Brain-Derived Neurotrophic Factor (BDNF) levels and Subjective Sleep Quality in the first trimester of pregnancy among Myanmar Migrant Workers in Samut Sakhon province, Thailand: A secondary data analysis

Mr. Thuvachit Kriengtuntiwong

A Thesis Submitted in Partial Fulfillment of the Requirements
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เบรน-ดีไรฟ นิวโรโทรฟิค แฟคเตอร์และคุณภาพการนอนในไตรมาสแรกของแรงงานหญิงที่ตั้งครรภ์ชาวเมียนมาที่จังหวัดสมุทรสาคร ประเทศไทย: การใช้ข้อมูลทุติยภูมิ

นายธุวชิต เกรียงตันติวงศ์

วิทยานิพนธ์นี้เป็นส่วนหนึ่งของการศึกษาตามหลักสูตรปริญญาสาธารณสุขศาสตรมหาบัณฑิต
สาขาวิชาสาธารณสุขศาสตร์ ไม่สังกัดภาควิชา/เทียบเท่า
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Thesis Title	Brain-Derived Neurotrophic Factor (BDNF) levels and Subjective Sleep Quality in the first trimester of pregnancy among Myanmar Migrant Workers in Samut Sakhon province, Thailand: A secondary data analysis
By	Mr. Thuvachit Kriengtuntiwong
Field of Study	Public Health
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ธุวชิต เกรียงตันติวงศ์ : เบรน-ดีไรฟ นิวโรโทรฟิค แฟคเตอร์และคุณภาพการนอนในไตรมาสแรกของแรงงานหญิงที่ตั้งครรภ์ชาวเมียนมาที่จังหวัดสมุทรสาคร ประเทศไทย: การใช้ข้อมูลทุติยภูมิ. (Brain-Derived Neurotrophic Factor (BDNF) levels and Subjective Sleep Quality in the first trimester of pregnancy among Myanmar Migrant Workers in Samut Sakhon province, Thailand: A secondary data analysis) อ.ที่ปรึกษาหลัก : ผศ. ดร.ณัฏฐา ฐานีพานิชสกุล

ความเป็นมา: ในระหว่างการตั้งครรภ์ สตรีจะพบเจอปัญหามากมายและความเปลี่ยนแปลงต่างต่อทั้งสุขภาพกาย สุขภาพจิต ครอบครัวและสังคม ผลลัพธ์ของความเปลี่ยนแปลงนี้ทำให้สตรีที่ตั้งครรภ์มีปัญหาสุขภาพจิตได้ทั้งในระหว่างตั้งครรภ์และหลังตั้งครรภ์ อาการซึมเศร้าและคุณภาพการนอนหลับเป็นปัญหาที่พบได้บ่อยระหว่างตั้งครรภ์ ซึ่งอาการเหล่านี้สงผลกระทบต่อสุขภาพของทั้งมารดาและทารกในครรภ์ เบรน-ดีไรฟ นิวโรโทรฟิค แฟคเตอร์ (BDNF) เป็นโปรตีนชนิดหนึ่งที่มีการศึกษาพบว่ามีความสัมพันธ์กับอาการซึมเศร้าและคุณภาพการนอนหลับของหญิงตั้งครรภ์ กลุ่มแรงงานต่างด้าวเป็นกลุ่มเสี่ยงที่มีโอกาสได้รับการดูแลจากระบบสาธารณสุขอย่างไม่ทั่วถึง จังหวัดสมุทรสาครเป็นจังหวัดที่มีแรงงานต่างด้าวมากเป็นอันดับที่ 2 ของประเทศไทยรองจากกรุงเทพมหานคร เป้าหมายของการศึกษาครั้งนี้เพื่อหาความสัมพันธ์ระหว่างโรคซึมเศร้าและคุณภาพการนอนในกลุ่มแรงงานต่างด้าวที่ตั้งครรภ์ในไตรมาสที่ 1 ในจังหวัดสมุทรสาคร ประเทศไทย

วิธีการ: การศึกษานี้เป็นการศึกษาภาคตัดขวางโดยใช้ข้อมูลทุติยภูมิจากงานศึกษาตั้งต้นในระหว่างเดือนมิถุนายน 2018 ถึงเมษายน 2019 ในจังหวัดสมุทรสาคร ประเทศไทย ผู้เข้าร่วมทั้งหมด 108 คนได้รับการเลือกเข้าการศึกษาครั้งนี้โดยจากงานวิจัยตั้งต้นโดยเลือกอาสาสมัครที่มีข้อมูลครบวมบูรณ์ที่จะวิเคราะห์ได้ ข้อมูลพื้นฐานและพฤติกรรมของอาสาสมัครได้รับข้อมูลโดยใช้แบบสอบถาม อาการซึมเศร้าประเมินโดยการใช้แบบสอบถาม Patient Health Questionnaire 9 (PHQ-9) คุณภาพการนอนหลับประเมินโดยใช้แบบสอบถาม Pittsburgh Sleep Quality index (PSQI) การวัดค่า BDNF ใช้วิธีการเอนไซม์ลิงค์อิมมูโนซอร์เบนต์แอสเสย์ (ELISA) การคำนวณทางสถิติเพื่อหาความสัมพันธ์ระหว่าง BDNF กับอาการซึมเศร้าและคุณภาพการนอนใช้วิเคราะห์ถดถอยโลจิสติกไบนารี

ผลการศึกษา: จากผู้เข้าร่วม 108 คน อาสาสมัคร 36 คน (ร้อยละ33.3) มีอาการซึมเศร้าต่ำถึงรุนแรง อาสาสมัคร 31 คน (ร้อยละ28.7)มีคุณการนอนหลับที่ไม่ดี ค่ามัธยฐานของ BDNF คือ 6.38 นาโนกรัมต่อมิลลิลิตร ซึ่งใช้ค่านี้แบ่งอาสาสมัครเป็นกลุ่ม BDNF สูง (> 6.38) และต่ำ (≤6.38) จากการวิเคราะห์การถดถอยโลจิสติกแบบไบนารีหลังปรับค่าตัวแปรกวนแล้ว พบว่าอาการซึมเศร้าและคุณภาพการนอนมีความสัมพันธ์อย่างมีนัยสำคัญทาสถิติกับระดับ BDNF โดยในกลุ่มที่อาการซึมเศร้าต่ำถึงรุนแรงจะมีค่า BDNF สูงกว่ากลุ่มที่ไม่มีอาการถึงมีอาการเล็กน้อย (aOR 2.972, 95% CI 1.111,7.949, p-value 0.030) ในส่วนของคุณภาพการนอนพบว่าคนที่คุณภาพการนอนไม่ดีจะมีค่า BDNF ต่ำกว่ากลุ่มที่มีคุณกาพการนอนดี (aOR 0.359, 95% CI 0.132,0.972, p-value 0.044)

สรุป: อาการศึมเศร้าและคุณภาพการนอนมีความสัมพันธ์กับระดับของ BDNF ปัญหาทางสุขภาพจิตทั้ง 2 ข้อนี้ส่งผลกระทบต่อสุขภาพของหญิงตั้งครรภ์และทารกในครรภ์ โรงพยาบาลในประเทศไทยควรมีการคัดกรองอาการปัญหา 2 ข้อนี้ในหญิง

สาขาวิชา สาธารณสุขศาสตร์ ลายมือชื่อนิสิต .....

ปีการศึกษา 2563 ลายมือชื่อ อ.ที่ปรึกษาหลัก .....

6374015653 : MAJOR PUBLIC HEALTH

KEYWORD: Brain-derived neurotrophic factor, Depression, Sleep quality, Pregnancy, First trimester pregnancy

Thuvachit Kriengtuntiwong : Brain-Derived Neurotrophic Factor (BDNF) levels and Subjective Sleep Quality in the first trimester of pregnancy among Myanmar Migrant Workers in Samut Sakhon province, Thailand: A secondary data analysis. Advisor: Asst. Prof. NUTTA TANEEPANICHSKUL, Ph.D.

Background: During pregnancy, mother will face many challenges in this time because so many things will change to their health, mental health, family and social. Result from these change lead pregnant woman to have mental illness both antepartum and postpartum period. Depression and poor sleep quality are common mental health problem during pregnancy, and these symptoms have effect to mother and child health. Brain-derived neurotrophic factor (BDNF) is one of the biomarkers that association with depression and sleep quality during pregnancy. Migrant people are risk group that will have treatment gap from Thailand health system. Samut Sakhon is the province that have migrant 2nd highest in Thailand after Bangkok. The objective of this study was to examine association between depression and sleep quality to BDNF level among pregnant migrant group at 1st trimester in Samut Sakhon, Thailand.

Methodology: This research was a cross-sectional study which used secondary data from birth cohort study conducting between June 2018 to August 2019 on Myanmar migrants in Samut Sakhon, Thailand. A total of 108 participants was recruit to this study from data of birth cohort study that have all data to analysis. The sociodemographic data and health behavior were assessed by self-report questionnaire. Depression was assessed by Patient Health Questionnaire 9 (PHQ-9) questionnaire. Sleep quality was assessed by Pittsburgh Sleep Quality index (PSQI) questionnaire. Plasma BDNF levels were measured by enzyme-linked immunosorbent assay. Binary logistic regression to evaluate association between BDNF to depression and sleep quality.

Result: From 108 participants, 36 participants (33.3%) have mild to severe depression, 31 participants (28.7%) have poor sleep quality and median range of BDNF was 6.38 ng/ml which used to separate into high (> 6.38) and low (≤6.38) BDNF group. After adjusted for confounder, we found that depression and sleep quality was significant association with BDNF level. For depression, mild to severe depression group have higher BDNF level compared to no to minimal depression group (aOR 2.972, 95% CI 1.111,7.949, p-value 0.030). For sleep quality, poor sleep quality will have lower BDNF level compared to good sleep quality (aOR 0.359,

Field of Study: Public Health Student's Signature .....

Academic Year: 2020 Advisor's Signature .....

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Thuvachit Kriengtuntiwong

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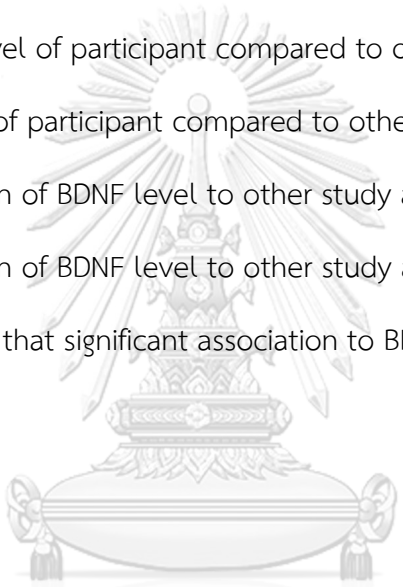


Chapter I

Introduction

1.1 Background

Pregnancy is one essential part in lifetime of some woman. They will have so many good feeling about it like happy to have a new member of family and become mother. But however they can have some bad feeling too like concern about future of her when new member coming in next few month or depress because they fight with so many problem or don't want to have child. But however bad feeling in pregnancy still hard to talk when society always expect mother to have good feeling about their pregnancy from moral. Sometime medical staff always focus on physical health of pregnancy more than psychology health. That is why depression in pregnancy don't always get any concern, or maybe it hard to identify that this symptom is come from physiologic change from pregnancy or it is predominant sign of depression like fatigue, loss of energy, sleep disturbance or depress mood. So some research don't want to use somatic symptom to evaluate depression because it can lead to over diagnosis of depression but other think that if don't use somatic symptom to evaluate maybe we cannot evaluate severity of depression.

Depression in pregnancy always talk in term of post-partum depression after woman have delivered but about mental health of woman while pregnancy have less talk. Some research have shown that depression in pregnancy can happen between 7-20% in high income country and approximately 20% or more can find in middle and low income country. Some research find that depression is maximum in 1st trimester about 11% and decrease to 8.5% in 3rd trimester but some research found controversy, show that it lowest in 1st trimester 7.4% and highest in 3rd trimester around 12% (Biaggi, Conroy, Pawlby, & Pariante, 2016).

Sleep quality is also one of problem in pregnancy woman. Some research show that in pregnancy woman it have been 53% who have poor sleep quality (Gao et al., 2019).

In Thailand from research of Kelvin found that from 132 pregnancy patient at Chaophraya Abhaibhubejhr hospital have poor sleep quality for 125 patient (94.7 percent) with Pittsburgh Sleep Quality Index (PSQI) more than 5 score (Thakolpattanakul, Deoisres, & Tachasuksri, 2019). This data show that Thai people will have trend to have poor sleep quality during pregnancy.

Cause of poor sleep quality during pregnancy is physiological change like polyuria, cannot find position to sleep well or mood disturbance. And poor sleep quality in pregnancy is lead to preterm birth, depression and suicidal idea (Sedov, Cameron, Madigan, & Tomfohr-Madsen, 2018). So if we can find the pregnant who have poor sleep quality at first trimester we have time for planning about treatment their symptom.

However, Thailand don't have system to survey sleep quality and depression in pregnancy woman for now. This is the research gap in Thailand. If we have system that can detect sleep quality and depression in pregnant woman we can help them to decrease their problem and find solution to solve their problem or advise them about how to solve problem.

From the data above we will see that depression and sleep quality is the hard thing to ask by questionnaire because of moral and cultural. So if we can find biomarker for detect it maybe it can prevent long depression and poor sleep quality in pregnancy woman.

Brain-derived neurotrophic factor (BDNF) is one of the neurotransmitter in the brain. It have effect to many site of rat brain in the hippocampus, cerebral cortex, cerebellum, striatum and amygdala (Dugich-Djordjevic et al., 1995; Kawamoto et al., 1996). Same as in human brain it have effect to hippocampus, claustrum, amygdala, bed nucleus of the stria terminalis, septum and the nucleus of the solitary tract (Murer et al., 1999).

