

## Relationship between Dietary Pattern and Depression among a Working Age Population in Bangkok

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### ABSTRACT

The purpose of this study was to examine the association of depression with the dietary pattern in a working age population in Bangkok. This cross-sectional survey study was conducted among 446 participants (123 males and 323 females) aged 20 years and over. The score of depression was defined by the Center for Epidemiological Studied-Depression Scale (CES-D) and dietary pattern was defined by collecting data from a food frequency questionnaire. The relationship between depression and dietary pattern was analyzed using binary logistic regression. The

results showed that the prevalence of depression was 29.4%. The analysis of the relationship between depression and dietary pattern showed that an intake of fruit for three days or less weekly was related to depression (Adjusted OR = 1.70, 95% CI = 1.09 – 2.66,  $p = 0.019$ ). This study indicated that dietary pattern was a factor that influenced the symptoms of depression. A dietary pattern with a high intake of fruit was found to be inversely associated with depression.

**Keywords:** depression, dietary pattern, working age

Currently, depression has become a major global mental health issue. According to the World Health Organization (WHO), more than 300 million people suffer from depression<sup>1</sup>. The WHO has stated that depression is ranked the fourth leading cause of disability. Moreover, by the year of 2020, it has been predicted that depression will become the second leading cause of disability in the world<sup>2</sup>. In the global population, the prevalence of depression was at 4.4% among people aged between 25 and 34 years<sup>3</sup>. In Thailand, the prevalence of major depressive episodes according to the Thai National Mental Health Survey in 2013 totaled 1.8% among Thais aged 18 years and older. The highest prevalence of depression (2.5%) was found in the north followed by the central region (1.8%)<sup>4</sup>. Depression can result in both mental and physical health problems such as diabetes, obesity, malnutrition and other chronic diseases, and may also increase the risk for committing suicide<sup>5</sup>.

Several factors are associated with the pathology of depression; such as physical activity<sup>6</sup>, social environment<sup>7</sup>, obesity<sup>8</sup>, light and sleep<sup>9-10</sup>. Dietary pattern is also one of the factors potentially involved with depression. Several studies have provided evidence revealing the association of dietary intake and depression<sup>11-12</sup>. The studies found that a healthy dietary pattern with high intake of fruits, vegetables, whole grains, poultry, fish

and low fat foods was associated with a reduced risk of depression<sup>13</sup>. Fruits and vegetables are good sources of antioxidants, which can exert protective effects against neuronal damage from oxidative stress<sup>11</sup>. On the other hand, a western dietary patterns with intakes of processed or fried foods, refined foods, alcohol, and sugar products were associated with symptoms of depression<sup>14-15</sup>. In Thailand, several factors such as marital status, social environment, psychosocial factors, education, and physical activity are related to depression.<sup>16-17</sup> Nevertheless, the relationship between depression and dietary pattern in the general Thai population has not been investigated. The purpose of the present study was to investigate the relationship between depression and dietary pattern in a working age population in Bangkok. The information on the prevalence of depression and the association of depression and dietary pattern would serve as a guide to prevent depression and could be beneficial in developing dietary advice for promoting health in the working age population in Bangkok.

## Materials and Methods

### Study design

A cross-sectional survey study was conducted to investigate the association of depression with dietary pattern in a working age population in Bangkok.

### **Study population and subjects**

The participants comprised males or females aged 20 years and older who were office workers in the private sector, or government or state enterprise in various inner areas of Bangkok. Eight of 21 districts, i.e., Pathumwan, Din Dang, Huai Khwang, Sathorn, Chatuchak, Bangsue, Phayathai and Ratchathewi were chosen. About 50 participants per district were randomly recruited in this study from October 2017 to March 2018. In addition, participants who were chosen had to be literate in Thai. Pregnant or breastfeeding women were excluded because their dietary pattern may not be the same as the general population, as they are more careful about eating, and breastfeeding also induces the risk for stress or depression<sup>18</sup>.

