



(RESEARCH ARTICLE)



## The influence of pregnant women's anxiety levels on fetal well-being and pregnancy complications: A cross-sectional study in Lombok, Indonesia

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### Abstract

Pregnant women are a vulnerable group who are at risk of experiencing physiological changes that result in a partial decrease in immunity. Pregnancy with anxiety for pregnant women, which can affect maternal health, hinder development, cause emotional disturbances at birth, and even result in pregnancy complications. This type of research is observational-analytic with a cross-sectional design from January to June 2021. The population in this study is all third-trimester pregnant women at the Mataram City Regional Health Center and West Lombok Regency. There were 228 respondents in the study, taken using the accidental sampling technique. Data collection was carried out by accessing medical record data and filling out questionnaires for pregnant women who underwent examinations. The results of the chi square test showed that there was a relationship between anxiety and pregnancy complications with a p value of 0.0000 ( $p < 0.05$ ) and a relationship between anxiety and fetal heart rate with a p value of 0.007 ( $p < 0.05$ ). The ANOVA test results also showed that there was a simultaneous influence of fetal heart rate and pregnancy complications on anxiety in pregnant women, with a significance value of 0.0000 ( $p < 0.05$ ) and an effect size of 74.6%. This research shows that early detection and management of anxiety during pregnancy is very necessary to prevent and minimize the occurrence of pregnancy complications and disruption of fetal well-being, which is characterized by an abnormal fetal heart rate.

**Keywords:** Anxiety; Pregnant Woman; Fetal Well-Being; Pregnancy Complication

### 1. Introduction

During pregnancy, various changes will occur in the mother, both physiologically and psychologically. This causes the mother to feel uncomfortable during pregnancy and triggers stress, which is indicated by the mother being often moody. Emotional disturbances in the form of stress or depression experienced during pregnancy will affect the fetus because, at that time, the fetus is in the formative period, which will result in stunted growth of the baby, or LBW (1,2).

In the third trimester of pregnancy, the psychological changes of pregnant women are more complex and increase compared to the previous trimester due to the growing condition of the pregnancy. Several psychological conditions occur, such as emotional changes and discomfort, so pregnant women need support from their husbands, family, and medical personnel (3).

In several developed countries, including England and Australia, around 10% of pregnant women and 13% of women giving birth experience mental health problems such as anxiety. This incident occurs more often in developing countries, reaching 15.6% of pregnant women and 19.8% of women giving birth, including in China, India, Pakistan, South Africa,

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Chile, Jamaica, Mexico, and Uganda. The incidence of anxiety among pregnant women in Indonesia is 28.7%, including among pregnant women approaching delivery (2,3).

According to Savitri in Muyasroh 2020, there are certain times in human life when anxiety occurs. Anxiety can take the form of constant worry and fear and is related to everyday life. Anxiety among pregnant women brings feelings of insecurity, constant worry, and fear. This will cause a high risk in the pregnancy process that a woman goes through. According to Hasim in Setiani 2020, anxiety in pregnant women can trigger stimulation of uterine contractions, which is very dangerous, especially in the first trimester (4–7).

The results of research conducted by Heriani in Wulandari 2019 showed that 53.3% (of 45 pregnant women respondents) experienced anxiety when facing childbirth. The results of research conducted by Fazdria and Meilani in 2019 showed that of the 25 respondents, 12 (48%) pregnant women experienced severe anxiety in facing childbirth, 12 (48%) pregnant women experienced moderate anxiety, and 1 (4%) pregnant mother experienced mild anxiety (8–11).

Anxiety that occurs in pregnant women can affect the health of the mother and fetus; the development of the fetus can be hampered or emotional disturbances can occur at birth if anxiety during pregnancy is not handled properly, even leading to pregnancy complications (12). Continuous (repeated) anxiety and stress during pregnancy will affect the physiological and psychological development of the fetus (8). In addition to the factor of vulnerability to virus transmission, this mental health condition can be exacerbated by a lack of direct family support and social support during pregnancy, childbirth, and the postpartum period. Although the pandemic situation and the implementation of screening for pregnant women are known to affect the mother's mental condition, there are not many reports or pieces of literature that report the relationship in detail (1,2).

