數>21分)、中度憂鬱(分數15-21)，及正常(分數<15)族群。飲食行為內容包含不規律飲食、不良飲食經驗、不健康飲食習慣和飲食偏好。分組依據採用卡方檢定和ANOVA檢定，並以羅吉斯回歸檢定飲食行為與憂鬱情況的關聯性。**結果：**不健康的飲食習慣在國中小學童中相當盛行，最低由47.6%有攝取宵夜之習慣至高達70.5%攝取含糖飲品，且在平均在一周內有3.1餐為不規律飲食。卡方檢定的結果指出，憂鬱組(N=71, 14.4%)相較於中度憂鬱(N=77, 14.6%)與正常(N=379, 71.9%)組，有更不規律的飲食(p=0.005)、不健康的飲食習慣(P<0.05，分項中宵夜攝取及含糖飲料攝取例外)及不良飲食經驗(p<0.05，分項中僅食慾被零食影響例外)。在控制性別、年齡、地區下，羅吉斯回歸顯示隨著不健康飲食習慣與的項目累計，會使憂鬱或中度憂鬱的風險上升(ORadj: 2.17-6.33)；相同控制背景之下，不良飲食經驗也同樣增加憂鬱的風險(ORadj: 1.79-16.5)此外，若學童對蔬菜有較不佳的偏好，也會顯示與憂鬱情況有正相關(p=0.018)。**結論：**不健康的飲食行為與青少年的憂鬱情況呈現正相關，同時也是憂鬱情況的風險因子。此結果顯示，應更加重視學童飲食行為的改善，以遏止日後青少年憂鬱情況的盛行。(台灣衛誌 2015; 34(3): 254-267)

關鍵詞：不規律飲食、飲食行為、飲食偏好、憂鬱

¹ 國立台灣大學流行病學與預防醫學研究所

² 中山醫學大學健康管理學院公共衛生學系

³ 中山醫學大學附設醫院家庭暨社區醫學科

⁴ 國立台灣大學公共衛生學院基因、環境與健康研究中心

* 通訊作者：郭柏秀

聯絡地址：台北市中正區徐州路17號

E-mail: phkuo@ntu.edu.tw

投稿日期：103年11月13日

接受日期：104年4月17日

DOI:10.6288/TJPH201534103126