### **Research instruments**

Demographic information was collected by questionnaires developed from reviews of relevant literature and from various experts' opinions in the field of nutrition. The questionnaire comprised eight items consisting of five questions on general information and three questions on health information. The self-reported questionnaire from the Center for Epidemiologic Studies Depression Scales (CES-D) in Thai version was used to scan depression status, totaling 20 questions. The four possible responses to each of the 20 questions in the CES-D scale were weighed

0 for none, 1 for rarely, 2 for often and 3 for all of the time. Scoring for positively worded items (4, 8, 12, 16) was reversed. When the participants received a total score above 16 of 60, they would be considered as a person with depression<sup>19</sup>. In this study, a food frequency questionnaire comprising 13 questions was used to determine the participant's dietary pattern. The questionnaire was adapted from the development promotion model of eating behavior modification of the Department of Health, Bureau of Nutrition, Ministry of Public Health, Thailand<sup>20</sup>. The dietary pattern comprised sweet, fatty, salty and healthy food. The four responses to each type of dietary pattern were none, 1-3 days monthly, 1-3 days weekly, and >3 days weekly. This questionnaire was tested for validity by three experts in the nutrition field, as well as tested for reliability using 30 individuals who showed similar characteristics to the participants. The reliability of the food frequency questionnaire was confirmed by Cronbach's alpha value equal to 0.709.

### **Data collection process**

The participants were recruited from a working age population in Bangkok. They were explained the procedures of the study and given informed consent forms to sign. The participants' information including sex, age, occupation, and lifestyle behaviors (physical activity, exercise behaviors, smoking,

and alcohol consumption) was collected. The participants were also asked to complete the CES-D test and food frequency questionnaire.

### **Data analysis**

The general information of the participants (sex, age, occupation, exercise, physical activity, health behavior such as smoking, alcohol consumption and medication use and the prevalence of depression) was presented as number, percentage, mean, and standard deviation. Binary logistic regression was performed to determine the effect of the variables of dietary pattern while controlling potential confounders. The covariates were selected using backward stepwise regression (cutoff of  $p > 0.2$  for exclusion). The statistical significance level was defined as a two-tailed  $p$ -value  $\leq 0.05$ .

### **Ethics consideration**

The research protocol was approved by the Research Ethics Review Committee for Research Involving Human Research Participants, Health Sciences Group, Chulalongkorn University on August 17, 2017 (COA No. 166/2017).

### **Results**

The characteristics of the 446 participants, 123 males and 323 females, are presented in Table 1. Exactly 131 participants comprised the depression group and 315 participants

comprised the nondepression group. The results showed no significant differences in age, exercise, smoking, alcohol consumption, and medication use between the depression and nondepression groups. However, significant differences were observed in occupation ( $p = 0.035$ ) and physical activity ( $p < 0.001$ ) between both groups. The participants who were government officers or state enterprise employees had a lower prevalence of depression compared with those who were private sector office workers. The prevalence of depression in the group of participants with a high level of physical activity was lower than that of the group of participants with a low or moderate level of physical activity. The relationship between depression and dietary pattern is presented in Table 2. The results showed a significant association of whole grains, vegetables, and fruit intake with depression ( $p = 0.021$ ,  $p = 0.025$  and  $p = 0.017$ , respectively). After adjusting occupation, exercise and physical activity, the results indicated a significant association of fruit intake with depression. Participants who consumed fruit three days and less weekly had a 1.70 times higher risk of depression than those who consumed more than three days weekly (adjusted OR = 1.70, 95% CI = 1.09-2.66,  $p = 0.019$ ).