BDNF first was synthesized as precursor call “pro-BDNF”. This precursor will cleaved to generate mature BDNF (mBDNF) (Mowla et al., 2001; Yang et al., 2009). These 2 type of BDNF will have effect to different receptor, pro-BDNF for pan-neurotropin receptor p75 ($p75^{NTR}$) and mBDNF for tyrosine kinase B receptor (TrkB) (Chao & Bothwell, 2002; Ibáñez, 2002). These two form of BDNF and receptor work together in many ways, cooperate and opposite, to have effect to our health. Example pro-BDNF activate $p75^{NTR}$ lead to long term depression and cell apoptosis in neuro (Teng et al., 2005), while activation of mBDNF at TrkB lead to long term potentiation and neuro development and neuro function (Figurov, Pozzo-Miller, Olafsson, Wang, & Lu, 1996; Korte et al., 1995)

In recent years, BDNF is one of the biomarker that have so many study that it have effect to depression and sleep quality. In case of depression, in animal study show that who have stress will reduce level of BDNF activity in hippocampus. Same as in human, BDNF level will decrease in Major depressive disorder (MDD) patient who not receive any treatment compare to normal people who don’t have MDD. And if compare in MDD patient before and after receive treatment it show that after treatment BDNF level of patient will increase. In case of MDD and suicidal behavior it show that patient with MDD that have suicidal attempt have lower BDNF level compare to MDD who don’t have suicidal attempt. So maybe it hint that BDNF level can use to evaluate severity of depression (Figurov et al., 1996).

However, migrant is group of people that have risk group that will have treatment gap from Thailand hospital. So the problem of depression and sleep quality in pregnancy in these people still miss and don’t have system to survey it. From data of “Health Center of Ethnic group, Marginal people and Migrant worker” said that in 2018 migrant worker in Thailand have Myanmar is the biggest proportion for 46.6 percent, follow by Cambodia, Laos and Vietnam (Health Center for Ethnic Group, 2561). So this paper will focus on Myanmar migrant because they have higher proportion.

Samut Sakhon is the province that have migrant Myanmar 2nd top in Thailand after Bangkok (Office, 2015).

So this paper is for study about relationship of depression and sleep quality to BDNF among pregnancy Myanmar migrant in Krathum Baen hospital.

1.2 Research question

Does sleep quality associate with Brain-Derived Neurotrophic Factor (BDNF) levels in the first trimester of pregnancy Myanmar migrant in Krathum Baen hospital?

1.3 Research objective

To find a percentage of poor sleep quality of pregnant women during the first trimester.

To find an association between sociodemographic and Brain-Derived Neurotrophic Factor (BDNF) levels in of pregnancy.

To find an association between health status and Brain-Derived Neurotrophic Factor (BDNF) levels in of pregnancy.

To find an association between health behavior and Brain-Derived Neurotrophic Factor (BDNF) levels in of pregnancy.

To find an association between depression and Brain-Derived Neurotrophic Factor (BDNF) levels in of pregnancy

To find an association between sleep quality and Brain-Derived Neurotrophic Factor (BDNF) levels in of pregnancy.

1.4 Research Hypothesis

There is an association between sociodemographic and Brain-Derived Neurotrophic Factor (BDNF) levels in of pregnancy.

There is an association between health status and Brain-Derived Neurotrophic Factor (BDNF) levels in of pregnancy.

There is an association between health behavior and Brain-Derived Neurotrophic Factor (BDNF) levels in of pregnancy.

There is an association between depression and Brain-Derived Neurotrophic Factor (BDNF) levels in of pregnancy.

There is association between sleep quality and BDNF among pregnancy Myanmar migrant in Krathum Baen hospital.

1.5 Research format

This research is quantitative study to find association between sleep quality and BDNF among pregnancy Myanmar migrant in Krathum Baen hospital.

This study is cross sectional study and used secondary data from "EFFECT OF MATERNAL BLOOD HEAVY METAL LEVEL ON BRAIN-DERIVED NEUROTROPHIC FACTOR AND PREGNANCY OUTCOMES AMONG MYANMAR MIGRANTS IN SAMUT SAKHON PROVINCE, THAILAND" that conduct by Mr. Ye Htet Zaw (Zaw & Taneepanichskul, 2019). The birth cohort study collect data from pregnancy woman in 1st trimester during June 2018 to April 2019. This study use some data from birth cohort study.

1. Sociodemographic data: Age, Marital status, Education, Occupation status, Occupation type, Monthly family income

2. Health status: BMI in early pregnancy.

3. Health behavior: Smoking history, Second-hand smoking, Drinking, Regular exercise.

4. Sleep quality: Using Pittsburgh Sleep Quality Index (PSQI) to evaluate.

5. Depression: Using Patient Health Questionnaire (PHQ-9) to evaluate.

6. Plasma BDNF level: Laboratory test by researcher of birth cohort study.

1.6 Research place

This research placed in Krathum Baen hospital.

1.7 Conceptual framework

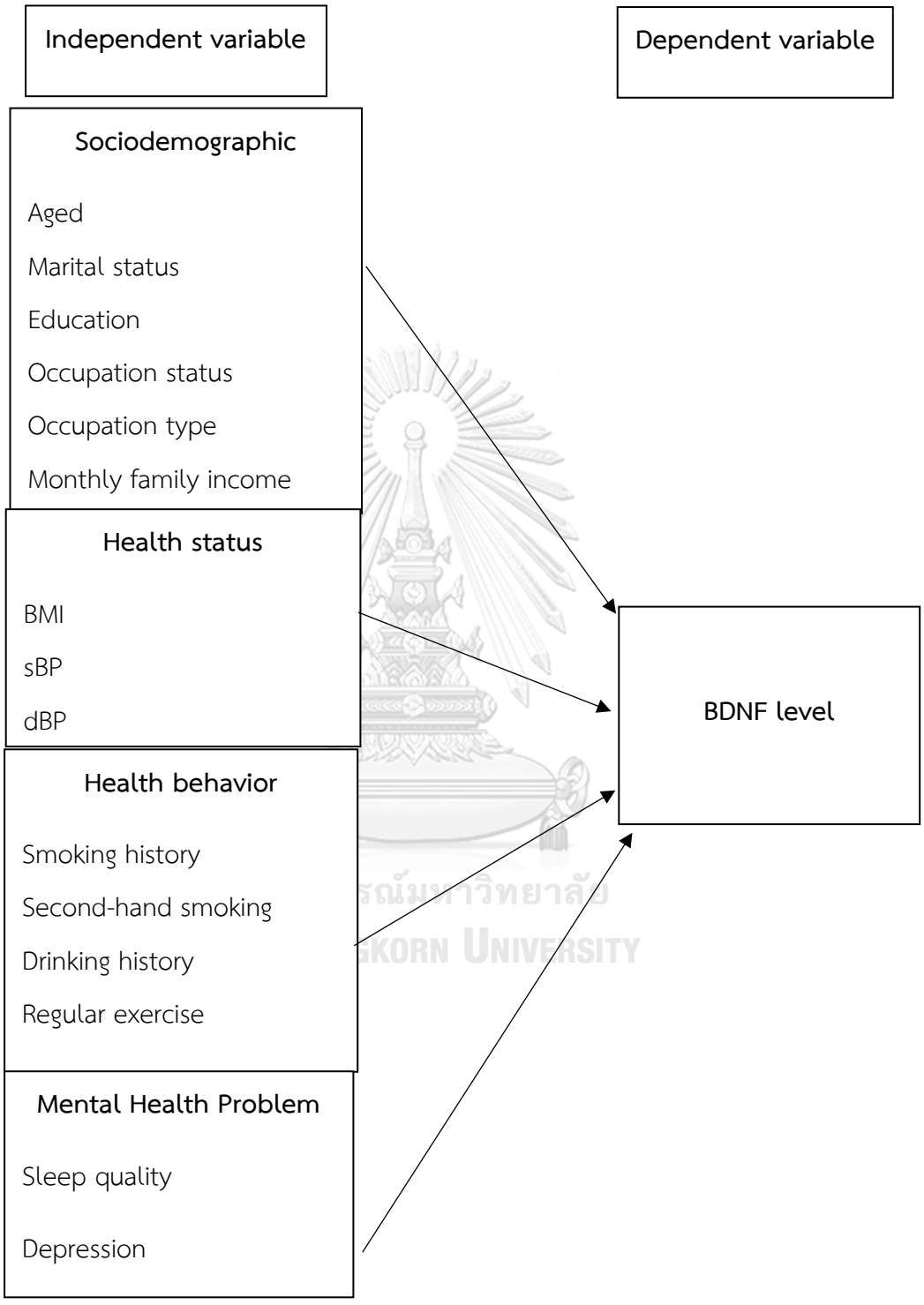
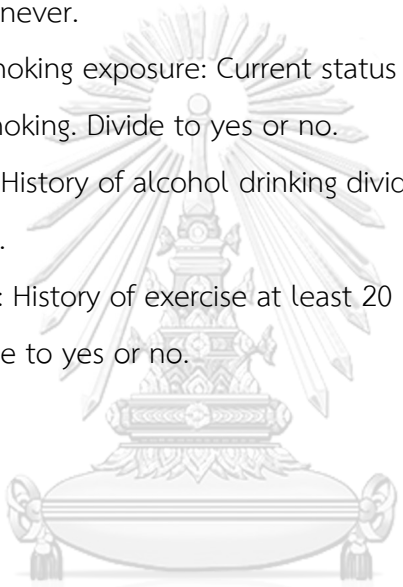


Figure 1 Conceptual framework

1.8 Operation definition

1. Sleep quality: Sleep quality in this research meaning to subjective sleep quality of participant because we use questionnaire to evaluate them, so it is their feeling about their sleep quality that is good or bad which have many aspect up to the questionnaire. In this research will evaluate by using PSQI questionnaire which have total 7 component of sleep quality with total 21 scores. Divide to good sleep quality (0-4 scores) and poor sleep quality (5-21 scores).
2. Depression: Depression is one of the mental health disorders. It has effect to human health and emotional and effect to their daily activity life, such as sleep or eating or quality of work. In this research depression is subjective because we use questionnaire to evaluate them by using PHQ-9. Divide to no depression (0 score), minimal depression (1-4 scores), mild depression (5-9 scores), moderate depression (10-14 scores), moderate to severe depression (15-19 scores) and severe depression (20 scores and above). Which question is up to criteria of diagnosis Major depressive disorder in DSM-V criteria.
3. BDNF level: It is level of BNDF (μg/L) in the plasma of participant. Divide to 6.38 μg/L and lower, compared to higher than 6.38 μg/L.
4. Age: Complete aged of participant. Divide to lower than 30 years old, compared to 30 years old and above.
5. Marital status: Status of pregnant woman. Divide to marry, single, divorced, widow and stay together without married.
6. Education: Education level of participant. Divide to able to read and write, primary school, secondary school, high school and above.
7. Occupation status: Occupational of participant. Divide to not have occupational and have occupational.
8. Occupational type: Type of occupational of participant. Divide to factory, domestic, agricultures and others.
9. Monthly family income: Average monthly income of their family in USD. Divide to 549 USD (18,000 Thai baths) and lower, compared to higher than 549 USD (18,000 Thai baths).

10. BMI in early pregnancy: Body weight (kilogram) divide by square of height (meter) at 1st trimester ANC visit. Divide to 25 Kg/m^2, compared to 25 Kg/m^2 and above.
11. Systolic blood pressure (sBP): Systolic blood pressure of participant. Divide to 120 mmHg and lower, compared to higher than 120 mmHg.
12. Diastolic blood pressure (dBP): Diastolic blood pressure of participant. Divide to 80 mmHg and lower, compared to higher than 120 mmHg.
13. Smoking history: Smoking status of participant. Divided to current, not current (ever used) and never.
14. Second-hand smoking exposure: Current status of participant that receive second-hand smoking. Divide to yes or no.
15. Drinking history: History of alcohol drinking divide to current, not current (ever used) and never.
16. Regular exercise: History of exercise at least 20 minute per days during this pregnancy. Divide to yes or no.



Chapter II

Review literature

This review literature consist of component with

1. Sleep quality in pregnancy
2. Depression in pregnancy
3. Sleep quality and depression
4. What is BDNF?
5. BDNF and sleep quality
6. BDNF and depression
7. Sleep quality measurement
8. Depression measurement
9. Migrant in Thailand

2.1 Sleep quality in pregnancy

Sleep have many effect to our life, it will help us to feel relieve from activity that we done in whole day and feeling refresh in morning. If we don't have good sleep quality it will affect our health in many aspect, like increase stress responsivity, somatic pain, reduce quality of life and work, finally it can lead to depression which consequence is suicidal idea and suicidal attempt (Medic, Wille, & Hemels, 2017). Especially in pregnant woman it have effect to both mother and newborn. For mother is same as normal people but pregnant woman is a vulnerable group due to so many thing change in that time and have effect of hormonal fluctuation. For newborn, poor sleep quality mother can lead to preterm birth which have many bad consequence come later like poor neuro cognitive development, it can increase

maternal stress and lead to abortion, and neonatal auditory problem (Lavonius et al., 2020).

Some research in china about sleep quality and pregnancy show that from 1,152 pregnant woman in China, 650 (53%) have poor sleep quality (by PSQI ≥ 5) and higher PSQI score is lead to have more stress both antenatal and post-natal duration, and high PSQI also link to antenatal depression and postpartum depression. This mean that if we can detect poor sleep quality pregnancy and help them, it will have effect to both mother and their kids (Gao et al., 2019).

It is still many research about sleep quality in pregnancy that result up to trimester of population, evaluate method of sleep quality and other factor.