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## 2. Material and methods

The research method used is observational analytics with a cross-sectional design. This research was conducted in the cities of Mataram and West Lombok Regency, especially in the working areas of the Mataram City Health Center and the West Lombok Regency Health Center, which represent the sub-district areas covered by the Mataram City and West Lombok Regency areas.

The population in this study were all pregnant women in the third trimester at the Community Health Center in Mataram City and West Lombok Regency. Researchers will use an accidental sampling technique of 228 respondents to carry out the research, namely from January to June 2021. The research was conducted in the working areas of the Mataram City Health Center and the West Lombok Regency Health Center. Mataram City and West Lombok Regency are considered representative of the sub-district area covered by Mataram City and West Lombok Regency. Research can be carried out by accessing medical record data that is stored completely at the community health center, as well as pregnant patients undergoing examinations in both areas. The Mataram city work area consists of 11 health centers, which were used as research subjects. There are 4 health centers that have inpatient status so they can provide 24 hour service. This puskesmas serves a 24 hour emergency room, has a maternity ward, a general inpatient room, and poly services. The four health centers are Karang Taliwang Health Center, Ampenan Health Center, Tanjungkarang Health Center, and Pejeruk Health Center. Another research subject, namely in the working area of West Lombok Regency, consists of 20 community health centers that are used as research subjects, namely 9 community health centers with inpatient status, namely Gunungsari Health Center, Penimbung Health Center, Sesela Health Center, Kediri Health Center, Narmada Health Center, Suranadi Health Center, Meninting Health Center, and Kuripan Community Health Center. Researchers were assisted by enumerators, namely midwives who work at the relevant community health centers, and by students from the Midwifery Department of the Mataram Ministry of Health Polytechnic in collecting data.

The data used are primary and secondary. Before the data collection process, researchers will conduct outreach with enumerators using the Zoom meeting platform regarding the instruments used so that data accuracy will be accounted for through this process. so that all respondents who are within the scope of the research and come to carry out the examination on that day will receive justice and the same opportunity to participate. Respondents and enumerators will sign informed consent and an integrity pact to commit to and maintain the principles adhered to in the research. The data collection process per respondent will be carried out using codes as the respondent's initials to maintain data confidentiality. Dissemination will be carried out to explain the findings, which will be disseminated to the community health center and community representatives. for bone ossification measurement and brown for RANKL expression were semi-quantified using the ImageJ software.

### 3. Results and discussion

#### 3.1. Respondent Characteristics

**Tabel 1** Characteristics of Respondents based on Age, Education, Parity, BMI, Gestational Age, Estimated Fetal Weight (n= 288)

Characteristics	Frequency	%
<b>Age</b>		
<20 years	30	13.1
20-35 years	183	80.3
35 years	15	6.6
<b>Education</b>		
No school	3	1.3
Elementary School/Equivalent	33	14.5
Middle School/Equivalent	68	29.8
SMA/Sederajat	119	52.2
DIII/PT	5	2.2
<b>Anemic Status</b>		
Not Anemic	84	36.8
Anemic	144	63.2
<b>BMI</b>		
Underweight	0	0
Normal weight	94	41.2
Overweight	134	58.8
<b>Gestational Age</b>		
< 36 weeks	27	12
36-40 weeks	198	87
>40 weeks	3	1
<b>Estimated Fetal Weight</b>		
< 2500 gr	26	11.4
>2500 gr	202	88.6
<b>Fetal Heart Rate</b>		
Bradycardia	8	3.5
Normal	216	94.7
Tachycardia	4	1.8
<b>Fetal Movement</b>		
Normal	216	94.7
Abnormal	12	5.3
<b>Anxiety Level</b>		

Not Anxious	148	64.9
Mild	35	15.4
Severe	45	19.7
<b>Pregnancy Complications</b>		
No Complications	184	80.7
There Are Complications	44	19.3

Source; Primary data, 2023

Based on table 1, the majority of respondents were aged 20–35 years, namely 80.3%. Several studies also state that maternal anxiety during pregnancy is related to age factors. At the age of 35 years, some women are classified as pregnancies at high risk of congenital abnormalities, and maternal and infant mortality rates increase due to complications during delivery, which will increase anxiety, while pregnant women aged less than 20 years are indicated to experience severe anxiety because their physical condition is not yet 100% ready (13,14).