**Table 1** Characteristics of Participants Stratified by Depression and Nondepression Groups.

Variable	Depression group	Nondepression group	Total	p
	(n=131)	(n=315)	(n=446)	
	N (%)	N (%)	N (%)	
Sex				
Male	34 (25.9)	89 (28.2)	123 (27.6)	0.621
Female	97 (74.1)	226 (71.8)	323 (72.4)	
Age (years)				
20-29	35 (26.7)	105 (33.3)	140 (31.4)	0.673
30-39	58 (44.3)	130 (41.3)	188 (42.2)	
40-49	21 (16.0)	48 (15.2)	69 (15.5)	
50-59	15 (11.5)	27 (8.6)	42 (9.4)	
≥60	6 (1.5)	1 (1.6)	7 (1.5)	
Mean ± SD	36.4 ± 9.2	35.3 ± 9.5	35.6 ± 9.5	0.229 <sup>b</sup>
Occupation				
Employee	11 (8.4)	12 (3.8)	23 (5.2)	0.035
Private company worker	90 (68.7)	200 (63.5)	290 (65.0)	
Government officer/ state enterprise worker	29 (22.1)	88 (27.9)	117 (26.2)	
Business owner/Trader	1 (0.8)	3 (1.0)	4 (0.9)	
Others	0 (0.0)	12 (3.8)	12 (2.7)	
Exercise				
Never	56 (42.8)	126 (40.0)	182 (40.8)	0.130
<3 days/week, <30 min	37 (28.2)	61 (19.4)	98 (22.0)	
<3 days/week, ≥30 min	16 (12.2)	50 (15.9)	66 (14.8)	
≥3 days/week, <30 min	3 (2.3)	8 (2.5)	11 (2.4)	
≥3 days/week, ≥30 min	19 (14.5)	70 (22.2)	89 (20.0)	
Physical activity				
Low	7 (5.5)	11 (3.6)	18 (4.1)	<0.001
Moderate	60 (45.3)	90 (29.0)	150 (34.3)	
High	60 (47.2)	209 (67.4)	269 (61.6)	
Cigarette smoking				
Nonsmoker	120 (91.6)	287 (91.1)	407 (91.3)	0.507
Exsmoker	7 (5.3)	12 (3.8)	19 (4.2)	
Smoker	4 (3.1)	16 (5.1)	20 (4.5)	
Alcohol consumption				
Never	84 (64.1)	213 (67.6)	297 (66.6)	0.635
Sometime (1-3 times/week)	45 (34.4)	95 (30.2)	140 (31.4)	
Often (>3 times/week)	2 (1.5)	7 (2.2)	9 (2.0)	
Medications				
No	105 (80.2)	258 (81.9)	363 (81.4)	0.455
Diabetic/Dyslipidemia	9 (6.9)	26 (2.3)	35 (7.8)	
Hypertension				
Depression	2 (1.5)	1 (0.3)	3 (0.7)	
Others	15 (11.4)	30 (9.5)	45 (10.1)	

<sup>a</sup> Chi-square test for comparison between the depression and nondepression groups.

<sup>b</sup> Independent sample T-test for comparison between the depression and nondepression groups.