Table 1 Factor related to sleep quality and pregnancy woman in antenatal period

No	Reference	Study population	Result
1	(Gelaye et al., 2017), Peru	Peru 2013-2014 2nd trimester 1,298 participant	1. Poor sleep quality prevalence 16.9% 2. Poor sleep quality lead to suicidal idea OR 2.81 (1.78-4.45)
2	(Kızılırmak, Timur, & Kartal, 2012), Turkey	Turkey 2010 All trimester 486 participant	1. Insomnia prevalence 52.2% 2. Aged more than 20 risk poor sleep quality OR 2.17 (1.37-3.44) 3. Depression is risk of poor sleep quality OR 2.63 (1.68-4.12)
3	(Mellor, Chua, & Boyce, 2014), Australia	Australia 2012-2013 All trimester 189 participant	1. Poor sleep quality prevalence 52% 2. Depression is risk for poor sleep quality OR 10.61 (2.32-46.86)
4	(Facco, Kramer, Ho, Zee, & Grobman, 2010), USA	USA 2007-2008 Compare 1st and 3rd trimester 189 participant	1. Poor sleep quality 1st trimester 39.0% 3rd trimester 53.5% 2. Aged lower than 24 is protective factor OR 0.31 (0.11-0.92) 3. Aged higher than 35 is risk factor OR 2.34 (1.03-5.34)

Table 1 Continue

No	Reference	Study population	Result
5	(Thakolpattanakul et al., 2019), Thailand	Thailand 2018 2nd and 3rd trimester 132 participant	1. Poor sleep quality prevalence 94.7% 2. Physical health condition Lead to poor sleep quality

2.2 Depression in pregnancy

Depression is one of the most common mental health disorder. Every year 264 million people suffer from depression. If people have depression it will effect to their health in many aspect like sleep disturbance, loss of appetize, poor concentration, relationship problem with family or co-worker, social problem because they have lower work quality and lead to economic problem, which finally it can lead them to suicidal idea and suicidal attempt (World Health Organization).

During pregnancy woman have so many thing change both physiological and social role, include mood that can change. We have seen so many study about postpartum depression (PPD) but not so much about antenatal depression.

Some study show that rate of depression during pregnancy is approximately 20%. Some said that in is highest in 1st trimester at 17% and decrease to 13% at 2 month after deliver, but in some research it show that 7% in 1st trimester and increase to 12% in 3rd trimester (Ryan, Milis, & Misri, 2005).

Risk factor of depression during pregnancy → insufficient social support, living alone, unwanted pregnancy, having multiple child and divorced. Another risk factor is aged, adolescent have more chance to have depression during pregnancy.

Effect to maternal and child is using substance, drinking alcohol, use tobacco and poor nutrition. For child it have risk of low BW, preterm delivery, BBA from mother lack of noticing sign of deliver. Lead to higher chance of admit NICU and lack

of mother-child interaction, show less affective and have low development and emotional outcome.

Risk of antidepressant in pregnancy (SSRI fluoxetine most common) → low BW, decrease length of gestation, low Apgar score, jitteriness, constant crying, and disruption of feeding and sleeping, however so many expert still want to continue antidepressant during pregnancy because compare risk and benefit it still good outcome to use it. One case-controlled, prospective study found that exposure to fluoxetine did not adversely affect the children's global IQ, language development, or behavior. IQ was significantly and negatively associated with the duration of the mother's depression, while language was negatively associated with the number of depressive episodes at time of delivery. Maternal depression may have a greater impact on the infant's developmental outcomes than psychotropic medication exposure itself (Wichman & Stern, 2015).

Table 2 Factor related to depression and pregnancy woman in antenatal period

No	Reference	Study population	Result
1	(Andersson et al., 2003), Sweden	Sweden 2000-2001 2nd Trimester 1,556 participants	1. MDD prevalence 3.3% 2. Minor depression prevalence 6.9%
2	(A. M. Lee et al., 2007), Hong Kong	Hong Kong 2007 All trimester 335 participants	1. 1st trimester prevalence of depression 22.1% 1.1 single or divorced (OR 3.27, *P*<.05) 1.2 history of drinking (OR 2.00, *P*<.05) 1.3 unwanted pregnancy (OR 6.51, *P*=.011) 2. 2nd trimester prevalence of depression 18.9% 2.1 Younger age (OR 0.92, *P*<.01) 3. 3rd trimester prevalence of depression 21.6% 3.1 history of drinking (OR 2.15, *P*<.05)

Table 2 Continue

No	Reference	Study population	Result
3	(Melville, Gavin, Guo, Fan, & Katon, 2010), USA	USA 2004-2009 2nd trimester 1,888 participants	1. Depression prevalence9.9% (Major 5.1%, minor 4.8%) 2. Younger maternal aged OR 0.92 (0.88-0.97) 3. Lower education OR 1.25 (0.72-2.19) 4. Psychosocial stress OR 1.29 (1.21-1.36) 5. Intimate partner violence OR 2.20 (1.0-4.84) 6. Chronic medical condition OR 2.14 (1.31-3.51)

Table 2 Continue

No	Reference	Study population	Result
4	(Kaewjanta et al., 2014), Thailand	Thailand 2012-2013 All trimester 455 participant (Adolescent)	1. Depression prevalence 19.82% 2. Don't live with husband OR 2.35 (1.15-4.78) 3. Substance use OR 4.94 (2.15-11.36) 4. Low-middle self esteem OR 9.08 (3.72-22.11) 5. Complication of pregnancy OR 2.68 (1.24-5.18) 6. History of violence OR 2.33 (1.14-4.75) 7. Low social support OR 4.91 (1.85-13.01) 8. Unplanned pregnancy OR 2.86 (1.22-6.67) 9. Non occupation OR 1.63 (1.05-3.51)
5	(Shitu Ayen, Alemayehu, & Tamene, 2020), Ethiopia	2019 Ethiopia All trimester 343 participant	1. Depression prevalence 26.5% 2. Unplanned pregnancy OR 2.11 (1.05-4.44) 3. Complication during last pregnancy OR 4.42 (2.06-9.48) 4. Don't happy with marriage OR 3.9 (1.15-13.21)

Table 2 Continue

No	Reference	Study population	Result
6	(Yin et al., 2021), China	2020 systemic review All trimester 173 study	1. 1st trimester 21.2% 2. 2nd trimester 15.8% 3. 3rd trimester 18.9% 4. High income country 18.1% 5. Upper to middle income country 24.2% 6. Lower to middle Income country 30.8% 7. Low income country 30.3% 8. Unemployment OR 2.41 (1.76-3.29) 9. Single OR 2.37 (1.80–3.13) 10. Low social support OR 3.13 (1.76–5.56) 11. Experience of violent OR 2.72 (2.26–3.27) 12. Unplanned pregnancy OR 1.86 (1.40–2.47) 13. Smoking during pregnancy OR 2.04 (1.41–2.95) 14. Smoking before pregnancy OR 1.97 (1.63–2.38)

2.3 Sleep quality and depression

Sleep disorder have many effect to our health like poor impulse control of our behavior (Peach & Gaultney, 2013), neurological function decrease (Yoo, Gujar, Hu, Jolesz, & Walker, 2007) and decrease emotional expression (Minkel, 2010). So it mean that if we have poor sleep quality it will have effect to our mood, and also one of mood that poor sleep quality will lead to is depression. Sleep disturbance is one of the criteria to diagnosis major depressive disorder from DSM-V criteria (American Psychiatric Association, 2013).

For explain this relation, some research think that it is due to sleep change physiological of brain (Novati et al., 2008), cognitive deterioration (Manber et al., 2008) or emotional deficit (Kahn, Sheppes, & Sadeh, 2013). However it still don't have summarize that which pathway to explain about relationship of poor sleep quality and depression (O'Leary, Bylsma, & Rottenberg, 2017).

Table 3 Relationship of sleep quality and depression

No	Reference	Study population	Result
1	(Hu et al., 2020), China	2020 China 814 Elderly people	Participant with poor sleep quality have higher depression score and higher depression symptom
2	(Liu et al., 2019), China	2019 China 8,888 adults	Depression participant have higher PSQI score compare to participant that don't have depression
3	(Okun, Mancuso, Hobel, Schetter, & Coussons-Read, 2018), USA	2018 USA 116 pregnancy woman or post-partum	Poor sleep quality significant associated with higher depression symptom
4	(Skouteris, Germano, Wertheim, Paxton, & Milgrom, 2008), Australia	2008 Australia 273 pregnant woman	Poor sleep quality in pregnancy associated with higher level of depression symptom later
5	(Ahmed et al., 2019), USA	2018 USA 92 pregnant woman	Poor sleep quality have related to depression symptom

2.4 What is Brain-derived neurotrophic factor (BDNF)?

BDNF synthesized in many neuro system in out body, central and peripheral neuro system (Nakahashi et al., 2000). It is a neurotransmitter which essential in part of learning and memory. It have multi-function like neurogenesis and neuro-protective activity, synaptic plasticity, action on cardiac and endothelial cell, lipid metabolism and restored systemic glucose balanced (reduce both blood sugar and HbA1C).

In case of neurologic disorder, BDNF have a role of neurogenesis and improved synaptic plasticity. It show that BDNF will lower in patient with neurologic deficit like Alzheimer's disease, dementia, Parkinson's disease, Huntington disease, autism, type 2 dm who have neurologic problem, schizophrenia, chronic alcohol use and depression. However, overexpression of BDNF in hippocampus can caused spontaneous seizure that finally lead to temporal lobe seizure (Bathina & Das, 2015).

In newborn, it have been report that BDNF have effect to newborn in many aspect. First is BDNF have related to preterm birth of newborn, it has been report that BDNF level will decrease in preterm birth compare to term newborn (Chouthai, Sampers, Desai, & Smith, 2003; Malamitsi-Puchner, Economou, Rigopoulou, & Boutsikou, 2004; Nikolaou et al., 2006). Second is BDNF level in newborn will lower in newborn with intraventricular hemorrhage (Chouthai et al., 2003). Third is it have been compare that mother who receive complete course of antenatal steroid that use for improve neurodevelopment of newborn have higher BDNF level compare to mother that receive partly course of don't receive antenatal steroid (Roberts & Dalziel, 2006). Fourth is BDNF level decrease neuronal atrophy, cell death and aging (Murer, Yan, & Raisman-Vozari, 2001). Finally it have report that BDNF level will decrease in newborn who have retinopathy of immaturity (Chen & Smith, 2007).

Mechanism of BDNF that have effect to our sleep quality is by binding between BDNF and TrkB will send signaling to pedunculopontine tegmental nucleus (PPT) which these PPT play an essential role in development of REM sleep

homeostatic drive. From the study in animal show that there is a significant positive relationship between REM sleep homeostatic drive and level of PPT BDNF expression. In contrast, TrkB receptor inhibition reduce REM sleep homeostatic drive (Barnes, Koul-Tiwari, Garner, Geist, & Datta, 2017).

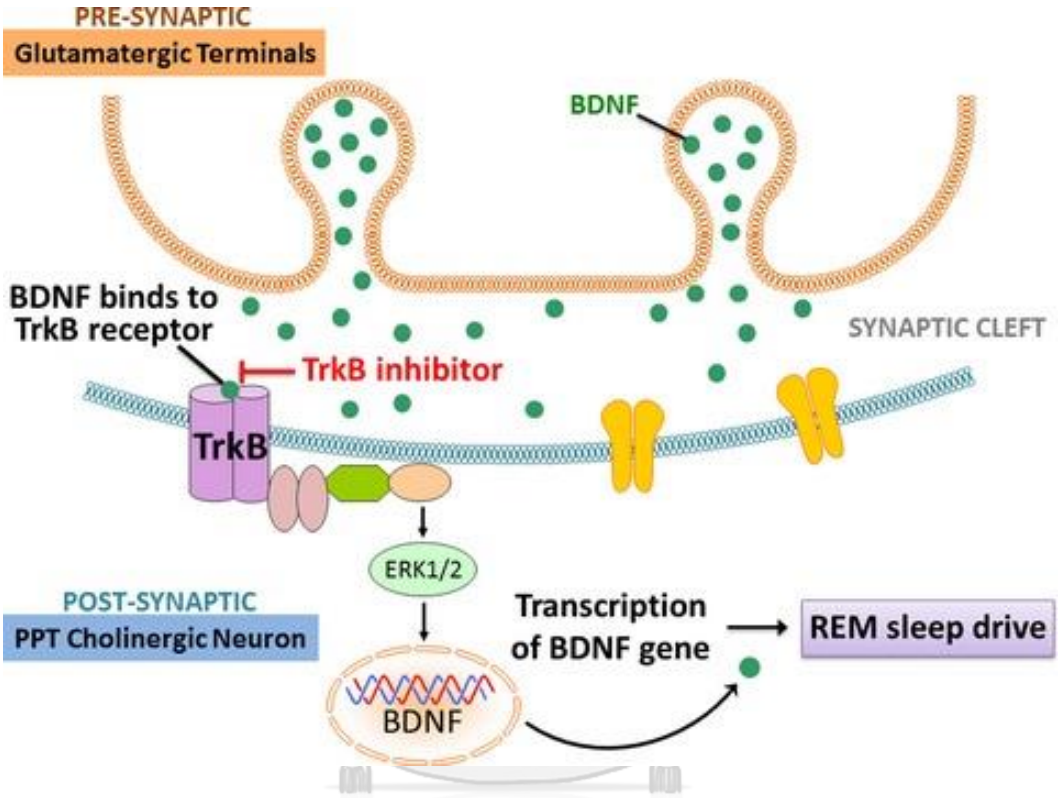


Figure 2 Mechanism of BDNF effect to sleep quality.

For mechanism of BDNF that effect to depression is after BDNF binding to TrkB receptor, it will increase expression of protein bcl-2 in hippocampus and regulate neuronal survival via phosphatidylinositol 3-kinase (PI3-kinase)/Akt pathway. If people have chronic stress it will lead to down regulation of BDNF level and result in decrease of bcl-2 and reducing neurogenic cell survival, resulting in develop of depression symptom (Groves, 2007).

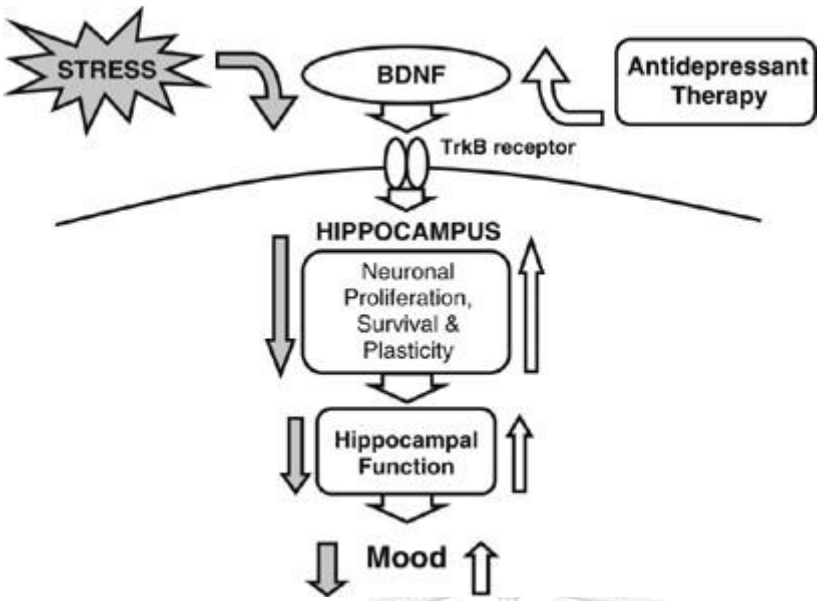


Figure 3 Mechanism of BDNF effect to depression.