The highest education is SMA/Equivalent 119 (52.2%); low education will cause a person to experience stress and anxiety; this occurs due to a lack of information and knowledge among pregnant women regarding their health and pregnancy (15).

Anemia status was 144 (63.2%), highest BMI with overweight category 134 (58.8%), Gestational age 36-40 weeks 198 (87%), In the third trimester, maternal psychological changes appeared more complex and increases again compared to the psychological condition in the previous trimester, this is because the mother is increasingly aware of the presence of a fetus in her womb which is getting bigger and bigger and a number of fears begin to increase, the mother feels increasingly anxious about the baby's life and the condition of the baby and the condition of the mother herself. Apart from that, pregnant women are a vulnerable population, both physiologically and psychologically. The vulnerability in question is due to various changes during pregnancy that affect the body's immune system. Meanwhile, psychologically it can cause psychological pressure including stress, anxiety and depression, which can increase maternal and infant morbidity (15,16).

The results of the study showed that the highest estimated fetal weight was >2500 gr 202 (88.6%), fetal heart rate was in the normal category 216 (94.7%), fetal movement was normal 216 (94.7%), level of anxiety was not anxious 148 (64.9%), and there were no pregnancy complications 184 (80.7%). Higher maternal anxiety and depression symptom scores during late pregnancy were associated with lower estimated infant brain WM development, which indicated in utero influences of maternal mental health during pregnancy on the developing brain (1). High frequencies of maternal mental health problems, such as clinically relevant anxiety and depression, during epidemics have been reported in many countries. Research by Bethany et al. (2021) mentions maternal stress during pregnancy as a potential causal factor; however, the majority of premature births are iatrogenic, thus indicating that the behavior of health care providers may be a causal factor in maternal stress (17–19).

### 3.2. Relationship between Pregnant Women's Anxiety Level and Pregnancy Complications

**Table 2** Relationship between Pregnant Women's Anxiety Level and Pregnancy Complications (n=288)

Anxiety Level	Pregnancy Complications				Amount		P-Value
	No Complications		There Are Complications		f	%	
	f	%	F	%			
Not Anxious	147	64.5	1	0.4	148	64.9	0.000
Mild	35	15.4	0	0	35	15.4	
Severe	2	0.9	43	18.9	45	19.7	

Table 2 above shows that the group of mothers who were not anxious during pregnancy and experienced complications was 0.4%, while mothers with anxiety (moderate and severe) and experienced complications were 18.9%. Based on these data, it can be seen that complications often occur in pregnant women with anxiety.

Based on the results of the analysis using the chi-square test, the P-value was 0.000. Based on this value, because the p value is  $<0.05$ , it can be concluded that the level of anxiety in pregnant women is related to complications in pregnancy.

These results are also in line with research conducted by Rudiyaniti Novita, entitled "Level of Anxiety in Pregnant Women with the Incident of Preeclampsia in a Lampung Provincial Hospital." This research shows that there is a relationship between the level of anxiety in pregnant women and the incidence of preeclampsia (P value = 0.005). This research is also in line with Saddam's research in 2023, which stated that there was a significant relationship between anxiety and the incidence of preeclampsia at the Pertiwi Makassar Regional Special Hospital for Women and Children. It has been found that mothers with anxiety can increase their blood pressure during pregnancy. High blood pressure, or hypertension, can be one of the causes of preeclampsia. It is known that preeclampsia is a complication that can occur in pregnant women (20–22).