**Table 2** Relationship Between Depression and Dietary Pattern. (n=446)

Variable	Depression (n=131)	Nondepression (n=315)	OR (95% CI)	Adjust ORa (95% CI)
	N (%)	N (%)		
Bakery product intake				
≤3 days/week	101 (77.1)	242 (76.8)	1.00	1.00
>3 days/week	30 (22.9)	73 (23.2)	0.98 (0.61-1.60)	0.93 (0.55-1.56)
High-sugar food intake				
≤3 days/week	80 (61.1)	201 (63.8)	1.00	1.00
>3 days/week	51 (38.9)	114 (36.2)	1.12 (0.74-1.71)	0.96 (0.61-1.50)
Fatty meat intake				
≤3 days/week	112 (85.5)	263 (83.5)	1.00	1.00
>3 days/week	19 (14.5)	52 (16.5)	0.86 (0.49-1.52)	0.76 (0.42-1.39)
Fish food intake				
≤3 days/week	19 (14.5)	53 (16.8)	1.19 (0.68-2.11)	1.43 (0.77-2.64)
>3 days/week	112 (85.5)	262 (83.2)	1.00	1.00
Fried food intake				
≤3 days/week	86 (65.7)	222 (70.5)	1.00	1.00
>3 days/week	45 (34.3)	93 (29.5)	1.25 (0.81-1.93)	1.18 (0.75-1.88)
Single plate food intake				
≤3 days/week	105 (80.1)	250 (79.4)	1.00	1.00
>3 days/week	26 (19.9)	65 (20.6)	0.95 (0.57-1.58)	0.81 (0.47-1.39)
Coconut milk food intake				
≤3 days/week	124 (94.7)	306 (97.1)	1.00	1.00
>3 days/week	7 (5.3)	9 (2.9)	1.92 (0.70-5.27)	1.55 (0.53-4.55)
Snack intake				
≤3 days/week	114 (87.0)	259 (82.2)	1.00	1.00
>3 days/week	17 (13.0)	56 (17.8)	0.69 (0.38-1.24)	0.57 (0.30-1.06)
Semi-instant intake				
≤3 days/week	127 (96.9)	300 (95.2)	1.00	1.00
>3 days/week	4 (3.1)	15 (4.8)	0.63 (0.21-1.94)	0.43 (0.13-1.43)
Salty processed food intake				
≤3 days/week	123 (93.9)	303 (96.2)	1.00	1.00
>3 days/week	8 (6.1)	12 (3.8)	1.64 (0.66-4.12)	1.22 (0.46-3.20)
Whole grain intake				
≤3 days/week	24 (18.3)	91 (28.9)	1.81 (1.09-3.00)*	1.70 (0.99-2.93)
>3 days/week	107 (81.7)	224 (71.1)	1.00	1.00
Vegetable intake				
≤3 days/week	60 (45.8)	181 (57.5)	1.60 (1.06-2.41)*	1.50 (0.97-2.32)
>3 days/week	71 (54.2)	134 (42.5)	1.00	1.00
Fruit intake				
≤3 days/week	54 (41.2)	169 (53.7)	1.65 (1.09-2.49)*	1.70 (1.09-2.66)*
>3 days/week	77 (58.8)	146 (46.3)	1.00	1.00

<sup>a</sup> Adjusted for occupation, exercise and physical activity.

\**p* < 0.05 based on binary logistic regression.

## Discussion

The prevalence of depression in a working age population in the current study was 29.4%. This was higher than those from related studies in Thailand. Related studies have reported that the prevalence of depression in the general population in Thailand was 1.8% and 11.5%<sup>4, 17</sup>. This difference may be due to the characteristics of the participants. Most participants (65.0%) in this study were private company employees who spent long hours at their workplaces. According to related studies, long term work was found to be associated with increased stress<sup>21</sup>. Therefore, the higher prevalence of depression in this study may be due to the stressful conditions of long working hours. However, the prevalence of depression in this study was similar to a related study in South Asia. The prevalence of depression in the general population aged from 39-43 years in Bangladesh, India and Nepal was 39.0, 17.7 and 49.9%, respectively<sup>22</sup>. Among these three countries, the lowest prevalence of depression was found in India. This may be due to a higher living standard of the Indian population<sup>22</sup>.

Dietary intake plays an important role in depression. One study found that a high quality diet was related to good mental health and showed an inverse association between depression and a healthy diet<sup>11</sup>. This study found a significant relationship between fruit

intake and depression.

Fruits are high in antioxidants and can reduce the effect of oxidative stress, which is associated with depression<sup>23</sup>. Another explanation for this relationship is that antioxidants affect inflammatory markers, which are known to increase depression<sup>24</sup>. Moreover, depression is strongly associated with increased levels of C-reactive protein (CRP)<sup>25</sup>. Carotenoids are antioxidants commonly found in fruit and vegetables. Another study found that low plasma concentrations of carotenoids were associated with depressive symptoms, and could predict the development of new depressive symptoms among older individuals<sup>26</sup>. Folate is also found in green vegetables and fruits. A related study found that a low level of folate was associated with a risk of depression<sup>27</sup>. Folate deficiency may lead to impaired methylation, neurotransmitter metabolism, and hyperhomocysteinemia<sup>28</sup>. Folate helps regulate methionine for S-adenosylmethionine synthesis, which is a cofactor in the methylation reaction in dopamine, norepinephrine, and serotonin synthesis<sup>29</sup>. Deficiencies of these neurotransmitters are associated with depression. Therefore, consuming foods with a high folate content may help prevent depression. In addition, fruit is a good source of dietary fiber and beneficial to health. Dietary fiber can help maintain the function of insulin and improve blood lipids. It also reduces inflammatory