2.5 Sleep quality and BDNF

It has been speculating the relationship between BDNF, sleep and depression. There is evidence that BDNF levels influence sleep patterns in individuals with depression (Lamego et al., 2015).

Giese and cols investigated if stress levels influence the association between sleep and BDNF levels, and found that the sleep quality interfere directly in the relation of stress with BDNF levels (Schramm, Poland, & Rao, 2014).

In another study they investigated BDNF serum levels in 26 patients with insomnia and compared the results with a control group and found that insomnia person present decreased serum BDNF levels, when compared to control group

Other study examined 44 insomniacs and found that sleep problems are related to impaired BDNF synthesis and that improvement in sleep patterns leads to enhance quality of life (Szabadi, 2014).

Table 4 Study related to sleep quality and BDNF

No	Reference	Study Population	Result
1	(Santiago et al., 2020), Brazil	Brazil 2020 Compare BDNF between depression/ control group with good sleep quality/ control group with poor sleep quality 57 participant	No significant different in BDNF between depression/ control group with good sleep quality/ control group with poor sleep quality
2	(Giese et al., 2013), Switzerland	Switzerland 2013 50 participant	BDNF level no insomnia >> subthreshold insomnia >> insomnia group /// Smoking have association with BDNF level (Don't have detail)
3	(Rethorst et al., 2015), USA	USA 2015 126 participant	Hypersomnia reduction association with reduction of BDNF level /// BDNF level don't association with insomnia

2.6 Depression and BDNF

Animal study show that who have stress will reduce level of BDNF activity in hippocampus. Same as in human, BDNF level will decrease in MDD patient who not receive any treatment compare to normal people who don't have MDD. And if compare in MDD patient before and after receive treatment it show that after treatment BDNF level of patient will increase. In case of MDD and suicidal behavior it show that patient with MDD that have suicidal attempt have lower BDNF level compare to MDD who don't have suicidal attempt. So maybe it hint that BDNF level can use to evaluate severity of depression (B. H. Lee & Kim, 2010).

Table 5 Study related to depression and BDNF

No	Reference	Study population	Result
1	(Molendijk et al., 2011), Netherland	Netherland 2011 2044 participant	Depression patient who don't use antidepressant have lower BDNF level compare to control group, depression patient who on antidepressant drug, depression patient who have fully remission
2	(Bocchio-Chiavetto et al., 2010), Italy	2010 Meta-analysis from 5 study 372 participant	Serum BDNF in depression free antidepressant group is lower than in no depression group
3	(Fung et al., 2015), Peru	Peru 2012 0-16 week of pregnancy 986 participant	Pregnancy who have antepartum depression have lower BDNF level that pregnancy who don't have antepartum depression OR 1.61 (1.13-2.30)
4	(Shimizu et al., 2003), Japan	Japan 2003 83 participant	BDNF level in depression who don't receive treatment is lower than in treatment group or in control group

2.7 Sleep quality measurement

We have too many sleep quality questionnaire too evaluate sleep quality. In 2020 Ali RM (Ali, Zolezzi, & Awaisu, 2020) have review instrument for assessment of insomnia in adult, it have total 31 instrument in his review, but only some of instrument that have common use in so many country.

1. Pittsburg sleep quality index (PSQI) is common to use in evaluate sleep quality. It have been translate to 21 language (include Thai). It compose of 24 question that compose of 7 component of sleep. 7 component are sleep quality, sleep latency, sleep duration, sleep efficiency, sleep disturbance, use of sleep medication and daytime dysfunction. Each component have 0-3 score which lower score mean good sleep quality while higher score mean poor sleep quality. It's evaluate last month of sleep quality and need to use 5-10 minute to complete this questionnaire.

2. Functional outcome of sleep questionnaire (FOSQ) is translate to 8 language (include Thai). It have 2 version of 30 question and 10 question, Thai use 30 question. It compose of 5 component of sleep quality. 5 component are daily activities including general productivity, vigilance, social outcome, activity level, and sexual relationship. Each component have score up to 4 point 1-4 which lower score mean poor sleep quality while higher score mean good sleep quality (Banhiran et al., 2012). It use 15 minute to complete questionnaire.

3. General sleep disturbance scale (GSDS) is translate to 4 language (not include Thai). It compose of 21 question which each question score 0-7. Lower score mean good sleep quality while higher score mean poor sleep quality. It's evaluate last week of sleep and use approximately 5 minute to complete questionnaire.

2.8 Depression measurement

Too many tool have developed for evaluate depression. But only a few of questionnaire is widely use around the world.

1. Patient Health Questionnaire (PHQ-9) is questionnaire for 10 question that come from diagnosis Major depressive disorder in DSM-IV criteria A for 9 question, each question of criteria A have 4 choice of score about your symptom of depression in last 2 wk. 0=none, 1= someday (1-7day in last 2 week), 2= almost every day (>7days in 2 week), 3= everyday (in last 2 week). For total score 0-27 scores for 9 question. Lower score mean mild depression while higher score mean severe depression (Kroenke, Spitzer, & Williams, 2001).

2. Beck depression inventory II (BDI-II) is questionnaire that compose of 21 question, each question have 4 score from 0-3 with maximum 63 score. Lower score mean no depression and higher mean severe of depression. It is used for evaluate symptom that can change in 1 week or 1 month, so it is more proper to use compare pre-post intervention (Hautzinger, 1991).

3. Hamilton depression rating scale (HDRS) or HAM-D is compose of 17 question, each question may have 3-5 score for 0-2 or 0-3 or 0-4 up to each question. With maximum score is 53 score, lower score mean low symptom while higher score mean severe symptom. However, this questionnaire is for clinician used to evaluate symptom of patient so it is not proper for used to people evaluate themselves (Hamilton, 1960).

2.9 Migrant in Thailand

Thailand have so many people that migrant from nearby country like Laos, Myanmar, Cambodia and others. From the data of Foreigner Workers Administration Office report that in 2015, all migrant worker in Thailand is 1,445,575 people, highest proportion is Myanmar for 991,070 people. These group of people have effect in Thailand industry to be a labor in construction and in restaurant.

The top 3 province that have migrant is Bangkok, Samut Sakhon and Pathum Thani. So if we want to study in migrant people, we need to use these area to study (Office, 2015).

Chapter III

Research Methodology

3.1 Study design

This research is cross sectional study, using secondary data from "EFFECT OF MATERNAL BLOOD HEAVY METAL LEVEL ON BRAIN-DERIVED NEUROTROPHIC FACTOR AND PREGNANCY OUTCOMES AMONG MYANMAR MIGRANTS IN SAMUT SAKHON PROVINCE, THAILAND" (Zaw & Taneepanichskul, 2019) that conduct by Mr. Ye Htet Zaw. A birth cohort study was Copyright of Chulalongkorn University, Doctor of Philosophy in Public Health, Academic Year 2018. Birth cohort study was only one research that have these data in these target population as pregnant migrant Myanmar worker in Thailand.

Birth cohort study was conducted to identify the association between maternal blood heavy metal and BDNF and pregnancy outcome. That research was cohort study that recruit participant at 1st trimester and follow up until they deliver which collect data from June 2018 to April 2019. Data collection is 4 time along study at 1st trimester, 2nd trimester, 3rd trimester and delivery room of newborn. Blood collection was done to 2 time in 1st and 3rd trimester.

3.2 Study area

A birth cohort study was conducted in Krathum Baen hospital, Krathum Baen district, Samut Sakhon, Thailand. (This area have 2nd highest of migrant Myanmar in Thailand)

3.3 Study population

A birth cohort study population ware pregnancy Myanmar that go for ANC at Krathum Baen hospital during June 2018 to April 2019.

3.4 Sample size calculation

This study don't have sample size calculation but we used calculation from birth cohort study. This was formula for calculation sample size of birth cohort study.

$$n_{exposure} = \left[\frac{z_{1-\frac{\alpha}{2}} \sqrt{\bar{p}\bar{q}\left(1+\frac{1}{r}\right)} + z_{1-\beta} \sqrt{p_1 q_1 + \frac{p_2 q_2}{r}}}{\Delta} \right]^2$$

$$p_1 = P(outcome|exposure), q_1 = 1 - p_1$$

$$p_2 = P(outcome|unexposure), q_2 = 1 - p_2$$

$$\bar{p} = \frac{p_1 + p_2 r}{1+r}, \bar{q} = 1 - \bar{p}, r = \frac{n_{unexposure}}{n_{exposure}}$$

Which

P (outcome/ unexposed) = 0.210 (C.M. Taylor et al., 2016)

P (outcome/ exposed) =0.460 (C.M. Taylor et al., 2016)

Ratio (r) =1.000

Alpha (α) = 0.05, z (0.975) = 1.9559964, Beta (β) = 0.20, z (0.800) = 0.841621

Exposed = 54, Unexposed = 54,

By a continuity correction,

High exposed (Exposed) = 62, Low exposed (Unexposed) = 62

After all calculation, he found that he need 124 participant. 62 for high maternal blood heavy metal level and 62 for low maternal blood heavy metal level.

3.5 Sampling method

Birth cohort study recruited participant by these criteria.

Inclusion criteria of birth cohort study.

1. Those who visited ANC clinic of the hospital within first trimester gestation.
2. Those who stayed in the study area at least three months before.
3. Those who aged between 18 to 35 years.
4. Those who planned to deliver the baby at the study hospital.
5. Those who could read, write and communicate in Myanmar language.
6. Those who were willing to participate.

Exclusion criteria of birth cohort study.

1. Those who was multiparous with more than five parities.
2. Those who had less than one year inter-pregnancy interval
3. Those who was confirmed as multiple pregnancy by ultrasound.
4. Those with history of PE, preterm birth, LBW and depression

This study use data from birth cohort study. This research is cross sectional study focus only on 1st trimester. This research used 5 data from birth cohort study.

1. Sociodemographic data: Age, Marital status, Education, Occupation status, Occupation type, Monthly family income.

2. Health Status: BMI, sBP, dBP

3. Health behavior: Smoking history, Second-hand smoking exposure, Drinking, Regular exercise.

4. BDNF level at 1st trimester

5. Depression at 1st trimester

6. Sleep quality in 1st trimester

Sample size data from original research come from calculation is 124 sample sizes. This research select data from birth cohort study by these criteria.

Inclusion criteria of this study

1. Participant that have all data to analysis

Exclusion criteria of this study

1. None

From review of birth cohort study data, participant in that study at 1st trimester were 119 participants. After screening for data, 7 participants were incomplete questionnaire and 4 participants were incomplete blood data. So, participants that recruit in this study were 108 participants.

However, these research target population is vulnerable group that have limitation to gather information in research because they are migrant and cannot speak Thai or English language. So, if we do not use data from birth cohort study it will have limitation in the future to study in these group of participants. Another reason is birth cohort study was only one paper that study in pregnant migrant Myanmar worker in Thailand. So researcher need to continue this study even participant lower than sample size calculation.

3.6 Statistic analysis

This study use data from birth cohort study which is raw data in SPSS version 22 programmed.

Sociodemographic data, health status and health behavior data from birth cohort study is raw data that separate by each variable without interpretation. Researcher interpretation each variable to different level by using descriptive statistic.

Sleep quality and depression data from birth cohort study is raw data that separate by each question and level without interpretation. Researcher interpretation

each question and sum total score in SPSS version 22 and interpretation to each level of sleep quality and depression by using descriptive statistic.

To find a percentage of sleep quality and depression of pregnant women during the first trimester, researcher used descriptive statistic to analysis.

BDNF level of participant from birth cohort study is raw data. Researchers decide to compare in low and high BDNF level. To find a distribution of data used normality test and then used descriptive statistic to find cut-point of data.

To find an association between sleep quality and Brain-Derived Neurotrophic Factor (BDNF) levels in of pregnancy at 1st trimester use binary logistic regression to analysis the result.

3.7 Measurement tool

3.7.1 Sociodemographic data, health status and health behavior.

Birth cohort study choose these data from review literature in their topic. Researcher choose some data from birth cohort study by literature review.

3.7.2 BDNF level at 1st trimester

Birth cohort study plasma BDNF level was done by researcher. First step is to collect blood sampling from participant by trained nurse then give it to researcher and store at 4°C before lab test. After go to laboratory test he put it in temperature room before use. Finally, he uses quantitative ELISA kit by following the manufacturer protocol. This study divides BDNF level to low and high level. To find a cut-point of BDNF, first is find distribution of data and then used descriptive statistic to find cut-point.

3.7.3 Depression at 1st trimester

In measurement of depression use Patient Health Questionnaire (PHQ-9) to evaluate it.

Study in 1997-1999 that have 580 participants to answer PHQ-9 by themselves and then within 48 hours mental health professional (MHP) have reevaluate them by telephone for compare result of PHQ with their opinion about symptom.

Result is 93% of participant who don't have depression have PHQ-9 score less than 10. While 88% of participant who have depression have score more than 10. We can assume that score less than 5 is absence of a depressive disorder with LR+ = 0.04, 5-9 mean predominantly depression or subthreshold with LR+ = 0.5, 10-14 mean spectrum of patient with LR+ = 2.6, 15 or more is suspected MDD with LR+ of 15-19 is 8.4 and LR+ of 20-27 is 36.8. PPV for score more than 9 to be depression is 31% compare to score more than 15 is 51%. Correlation in this study to compare PHQ-9 and MHP is 0.84 and mean score is nearly identical (5.08 vs 5.03) (Kroenke et al., 2001).

Birth cohort study use PHQ-9 to test depression. It compose of 9 question about depression symptom by DSM-V and 1 question about those problem affect to their daily life or not, total 10 question. Each question have score 0-3, 0 mean Never, 1 mean several day, 2 mean more than half days with in 2 week and 3 mean almost everyday. Total score are 30 and divided depression to 6 level. 0 score mean no depression, 1-4 score mean minimal depression, 5-9 mean mild depression, 10-14 mean moderate depression, 15-19 mean moderate severe depression, and 20 or above mean severe depression.

Original version of PHQ-9 is English version. Birth cohort study use Myanmar version in his study. To translate from English to Myanmar he use forward and backward translation by 2 separate English-Myanmar influence. Validity no need to test because it is standard questionnaire. Reliability test Cronbach's alpha is 0.771.

3.7.4 Sleep quality in 1st trimester

Birth cohort study use PSQI to test sleep quality. It composes of 7 component of sleep quality with total 24 question. 7 components are sleep quality, sleep latency, sleep duration, sleep efficiency, sleep disturbance, use of sleep medication and daytime dysfunction. Each component has score 0-3, 0 mean no difficult to sleep, 1 mean mild difficult to sleep, 2 mean moderate difficult to sleep and 3 mean severe difficult to sleep. Total score are 21 and divided sleep quality to 2 level. 0-4 score mean good sleep quality and 5-21 score mean poor sleep quality.

Original version of PSQI is English version. Birth cohort study use Myanmar version in his study. To translate from English to Myanmar he use forward and backward translation by 2 separate English-Myanmar influence. Validity no need to test because it is standard questionnaire. Reliability test Cronbach's alpha is 0.581.

3.8 Timeline: November 2020 – July 2021

Month	November	December	January	February	March	April	May-July
Data finding	←	→					
Writing proposal		←	→				
Ethic approval				←	→		
Interpret					←	→	
Report writing							← →
Publish							← →

Figure 4 Timeline

3.9 Ethic consideration

This research ethical approval will be obtained from "The Research Ethic Review Committee for Research Involving Human", Chulalongkorn University, Thailand. (COA No. 094/2021)

3.10 Expected benefit

If this research find relationship between BDNF and depression or sleep quality. In the future we can use plasma BDNF to predict sleep quality in Myanmar migrant pregnancy.

3.11 Money

This research no need to use money during work because it is secondary data, but it will use in publish phase.

3.12 Limitation

This study is secondary data and our target population is limit because reference research have some data missing.

Chapter IV

Result

This study used secondary data from birth cohort study that was conduct in pregnant migrant Myanmar in Samut Sakhon province, Thailand (Zaw & Taneepanichskul, 2019). The collection period was in June 2018 to April 2019. After use inclusion and exclusion criteria, there are 108 participants in this study.

The result of this study will present in five parts.

4.1 General characteristic of participant

4.2 Depression level of participant

4.3 Sleep quality level of participant

4.4 BDNF level of participant

4.5 Association of each factor to BDNF level

4.6 Factor affecting to BDNF

4.1 General characteristic of participant

In the birth cohort study, 119 Myanmar migrant was registered in that study in the 1st trimester. After screening data from birth cohort study, only 108 participant was have all data to include in this study.

Baseline data was collected by 108 participant and present in Table 6. The average (mean ± S.D.) age of participant is 27.95 ± 4.18, while range of age is between 18-35 years old. Average monthly family income average is 464.5 ± 157.25 USA, while range of monthly family income is between 122 – 915.11 USD. Average BMI is 23.55 ± 3.64, while range of BMI is between16.73 – 36.63. Average of systolic blood pressure (sBP) is 114.18 ± 10.77, while range of sBP is 90 - 140. Average of diastolic blood pressure (dBP) is 70.06 ± 8.00, while range of dBP is 52-89.

Table 7 use to present baseline data of participant in divide by the group. Aged of participant have 69 (63.9%) participant who aged lower than 30, while 39

(36.1%) are aged 30 or higher. Married status of participant have only 1 (0.9%) participant who don't married but live together, while other 107 (99.1%) participant was married. Education of participant most of them are secondary school for 39 (36.1%) participant and follow by primary school for 35 (32.4%) participant. Occupation status 85 (78.7%) participant have occupation while 23 (21.3%) participant don't have occupation, while almost of participant that have occupation are factory occupation (90.5% of participant who have occupation). Income of 71 (65.7%) participant are 549 USD or lower, while 37 (34.3%) participants are higher than 549 USD. BMI of 79 (73.1%) participant are lower than 25, while 29 (26.9%) participant BMI are 25 or higher. In sBP, 75 (69.4%) participant are lower or equal to 120 while 33 (30.6%) participant are higher than 120. In dBP, 96 (88.9%) participant are lower or equal to 80 while 12 (11.1%) participant are higher than 80. Almost of participant never smoke for 106 (98.1%) participant while 2 (1.9%) participant are not current smoke. In second hand smoke, 59 (54.6%) participant are second hand smoking while 49 (45.4%) are not. In alcohol drinking, 90 (83.3%) participant are never drinking while 18 (16.7%) participant are not current drinking. In exercise, 85 (78.7%) participant have not exercise and 23 (21.3%) participant have exercise, while 23 participant who exercise 16 (69.6%) are often exercise and 7 (30.4%) are sometimes exercise.

Table 6 General characteristic of participant in continuous data.

General characteristic	Average (mean ± S.D.)	Range (min-max)
Ages (years)	27.95 ± 4.18	18-35
Monthly family income (USD)	464.5 ± 157.25	122 – 915.11
BMI (kg/m^2)	23.55 ± 3.64	16.73 – 36.63
sBP (mmHg)	114.18 ± 10.77	90-140
dBP (mmHg)	70.06 ± 8.00	52-89

Table 7 General characteristic of participant in grouping data.

General characteristic	n	Percent
Age		
< 30	69	63.9
≥ 30	39	36.1
Married status		
Married	107	99.1
Not married but live together	1	0.9
Education		
Primary school and lower	45	41.7
Higher than primary school	63	58.3
Occupation status		
Have	85	78.7
Don't have	23	21.3
Occupation type		
Factory	76	90.4
Domestic	1	1.2
Agriculture	3	3.6
Other	4	4.8
Monthly income (USD)		
≤ 549	71	65.7
> 549	37	34.3
BMI		
< 25	79	73.1
≥ 25	29	26.9

Table 7 Continue

General characteristic	n	Percent
sBP		
≤120	75	69.4
> 120	33	30.6
dBP		
≤ 80	96	88.9
> 80	12	11.1
History of smoking		
Not current	2	1.9
Never	106	98.1
Second hand smoking		
No	49	45.4
Yes	59	54.6
Drinking history		
Never	90	83.3
Not current	18	16.7
Exercise		
Yes	23	21.3
No	85	78.7

From the table 7, there are 3 variable that cannot use in binary logistic regression. First is “Married status” due to only 1 participant that in group of live together but not married, while other 107 is married, so we cannot use this variable. Second is “Occupation type” due to only participant who have occupation will have this data, while participant who don’t have occupation will not have this data so we cannot use it. Third is “Smoking”, same as “Married status”, only 2 participant is in group of not current, while other 106 in group of never, so we cannot use these data.

4.2 Depression level of participant

Depression level of participant is come from PHQ-9 questionnaire for 9 question and divide into 6 level.

For the first three question about “Little interest or pleasure in doing things”, “Feeling down, depressed or hopeless” and “Trouble falling or staying asleep, or sleeping too much” more than half of participant (60-80%) don’t have don’t have problem about these symptom, while some participant have these problem several day (20-30%). For next two question about “Feeling tired or having little energy” and “Poor appetite or overeating” nearly half of people don’t have problem about these symptom (35-50%), while the other people have problem about these symptom more than 10% in any level for both symptom. For the last 4 question about “Trouble concentrating on things such as reading the newspaper or watching TV”, “Moving or speaking so slowly that other people could have noticed. Or the opposite-being so fidgety or restless that you have been moving around a lot more than usual”, “Thoughts that you would be better off dead or of hurting yourself” and “How difficult have these problems made it for you to do your work, take care of things at home or get along with other people?” almost of participant don’t have symptom about these problem (higher than 80%), while some people have symptom in these problem.

Result of depression level of participant is approximately half of them have minimal depression (50.9%), follow by mild depression (19.4%), no depression (15.7%), moderate depression (10.2%) and moderate to severe depression (3.7%). No participant have severe depression.

Table 8 Depression score of participant

Depression scale	Number	Percent
Little interest or pleasure in doing things		
Never	75	70.4
Several days	25	23.1
More than half of days within two weeks	1	0.9
Almost everyday	6	5.6
Feeling down, depressed or hopeless		
Never	77	71.3
Several days	23	21.3
More than half of days within two weeks	3	2.8
Almost everyday	5	4.6
Trouble falling or staying asleep, or sleeping too much		
Never	66	61.1
Several days	28	25.9
More than half of days within two weeks	5	4.6
Almost everyday	9	8.3
Feeling tired or having little energy		
Never	51	47.2
Several days	35	32.4
More than half of days within two weeks	11	10.2
Almost everyday	11	10.2
Poor appetite or overeating		
Never	41	38.0
Several days	33	30.6
More than half of days within two weeks	19	17.6
Almost everyday	15	13.9

Table 8 Continue

Depression scale	Number	Percent
Trouble concentrating on things such as reading the newspaper or watching TV		
Never	94	87.0
Several days	9	8.3
More than half of days within two weeks	2	1.9
Almost everyday	3	2.8
Moving or speaking so slowly that other people could have noticed. Or the opposite-being so fidgety or restless that you have been moving around a lot more than usual.		
Never	89	82.4
Several days	12	11.1
More than half of days within two weeks	5	4.6
Almost everyday	2	1.9
Thoughts that you would be better off dead or of hurting yourself		
Never	94	87.0
Several days	11	10.2
More than half of days within two weeks	0	0
Almost everyday	3	2.8
How difficult have these problems made it for you to do your work, take care of things at home or get along with other people?		
Never	90	83.3
Several days	17	15.7
More than half of days within two weeks	0	0
Almost everyday	1	0.9

Table 8 Continue

Depression scale	Number	Percent
Total depression level		
No depression	17	15.7
Minimal depression	55	50.9
Mild depression	21	19.4
Moderate depression	11	10.2
Moderate to severe depression	4	3.7
Severe depression	0	0

4.3 Sleep quality level of participant

Sleep quality of participant come from PSQI questionnaire and divide into 7 component and summary to good and poor sleep quality.

For component 1 “Subjective sleep quality” 70.4% of participant report that they have good sleep quality (1 score) follow by 19.4% report bad quality (2 score), 9.3% report very good quality (0 score) and 0.9% report very bad (3 score). Component 2 “Sleep latency” 39.8% of participant report 1 score, follow by 34.3% 0 score, 20.4% 2 score and 5.6% 3 score. Component 3 “Sleep duration”, 4 “Sleep efficiency” and 6 “Use of medication” higher than 85% of participant report 0 score, while some participant report 1 score. Component 5 “Sleep disturbance” 68.5% of participant report 1 score, follow by 0 score for 16.7% and 2 score for 14.8%. Component 7 “Day time dysfunction” 73.1% of participant report 0 score, follow by 1 score for 22.2%.

For summary of sleep quality, 71.3% of participant have good sleep quality and 28.7% have poor sleep quality.

Table 9 Sleep quality score of participant

Sleep quality scale	Number	Percent
Component 1 Subjective sleep quality		
0 = Very good	10	9.3
1 = Good	76	70.4
2 = Bad	21	19.4
3 = Very bad	1	0.9
Component 2 Sleep latency		
0	37	34.3
1	43	39.8
2	22	20.4
3	6	5.6
Component 3 Sleep duration		
0 = > 7 hr.	92	85.2
1 = 6-7 hr.	12	11.1
2 = 5-6 hr.	3	2.8
3 = < 5 hr.	1	0.9
Component 4 Sleep efficiency		
0 = > 85%	106	98.1
1 = 75-84%	2	1.9
2 = 65-74%	0	0
3 = < 65%	0	0
Component 5 Sleep disturbance		
0 = 0	18	16.7
1 = 1-9	74	68.5
2 = 10-18	16	14.8
3 = 19-27	0	0

Table 9 Continue

Sleep quality scale	Number	Percent
Component 6 Use of medication		
0 = Did not use in last month	100	92.6
1 = Use less than once a week	5	4.6
2 = One or two times a week	1	0.9
3 = Three times a week or higher	2	1.9
Component 7 Day time dysfunction		
0 = 0	79	73.1
1 = 1-2	24	22.2
2 = 3-4	4	3.7
3 = 5-6	1	0.9
Total sleep quality		
Good = 0-4 score	77	71.3
Poor = 5-21 score	31	28.7

4.4 BDNF level of participant

Brain-derived neurotrophic factor (BDNF) don't have normal range in people due to many condition that depend on this number. Even it have many study about BDNF level but normally it is compare to lower or higher between group, more than have a cut point in each study.

However, this study will compare about BDNF level and sleep quality. So researcher decide to divide BDNF to 2 group with low and high BDNF. After testing for normality test and result is these data are non-normal distribution. So researcher decide to use median as a cut point. After running SPSS for find median of BDNF level of all participant and find that median of BDNF is 6.38.

So participant who have BDNF level higher than 6.38 is define as high participant group, while participant who BDNF level is lower or equal to 6.38 is define as low participant group.

Total participants mean of BDNF level is 5.70 and S.D. for 2.13. Low BDNF group have mean BDNF level for 4.26 μg/L and S.D. for 2.13, while high BDNF group have mean for 7.14 μg/L and S.D. for 0.61

Table 10 BDNF level of participant

BDNF level	Number	Percent
≤ 6.38	54	50
> 6.38	54	50

4.5 Association of each variable to BDNF level

The association between each variable and BDNF level is present in Table 11. From the result of binary logistic regression test for each variable, there are no single variable that associated with BDNF level with significant level lower than 0.05.