markers such as CRP and tumor necrosis factor- $\alpha$  (TNF- $\alpha$ ) and tumor necrosis factor2 (TNF2)<sup>30</sup>. A high fiber diet is important in promoting gut health<sup>31</sup>. One study found that a higher intake of dietary fiber may be associated with a lower prevalence of depressive symptoms<sup>32</sup>. A gut microflora imbalance is common in mental disorders causing altered behaviors, cognition and emotion<sup>33</sup>. Dietary fiber can alter the gut microflora to reduce oxidative stress and inflammation<sup>32</sup>. A Western diet or low fiber diet can increase gut mucosal inflammation. Consequently, a high whole grain intake may play a role in reducing the risk of mental disorders such as depression<sup>31</sup>. Nevertheless, in this study, no statistical significance was observed regarding the intake of whole grains and vegetables; however, these types of foods are rich in antioxidants, folate, and dietary fiber. Therefore, consuming whole grains and vegetables is likely to reduce the risk of depression.

A few limitations were noted in this study. First, data was collected using self-reported questionnaires, so it may have affected the accuracy of the data. Second, this study enrolled a small sample size, which may not

represent the general population in Bangkok. Third, the CES-D scale was only used for screening depression status. For future studies, the data regarding dietary pattern could be recorded in detail by exploring other factors related to depression such as total energy and caloric distribution. A semi-quantitative food frequency questionnaire could be designed to estimate other nutrients related to depression. Moreover, the sample size should be increased to represent the general population in Thailand.

## Conclusion

The prevalence of depression in a working age population in Bangkok was 29.4%. A dietary pattern with high fruit intake was found to be inversely associated with depression. In conclusion, dietary patterns may be important factors influencing the development of depression. Therefore, increased consumption of fruit may help reduce the risk of depression.

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## ความสัมพันธ์ระหว่างรูปแบบการบริโภคอาหารและภาวะซึมเศร้าของประชากรวัยทำงาน ในกรุงเทพมหานคร

มัทวัน สุจินพรัหม\* กุลวรา เมฆสุวรรณคิ\* สุญาณี พงษ์อนานิกร\*

### บทคัดย่อ

การศึกษานี้มีวัตถุประสงค์เพื่อศึกษาความสัมพันธ์ระหว่างภาวะซึมเศร้ากับรูปแบบการบริโภคอาหารในกลุ่มประชากรวัยทำงานในกรุงเทพมหานคร กลุ่มตัวอย่างจำนวน 446 คน (เพศชาย 123 คน และเพศหญิง 323 คน) อายุ 20 ปีขึ้นไป โดยมีการเก็บข้อมูลภาวะซึมเศร้าด้วยแบบทดสอบภาวะซึมเศร้า CES-D ฉบับภาษาไทย และใช้แบบสอบถามความถี่ของการบริโภคอาหารเพื่อประเมินแบบแผนการบริโภคอาหาร ใช้สถิติความถดถอยโลจิสติกเชิงทวิในการประเมินความสัมพันธ์ระหว่างภาวะซึมเศร้าและรูปแบบการบริโภคอาหาร ผลการศึกษาพบความชุกของภาวะ

ซึมเศร้าของประชากรวัยทำงานในกรุงเทพมหานคร ร้อยละ 29.4 และพบว่า การบริโภคอาหารผลไม้ น้อยกว่า 3 ครั้งต่อสัปดาห์มีความสัมพันธ์กับการเกิดภาวะซึมเศร้าอย่างมีนัยสำคัญทางสถิติ (Adjusted OR = 1.70, 95% CI = 1.09-2.66,  $p = 0.019$ ) จากการศึกษาพบว่า รูปแบบการบริโภคอาหารเป็นอีกหนึ่งปัจจัยที่มีความสัมพันธ์กับภาวะซึมเศร้า การรับประทานอาหารประเภทผลไม้ในปริมาณสูง มีสัมพันธ์ผกผันกับการเกิดภาวะซึมเศร้า

**คำสำคัญ:** ภาวะซึมเศร้า, แบบแผนการบริโภคอาหาร, วัยทำงาน