However, there are 2 variable that have p-value lower than 0.2 which is "drinking" that have 0.128 and "depression" that have 0.105. Adjust odd ratio of participant who are not current drinking are 0.438 compared to participant who never drink. It's mean that participant who have stop drinking trend to have lower BDNF compared to participant who never drink. Another variable that have p-value lower than 0.2 is "depression". Adjust odd ratio of participant who have mild to severe depression are 1.964 compared to participant who don't have depression or minimal depression. It's mean that participant who have more symptom of depression trend to have higher BDNF level.

Table 11 Binary logistic regression of each variable to BDNF level.

Variable	BDNF low		BDNF high		Crude	95% CI		p-value
	n	%	n	%	OR	lower	upper	
Aged								0.841
< 30	34	62.96	35	64.81	Ref			
≥ 30	20	36.04	19	35.19	0.92	0.421	2.024	
Education								0.330
Primary school and lower	25	46.30	20	37.04	Ref			
Higher than primary school	29	53.70	34	62.96	1.466	0.679	3.162	
Occupation								0.814
Have	11	20.37	12	22.22	Ref			
Don’t have	43	79.63	42	77.78	0.895	0.356	2.251	
Income								0.543
≤ 549	34	62.96	37	68.52	Ref			
> 549	20	37.04	17	31.48	0.781	0.352	1.733	
BMI								0.355
≤ 25	36	66.67	43	79.63	Ref			
> 25	18	33.33	11	20.37	0.688	0.321	1.472	
sBP								0.298
≤ 120	40	74.07	35	64.81	Ref			
> 120	14	25.93	19	35.19	1.551	0.679	3.543	

Table 11 Continue

Variable	BDNF low		BDNF high		Crude	95% CI		p-value
	n	%	n	%	OR	lower	upper	
dBP								1
≤ 80	48	88.89	48	88.89	Ref			
> 80	6	11.11	6	11.11	1.00	0.301	3.321	
2nd smoking								0.335
Yes	22	40.74	27	50	Ref			
No	32	59.26	27	50	0.688	0.321	1.472	
Drinking								0.128
Never	42	77.78	48	88.89	Ref			
Not current	12	22.22	6	11.11	0.438	0.151	1.268	
Exercise								0.814
Yes	11	20.37	12	22.22	Ref			
No	43	79.63	42	77.78	0.895	0.356	2.251	
Depression								0.105
No to minimal depression	40	74.07	32	59.26	Ref			
Mild to severe depression	14	25.93	22	40.74	1.964	0.869	4.44	
Sleep quality								0.289
Good	36	66.67	41	75.93	Ref			
Poor	18	33.33	13	24.07	0.634	0.273	1.472	

4.6 Factor affecting to BDNF

Table 12 shows the binary logistic regression models for examined the association between sleep quality and BDNF with an adjustment of aged, BMI, and depression. The results presents that pregnant women with mild to severe depression group increased 3-time odds of having high BDNF level compared to pregnant women with no to minimal depression group (AOR = 3.00; 95%CI 1.123, 8.018) with achieve statistical significant (p-value = 0.028). Poor sleep quality among pregnant women presented 0.378 odds of having high BDNF level compared to pregnant women with good sleep quality (AOR = 0.378; 95%CI 0.141, 1.015), however statistical significant was not achieve (p-value = 0.054)

Table 12 Binary logistic regression for sleep quality (independence) and BDNF (dependence). Which adjusted for aged, BMI and depression.

Variable	aOR	95% CI		p-value
		Lower	upper	
Aged				0.484
< 30	Ref			
≥ 30	0.741	0.319	1.718	
BMI				0.140
≤ 25	Ref			
> 25	0.510	0.209	1.248	
Depression				**0.028***
No to minimal depression	Ref			
Mild to severe depression	3.000	1.123	8.018	
Sleep quality				0.054
Good	Ref			
Poor	0.378	0.141	1.015	

* = p-value < 0.05

Table 13 is shows the binary logistic regression for examined the association between sleep quality and BDNF with an adjustment of aged, BMI, exercise and depression. The results presents that pregnant women with mild to severe depression group increased 2.964-time odds of having high BDNF level compared to pregnant women with no to minimal depression group (AOR = 2.964; 95%CI 1.106, 7.945) with achieve statistical significant (p-value = 0.031). Poor sleep quality among pregnant women presented 0.377 odds of having high BDNF level compared to pregnant women with good sleep quality (AOR = 0.377; 95%CI 0.141, 1.010), however statistical significant was not achieve (p-value = 0.052).

Table 13 Factor affecting to BDNF adjust for aged, BMI, exercise and depression.

Variable	Adjust OR	95% CI		p-value
		Lower	upper	
Aged				0.482
< 30	Ref			
≥ 30	0.740	0.319	1.716	
BMI				0.135
≤ 25	Ref			
> 25	0.503	0.204	1.239	
Exercise				0.784
Yes	Ref			
No	0.872	0.327	2.324	
Depression				**0.031***
No to minimal depression	Ref			
Mild to severe depression	2.964	1.106	7.945	
Sleep quality				0.052
Good	Ref			
Poor	0.377	0.141	1.010	

* = p-value < 0.05

Table 14 is shows the binary logistic regression for examined the association between sleep quality and BDNF with an adjustment of BMI, drinking and depression. The results presents that pregnant women with mild to severe depression group increased 3.027-time odds of having high BDNF level compared to pregnant women with no to minimal depression group (AOR = 3.027; 95%CI 1.146, 7.997) with achieve statistical significant (p-value = 0.025). Poor sleep quality among pregnant women presented 0.404 odds of having high BDNF level compared to pregnant women with good sleep quality (AOR = 0.404; 95%CI 0.150, 1.088), however statistically significant was not achieve (p-value = 0.073).

Table 14 Factor affecting to BDNF adjust for BMI, drinking and depression.

Variable	Adjust OR	95% CI		p-value
		Lower	upper	
BMI				0.186
≤ 25	Ref			
> 25	0.542	0.219	1.343	
Drinking				0.137
Never	Ref			
Not current	0.424	0.137	1.313	
Depression				**0.025***
No to minimal depression	Ref			
Mild to severe depression	3.027	1.146	7.997	
Sleep quality				0.073
Good	Ref			
Poor	0.404	0.150	1.088	

* = p-value < 0.05

Table 15 is showing the binary logistic regression for examined the association between sleep quality and BDNF with an adjustment of aged, BMI, education and depression. The results present that pregnant woman with mild to severe depression group increased 2.972-time odds of having high BDNF level compared to pregnant women with no to minimal depression group (AOR = 2.972; 95%CI 1.111, 7.949) with achieve statistically significant (p-value = 0.030). Poor sleep quality among pregnant women presented 0.359 odds of having high BDNF level compared to pregnant women with good sleep quality (AOR = 0.359; 95%CI 0.132, 0.972) with achieve statistically significant (p-value = 0.044).

For summarize of the model, only 2 variable that significant associated to BDNF. First variable is depression, participant who have more symptom of depression will increase 2.972-time odds of having high BDNF compared to participant who have lower depression symptom. Second variable is sleep quality, participant who have poor sleep quality will decrease 0.359-times odds of having high BDNF compared to participant who have good sleep quality.

Table 15 Factor affecting to BDNF adjust for Aged, BMI, education and depression

Variable	Adjust OR	95% CI		p-value
		Lower	upper	
Aged				0.458
< 30	Ref			
≥ 30	0.726	0.312	1.691	
BMI				0.152
≤ 25	Ref			
> 25	0.519	0.211	1.274	
Education				0.300
Primary school and lower	Ref			
Higher than primary school	1.536	0.682	3.460	
Depression				**0.030***
No to minimal depression	Ref			
Mild to severe depression	2.972	1.111	7.949	
Sleep quality				**0.044***
Good	Ref			
Poor	0.359	0.132	0.972	

* = p-value < 0.05

Chapter V

Discussions

5.1 General characteristic of participant

In this study, there are 108 participant who were recruited. The average aged of participant was 27.95±4.18 years old and range between 18-35 years old. However, proper aged for pregnancy is 20-35 years old. Woman who pregnant which aged lower than 20 call “Teenage pregnancy” (Luewan, 2010), while woman aged higher than 35 call “Advance maternal aged” (Phangsuwan, 2017). It’s mean that some participant in this study in a range of teenage pregnancy. Monthly family income of participant in this study average are 464.5 ± 157.25 USD with range between 122 – 915.11 USD. BMI of participant in this study average are 23.55±3.64 kg/m^2 with range between 16.73-36.63 kg/m^2. If compared to normal person BMI should be between 18.5-24.9 kg/m^2. However, woman who pregnancy will have weight gain during pregnancy in 1st trimester for 0.5-2 kg (KHUNTHONG, 2018). So BMI will not have significant change in 1st trimester compare to normal people. Systolic blood pressure in pregnancy use same range with normal people from 90-140 mmHg (Deachnantapipat, 2020). In this study participant average sBP was 114.18±10.77 mmHg with range 90-140 mmHg. It’s mean that participant have normal systolic blood pressure. Same to diastolic blood pressure, normal range same as normal people from 60-90 mmHg. In this study participant average dBP was 70.06±8.00 mmHg with range from 52-89 mmHg. It’s mean that some participant in this study have lower diastolic blood pressure. However it need to compare with their baseline BP too.

In grouping, almost of all participant have married with their husband, only 1 participant was not married but lived together. More than half of participant (58.3%) was graduated higher than primary school. Approximately 80% of participant have occupation during pregnancy while almost of them working in factory (90% of participant who have occupation). Two-third of participant have monthly family

income lower than 549 USD. This point maybe effect to their future because when they are deliver a child they need to use more money for their children and mother sometime lack of money due to maternity leave. So maybe participant will have more worry about their money in future. Smoking in participant group almost of them never smoke while only 2 participant have once smoke but already quit smoking. However, more than half of participant (54.6%) have effect from second hand smoking which will have many effect for their newborn in the future like preterm delivery, low birth weight, weaker lung development and sudden infants dead syndrome (Center for Disease Control and Prevention). No participant was drinking during pregnant, only 20 percent who was drinking in the past while other never drink. Only 20 percent of participant was exercise during pregnant while other not.

5.2 Depression level of participant

In this study, depression level was measure by using PHQ-9 questionnaire in Myanmar version to ask about symptom of depression. Result from this study found that no depression 15.7%, minimal depression 50.9%, mild depression 19.4%, moderate depression 10.2% and moderate to severe depression 3.7%. This study show that two-third (66.6%) of participant have level depression in no to minimal depression, while one-fifth have mild symptom (19.4%) and other have higher than moderate symptom (13.9%). This study divide participant base on depression level into two group for no depression and minimal depression combine for 66.6% while higher depression level from minimal depression is combine for 33.4%.

Compare to other study in Thailand found that depression level during pregnancy have prevalence for 19.82% (Kaewjanta et al., 2014), while other country study found that it have vary from 10-28% (Andersson et al., 2003; A. M. Lee et al., 2007; Melville et al., 2010; Shitu Ayen et al., 2020; Yin et al., 2021). These result show that migrant Myanmar will have more chance to have depression level compared to other study. However, according to systemic review about migrant and depression level of Shea (Foo et al., 2018), he found that no significant different between

migrant and native people in prevalence of depression. This different result maybe because different method of define depression, both from method that use for evaluating depression and cut-point of each study. If this study combine mild depression in group of low symptom we will find that only 13.9% of participant will have high symptom of depression while 86% of participant have low symptom.

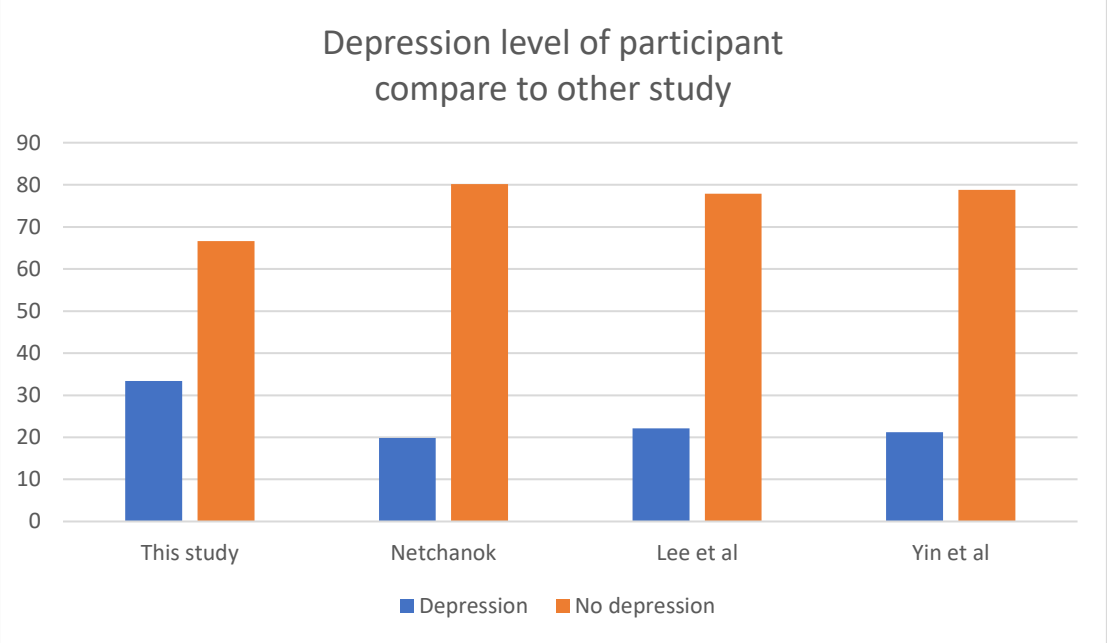


Figure 5 Depression level of participant compared to other study

5.3 Sleep quality of participant

In this study, sleep quality was measured by using PSQI questionnaire in Myanmar version to ask about behavior of sleep. Result from this study found that 71.3% of participant have good sleep quality while 28.7% of participant have poor sleep quality.

Compare to other study in 1st trimester they found that there is 39.0% of poor sleep quality in 1st trimester and 53.5% in 3rd trimester (Facco et al., 2010). Compare to study in Thailand found that there is 94.7% of poor sleep quality during pregnant in 2nd trimester (Thakolpattanakul et al., 2019). However, some found that it is 16.9% of poor sleep quality even it is in 2nd trimester (Gelaye et al., 2017). From review literature, poor sleep quality percentage in pregnancy is still vary up to each

study and factor of participant, like trimester to screening and country that research done. Cause of poor sleep quality can come from many cause like mood disturbance, physiologic change of pregnant cause polyuria or make they cannot find good position to sleep (Sedov et al., 2018).

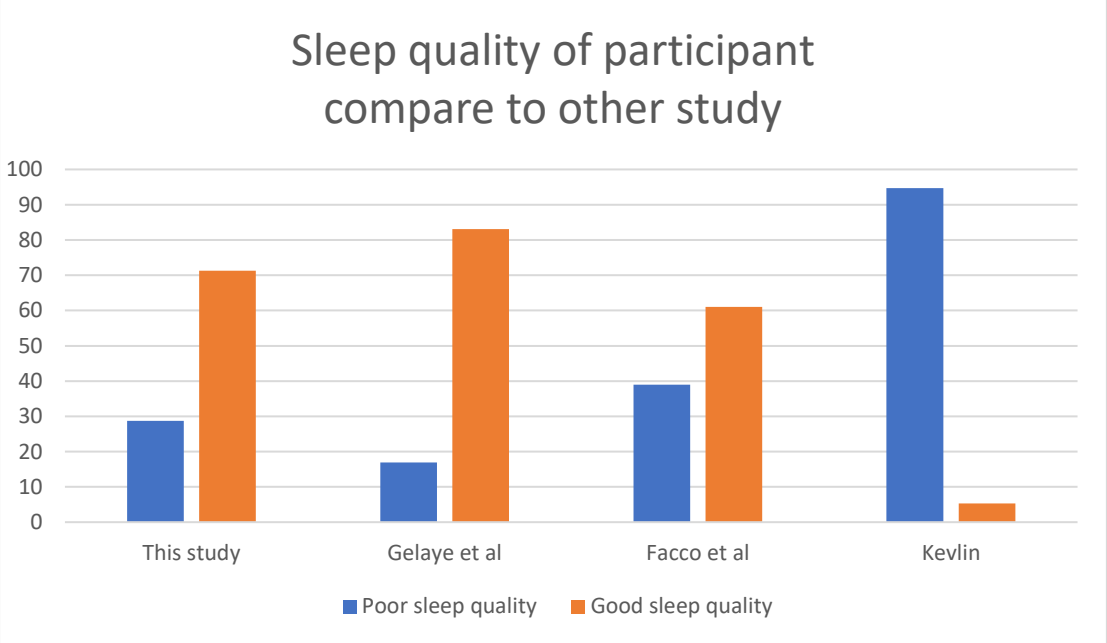


Figure 6 Sleep quality of participant compared to other study.

5.4 Factor association to BDNF level

In this study, using binary logistic regression to measure association of each variable to BDNF level. By dividing BDNF level into 2 level BDNF level equal to 6.38 and lower is define as low BDNF group and BDNF higher than 6.38 define as high BDNF group.

From binary logistic of each variable in Table 11 will found that not a single variable that significant associated to BDNF level which have p-value less than 0.05. In Table 11 we will see that depression have the lowest p-value at 0.105.

However, in the final model that use many variable to calculate together it found that depression is the factor that have a significant association with BDNF level in every model with adjust OR approximately 3 in each model by using no depression or minimal depression as reference group. Which mean that if participant

have more symptom of depression their BDNF level will be higher compared to participant who have low symptom of depression. But this is not inconsistent with previous study that done in 968 women and using PHQ-9 to evaluate depression too, that study found that pregnancy patient with more depression symptom will have lower BDNF (mean, 20.78 ng/mL; SD, 5.97) level compared to patient who don't have depression symptom (mean, 21.85 ng/mL; SD, 6.42; p =.024) (Fung et al., 2015). Also inconsistent with previous study in normal people who are not pregnant that 16 people who have depression but not receive treatment will have lower BDNF level (mean, 17.6 ng/mL; SD, 9.6) compared to depression patient who receive treatment (mean, 30.6 ng/mL; SD, 12.3; p =.001) and normal people group (mean, 27.7 ng/mL; SD, 11.4; p =.002) (Shimizu et al., 2003).

The inconsistency result from BDNF level can come from many factor. First is the study population, due to this study use secondary data from birth cohort study that trying to study about blood heavy metal and BDNF level. So participant in this study will have more chance to have higher blood heavy metal compare to other study, even in birth cohort study mean and S.D. of blood heavy metal in participant will not over limit but it can higher that other people in other area. This can have effect to our inconsistent result compared to other study. Second is operation definition, some studies have use different definition of depression even use PHQ-9 questionnaire to evaluate depression. Some study use cut-point of depression at 10 score while this study use at 5 score, so this can effect to inconsistent of the result. Third is mean of BDNF range, mean of BDNF in all participant of this study is around 5.70 ± 2.13 which very different from other study, so this can affect the inconsistent result. Fourth is race, some study about BDNF have found that Black woman have trend to have higher BDNF level compared to White women, so the reference study from other country which use different race of subject maybe effect the result of study (Christian, Mitchell, Gillespie, & Palettas, 2016).

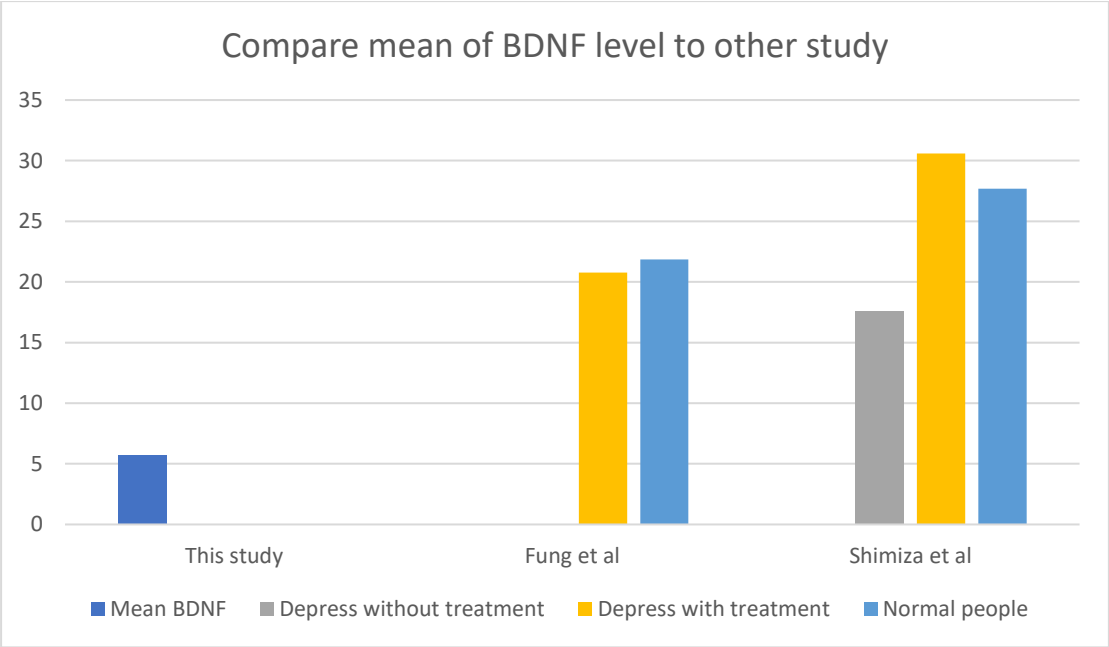


Figure 7 Compare mean of BDNF level to other study about depression.

Another variable that found to have significant to BDNF level is sleep quality in Table 15 which have adjust odd ratio 0.359 and p-value for 0.044 by using good sleep quality as reference. It mean that when people have poor sleep quality they will have lower BDNF level compare to people who have good sleep quality. These finding consistent with previous study that found no insomnia group will have higher BDNF level compare to subthreshold insomnia group, and these two group have higher BDNF compare to insomnia group (Giese et al., 2013). However, some previous study found that no significant association in sleep quality to BDNF level (Santiago et al., 2020). And some study found that decrease of hypersomnia will have effect to decrease BDNF level, which mean that good sleep quality will have lower BDNF level compare to people who have hypersomnia (Rethorst et al., 2015).

Same as depression, mean BDNF of participant in this study is different from other study. This study BDNF mean is 5.70 and median is 6.38. While study of Giese have mean BDNF at 18.01 and study of Rethorst have mean BDNF at 19.06 and median at 18.04. Which need further study to explain these different.

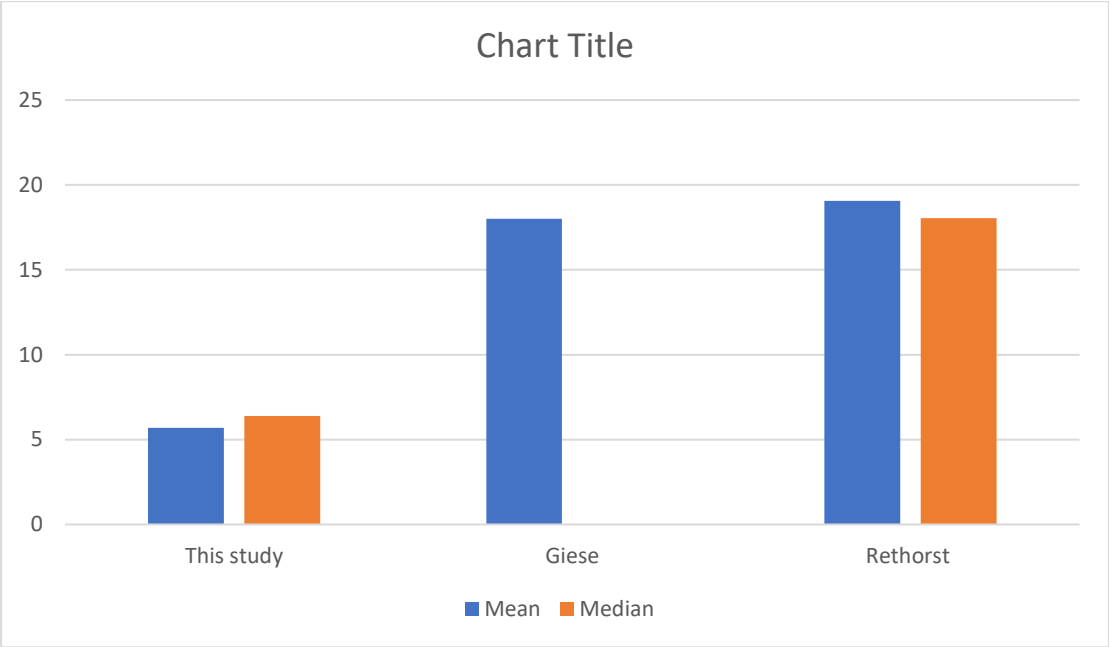


Figure 8 Compare mean of BDNF level to other study about sleep quality

From the result of this study, even many research have found that poor sleep quality related to lower BDNF level compare to good sleep quality. However, some research found inconsistent ways. Previous study have found that BDNF level did not related to sleep quality or sleep duration, but it related to specific sleep duration of sleep stage N3 and REM sleep. Which that study was compare BDNF level between patient with primary insomnia, patient with restless leg syndrome, patient with idiopathic insomnia, patient with narcolepsy and control group. Result of that study was BDNF level associated with sleep stage N3 and REM sleep, but not associated to sleep stage N1, N2 and sleep efficiency. However, that study was use polysomnography to evaluate sleep quality which different from our study that use PSQI questionnaire to evaluate it (Deuschle et al., 2018). Which need to have more study in the future.

Chapter VI

Conclusion and recommendation

6.1 Conclusion

To identify association between sleep quality, sociodemographic data, health status, health behavior and depression to BDNF level among pregnant migrant Myanmar in Samut Sakhon province, Thailand. This study have collect data from 1st trimester of participant. By using binary logistic regression and confounding factor adjust by age, BMI, education, depression and sleep quality. About 54 (50%) participant was define in low BDNF level group by BDNF level equal to 6.38 and lower, while other 54 (50%) participant was define in high BDNF level group with BDNF higher than 6.38. The result show that plasma BDNF level was significant associated with depression at adjust OR for 2.972 and p-value for 0.030, while the other variable that significant associated with plasma BDNF is sleep quality at adjust OR 0.359 and p-value for 0.044.

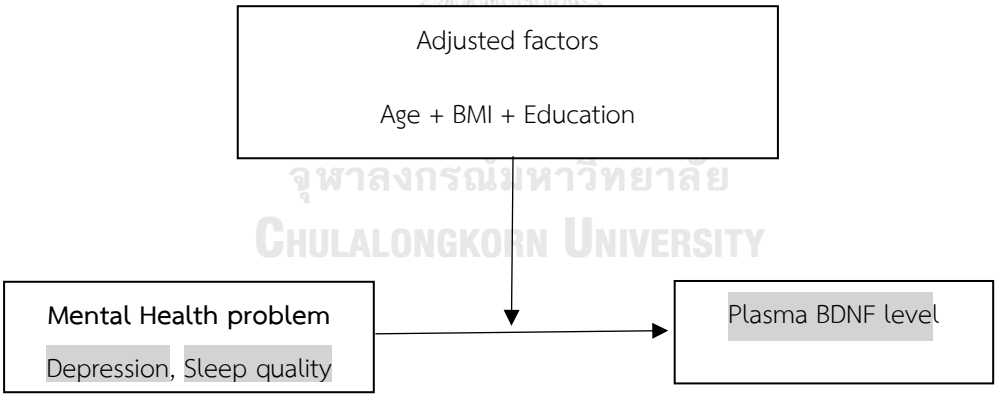


Figure 9 Show variable that significant association to BDNF level.

6.2 Strength

1) This is the first study in the association between sleep quality and plasma BDNF level on the pregnant migrant Myanmar in Thailand.
2) The significant association between sleep quality to plasma BDNF was found. This association might be support the previous study about relation of sleep quality to plasma BDNF level in new population group.
3) Result of this study is inconsistent to other previous study about relationship of depression and plasma BDNF level. Previous study found that people who have more symptom of depression will have lower BDNF level while this study found that people who have more symptom of depression will have high BDNF level. Which need to have more study about relationship of depression and plasma BDNF level in these population group.

6.3 Limitation

1) This study use secondary data from birth cohort study, so some data of participant are not complete which lead to lower sample size to our calculation. Researchers try to used 3rd trimester combine with 1st trimester in this study, but birth cohort study data of 3rd trimester have only 103 participant. So sample size is lower than calculate and cannot used to analysis.
2) Plasma BDNF measure in this study use ELISA kits that can detect both mature BNDF and it precursor, pro BDNF. So it cannot differentiate between these 2 BDNF expressions.
3) This study design is cross-sectional study, so it cannot prove causal relationship between sleep quality and BDNF level.
4) There are other factor that have association to BDNF level. Stress is one factor that have strong relation with BDNF level, however birth cohort study did not have these data so we cannot use it in statistical analysis.
5) All participant in this study come from only 1 hospital in target area. So result of this study is not generalizability.

6.4 Recommendation

6.4.1. For future study

1) Study in the future need more participant in the research to confirm power of statistic.
2) Participant in the future should concern about variable the can effect to BDNF level, in this study is blood heavy metal level. Because other study about sleep quality in pregnancy is always don't have this variable to calculate and compare. Another factor that have effect to BDNF level is stress that this study don't use to analyses.
3) ELISA kits in this study can detect both mature BDNF and pro BDNF. So future study should use method that can detect only mature BDNF to see real level of BDNF that have effect to participant.
4) Study design of future study should be cohort study that can compare participant in all trimester and postpartum period.
5) Participant in the future study should not come from only 1 hospital because result of data cannot generalizability.

6.4.2. For policy making

1) From this study, we will see that participant have depression for 33.3% and poor sleep quality for 28.7%. So, Thailand hospital should have screening for depression and sleep quality in ANC unit of hospital.
2) Antenatal care unit of Krathum Baen hospital should have screening system for depression and sleep quality in migrant pregnant woman that for ANC and should provide Myanmar version of questionnaire for Myanmar patient.
3) Together with other study, we will see that pregnant with BDNF level have association with poor sleep quality, depression, stress and other mental health problem. But sometime in OPD unit it is hard to identify that it come from physiological change or it is mental health problem. So, if the future BDNF level test has in every hospital, it should have been screening in pregnant woman.

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Appendices

Appendices A: Certificated of ethic approval by Chulalongkorn University.

AF 01-12

The Research Ethics Review Committee for Research Involving Human Research Participants, Group I, Chulalongkorn University

Jamjuree 1 Building, 2th Floor, Phyathai Rd., Patumwan district, Bangkok 10330, Thailand,
Tel: 0-2218-3202, 0-2218-3049 E-mail: eccu@chula.ac.th

COA No. 094/2021

Certificate of Approval
Exemption for Ethics Review

Study Title No. 080.1/64 : BRAIN-DERIVED NEUROTROPHIC FACTOR (BDNF) LEVELS AND SUBJECTIVE SLEEP QUALITY IN THE FIRST TRIMESTER OF PREGNANCY AMONG MYANMAR MIGRANT WORKERS IN SAMUT SAKHON PROVINCE, THAILAND: A SECONDARY DATA ANALYSIS

Principal Investigator : MR. THUVACHIT KRIENGTUNTIWONG

Place of Proposed Study/Institution : College of Public Health Sciences, Chulalongkorn University

This Research proposal is exempted for ethics review in compliance with the Office for Human Research Protections (OHRP Exempt Categories) 45 CFR part 46.101(b).

Certified under condition: To conduct this research project, the researcher (s) must strictly adhere to research proposal approved by the committee. If there is any amendment, it must be sent to the committee for review before carrying on the project.

Signature: Prida Tasanapradit
(Associate Professor Prida Tasanapradit, M.D.)
Chairman

Signature: Raveenan Mingpalearee
(Assistant Prof. Raveenan Mingpakanee, Ph.D.)
Secretary

Date of Exemption : 23 April 2021

Appendices B: Questionnaire for General data of participant.

This research is about "Effect of maternal blood heavy metal level on brain-derived neurotrophic factor and pregnancy outcomes among Myanmar migrants in Samut Sakhon Province, Thailand". For this part of interview you are asked to answer the following questions on the interview from yourself. Please answer the questions by placing an "X" mark over the box next to the response that you have chosen. The questions in this part of interview contain those dealing with your socio-demographics, health history, health behaviors and environmental factors that are possible to expose heavy metals. As with any part of interview, you are free to choose not to participate, or if you choose to participate you can skip any question that you do not wish to answer. Your responses are confidential as neither your name, address nor any other identifier will be attached to any of your responses.

Socio-demographics

1) How old are you? ---------- (years)

2) What is your ethnicity?

☐ 1. Burmese

☐ 2. Karen

☐ 3. Mon

☐ Others (Please specify) ----------

3) What is your marital status?

☐ 1. Married: official married

☐ 2. Single

☐ 3. Separated/ Divorced

☐ 4. Stay together without married (not married but living together with partner)

☐ 5. Windowed

4) What is your highest education?

☐ 1. Can read and write

☐ 2. Primary school

☐ 3. Secondary school

☐ 4. High school and above

6) Do you have any current occupation?

☐ 1. Yes

☐ 2. No

If 'Yes", which one of the following sectors you work related to?

☐ 1. Industry

☐ 2. Construction

☐ 3. Domestic work

☐ 4. Fishery and fishery products factory

☐ 5. Agriculture

☐ 6. Others (Please specify) ----------

7) What is your average monthly family income ----------(THB/month)

8) How long did you stay in Samut Sakhon? ----------(years)

Health history and health behaviors

9) Have you ever been pregnant?

☐ 1. Yes

☐ 2. No

10) How many child (ren) have you given birth to? ----------

11) Have you ever suffer any gynecological problems such as abnormal menstruations, mass in the uterus or ovary?

☐ 1. Yes

☐ 2. No

If "Yes", please specify when----------what ----------?

12) Do you have past history of hypertension?

☐ 1. Yes

☐ 2. No

13) Do you have family history of hypertension?

☐ 1. Yes

☐ 2. No

14) Do you have family history of depression?

☐ 1. Yes

☐ 2. No

15) Have you ever smoke?

☐ 1. Current

☐ 2. Not current

☐ 3. Never

16) Did you contact secondhand smoke exposure during the present pregnancy?

☐ 1. Yes

☐ 2. No

17) Have you ever drink?

☐ 1. Current

☐ 2. Not current

☐ 3. Never

18) Have you ever go to apply coloring your hair during this pregnancy (or) 3 months before?

☐ 1. Yes

☐ 2. No

19) Have you ever receive amalgam filling treatment during this pregnancy (or) 3 months before?

☐ 1. Yes

☐ 2. No

20) Have you ever take walking exercise (at least 20 minutes per day) during the present pregnancy?

☐ 1. Yes

☐ 2. No

If "Yes", how often do you go to do?

☐ 1. Daily

☐ 2. Not daily

21) How many frequency do you have seafood during the present pregnancy?

☐ 1. Less than once a week

☐ 2. Once a week

☐ 3. 2-3 times per week

☐ 4. >3 times per week

Environmental factors

22) Is your house/ room located within 1 km to the factory?

☐ 1. Yes

☐ 2. No

If "Yes", please choose the type of factory (ies). (You can chose more than one answer)

☐ 1. Alloy production factory

☐ 2. Battery manufacturing factory

☐ 3. Ceramic manufacturing factory

☐ 4. Electronics manufacturing factory

☐ 5. Glass manufacturing factory

☐ 6. Insecticides/ pesticides manufacturing factory

☐ 7. Metal pipe production factory

☐ 8. Paints production factory

☐ 9. Paper manufacturing factory

☐ 10. Pigments manufacturing factory

☐ 11. Plastics manufacturing factory

☐ 12. Textile printing factory

☐ 13. Others (Please specify) ----------

23) Is your house/ room located within 1 km to the followings? (You can choose more than one answer)

☐ 1. Construction site

☐ 2. Farm using insecticides/ pesticides

☐ 3. Solid waste combustion site

Appendices C: Pittsburgh Sleep Quality Index (PSQI) in English.

ID _____ Date _____

Pittsburgh Sleep Quality Index (PSQI)

1. During the past month, when have you usually gone to bed at night?

Usual bed time _____

2. During the past month, how long (minute) has it usually take you to fall asleep each night?

Number of minute _____

3. During the past month, when have you usually gotten up in the morning?

Usually getting up time _____

4. During the past month, how many hours of actual sleep did you get at night?

(This may be different than the number of hours you spend in beds)

Hour of sleep per night _____

5. During the past month, how often have you had trouble sleeping because you...

	Not during the past month	Less than once a week	Once or twice a week	Three or more times a week
a. ... cannot go to sleep within 30 minute				
b. .... wake up in the morning of night or early morning				
c. ... have to get up to use the bath room				
d. ... cannot breath comfortably				
e. ... cough or snore loudly				
f. ... feel too cold				
g. ... feel too hot				
h. ... had a bad dream				
i. ... have a pain				
J. Other reasons, please describe _____ _____				

	Not during the past month	Less than once a week	Once or twice a week	Three or more times a week
6. During the past month, how often have you taken medicine to help you sleep (prescribed or “over the counter”)?				
7. During the past month, how often have you had trouble staying awake while driving, eating meals, or engaging in social activity?				
	No problem at all	Only a very slight problem	Somewhat of a problem	A very big problem
8. During the past month, how much of a problem has it been for you to keep up enough enthusiasm to get things done?				
	Very good	Fairly good	Fairly bad	Very bad
9. During the past month, how would you rate your sleep quality overall?				

	No bed partner or roommate	Partner/ roommate in other room	Partner in same room but not same bed	Partner in same bed
10. Do you have a bed partner or roommate?				
	Not during the past month	Less than once a week	Once or twice a week	Three or more times a week
If you have a roommate or bed partner, ask him/her how often in the past month you have had.....				
a. loud snoring				
b. Long pauses between breaths while asleep				
c. Legs twitching or jerking while you sleep				
d. Episodes of disorientation or confusion during sleep				
e. Other restlessness while you sleep, please describe _____ _____				

Scoring of PSQI

The order of the PSQI items has been modified from the original order in order to fit the first 9 items (which are the only items that contribute to the total score) on a single page. Item 10, which is the second page of the scale, does not contribute to the PSQI score.

In scoring the PSQI, seven component scores are derived, each scored 0 (no difficulty) to 3 (severe difficulty). The component scores are summed to produce a global score (range 0 to 21). Higher scores indicate worse sleep quality.

Component 1: Subjective sleep quality—question 9

Response to Q9	Component 1 score
Very good	0
Fairly good	1
Fairly bad	2
Very bad	3

Component 1 score: _____

Component 2: Sleep latency—questions 2 and 5a

Response to Q2	Component 2/Q2 subscore
< 15 minutes	0
16-30 minutes	1
31-60 minutes	2
> 60 minutes	3

Response to Q5a	Component 2/Q5a subscore
Not during past month	0
Less than once a week	1
Once or twice a week	2
Three or more times a week	3

Sum of Q2 and Q5a subscores	Component 2 score
0	0
1-2	1
3-4	2
5-6	3

Component 2 score:_____

Component 3: Sleep duration—question 4

Response to Q4	Component 3 score
> 7 hours	0
6-7 hours	1
5-6 hours	2
< 5 hours	3

Component 3 score:_____

Component 4: Sleep efficiency—questions 1, 3, and 4

Sleep efficiency = (# hours slept/# hours in bed) X 100%

hours slept—question 4

hours in bed—calculated from responses to questions 1 and 3

Sleep efficiency	Component 4 score
> 85%	0
75-84%	1
65-74%	2
< 65%	3

Component 4 score:_____

Component 5: Sleep disturbance—questions 5b-5j

Questions 5b to 5j should be scored as follows:

Not during past month	0
Less than once a week	1
Once or twice a week	2
Three or more times a week	3

Sum of 5b to 5j scores	Component 5 score
0	0
1-9	1
10-18	2
19-27	3

Component 5 score:_____

Component 6: Use of sleep medication—question 6

Response to Q6	Component 6 score
Not during past month	0
Less than once a week	1
Once or twice a week	2
Three or more times a week	3

Component 6 score:_____

Component 7: Daytime dysfunction—questions 7 and 8

Response to Q7	Component 7/Q7 subscore
Not during past month	0
Less than once a week	1
Once or twice a week	2
Three or more times a week	3

Response to Q8	Component 7/Q8 subscore
No problem at all	0
Only a very slight problem	1
Somewhat of a problem	2
A very big problem	3

Sum of Q7 and Q8 subscores	Component 7 score
0	0
1-2	1
3-4	2
5-6	3

Component 7 score:_____

Global PSQI Score: Sum of seven component scores:_____

Citation: Buysse, DJ, Reynolds CF, Monk TH, Berman SR, Kupfer DJ: The Pittsburgh Sleep Quality Index (PSQI): A new instrument for psychiatric research and practice. Psychiatry Research 28:193-213, 1989

Appendices D: Patient Health Questionnaire (PHQ-9)

ID _____ Date _____

Patient Health Questionnaire (PHQ-9)

Over the last 2 weeks, how often do you have been bothered by any of these following problem?

	Not at all	Several days	More than half the days	Nearly every day
1. Little interest or pleasure in doing things	0	1	2	3
2. Feeling down, depressed, or hopeless	0	1	2	3
3. Trouble falling or staying asleep, or sleeping too much	0	1	2	3
4. Feeling tired or having little energy	0	1	2	3
5. Poor appetite or overeating	0	1	2	3
6. Feeling bad about yourself or that you are a failure or have let yourself or your family down	0	1	2	3
7. Trouble concentrating on things, such as reading the newspaper or watching television	0	1	2	3
8. Moving or speaking so slowly that other people could have noticed. Or the opposite being so fidgety or restless that you have been moving around a lot more than usual	0	1	2	3
9. Thoughts that you would be better off dead, or of hurting yourself	0	1	2	3
10. If you checked off any problems, how difficult have these problems made it for you to do your work, take care of things at home, or get along with other people?	0	1	2	3

VITA

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