During pregnancy, there is an increase in the hormone progesterone, which causes emotional disturbances and makes the mother tired quickly, thus having an anxious effect on pregnant women. The hormone adrenaline also increases, causing dysregulation of the body's biochemistry and resulting in physical tension in pregnant women, such as being irritable, easily restless, unable to concentrate, and experiencing anxiety. Changes in the psychological state of pregnancy require pregnant women to get used to them. Anxiety is a form of psychological adaptation, but if it lasts for a long period of time, it will cause excessive stress and even depression. Pregnant women who experience anxiety can increase their blood pressure. In anxiety, there is excessive secretion of the hormone adrenaline, causing high blood pressure. Anxiety in pregnant women can strongly activate the HPA (Hypothalamus-Pituitary-Adrenal) stress response, increase the production of the CRH (Corticotropin-Releasing Hormone) hormone, and stimulate the production of inflammatory cytokines during pregnancy (15,23). Increases in the maternal HPA axis can influence fetal HPA development, thereby causing long-term stressful effects on the entire developmental pathway. Mothers who experience stress are more susceptible to infections and illnesses during pregnancy, as well as behavioral changes such as poor nutrition, reduced physical activity, and sleep disorders (15).

### 3.3. The Relationship between Pregnant Women's Anxiety Level and Fetal Welfare

**Table 3** Relationship between Pregnant Women's Anxiety Level and Fetal Welfare (n=288)

Anxiety Level	Fetal Welfare						P -Value					P-Value
	Fetal Heart Rate							Fetal Movement				
	Bradycardia		Normal		Tachycardia			Abnormal		Normal		
	f	%	f	%	f	%		f	%	f	%	
Not Anxious	7	3.1	14.1	61.8	0	0	0.007	8	3.5	140	61.4	0.960
Mild	0	0	32	14	3	1,3		2	0.9	33	14.5	
Severe	1	0.4	43	18.9	1	0.4		2	0.9	43	18.9	

Based on table 3, it can be seen that 61.8% of mothers who do not experience anxiety have a normal heart rate, while 2.1% of pregnant women with anxiety have an abnormal heart rate (bradycardia or tachycardia). The results of the chi square test on the relationship between anxiety and fetal heart rate found a p value of 0.007, which means the p value  $< 0.05$  so that  $H_0$  is accepted, namely that there is a relationship between anxiety and fetal heart rate.

This research is in line with Saddam's research from 2023, which found that pregnant women who experience anxiety can increase their heart rate. Pregnant women with anxiety can have their blood pressure increase. Preeclampsia in pregnant women can result in the unborn baby having a low birth weight and even death. The baby in the womb can feel and respond to what the mother is feeling, including the mother's heartbeat. The faster the mother's heartbeat, the faster the fetus moves in the womb (22,24).

Table 3 also shows that for mothers who were not anxious, almost all of their babies (61.4%) had normal movements, whereas for mothers who experienced anxiety, only a small proportion of babies (1.8%) had abnormal movements. The results of the chi square test on the relationship between anxiety and fetal heart rate found a p value of 0.960, which means the p value is  $> 0.05$ , so  $H_0$  is rejected, namely that there is no relationship between anxiety and fetal movement.

Poor maternal anxiety can greatly affect the neuro-behavioral development of the fetus. Based on Olesen's research in Reissland, 2020, it was stated that at 32 weeks of gestation, fetuses from mothers suffering from HG showed a much higher level of fetal movement than fetuses from healthy mothers. On the one hand, a significant decrease in fetal movements indicates an increased risk of fetal growth restriction, stillbirth, premature birth, and the need for an emergency caesarean section (16,25,26).

Based on research by Sjostrom et al. (2002), it was found that the condition of fetuses from pregnant women who had high anxiety showed rapid fetal movements exceeding normal values, compared to the condition of fetuses from pregnant women who had low levels of anxiety, with fetal movements that were less than normal. In two different studies, Van den Bergh and colleagues found a significant positive correlation between maternal anxiety in late pregnancy and fetal movements in other states. Another finding from the research that has been conducted is that there is a positive correlation between maternal anxiety scores and the duration of the fetal heart rate pattern. Maternal anxiety may have an impact on the time the fetus is awake at the end of pregnancy (a tendency for a longer fetal heart rate duration). High maternal anxiety may be associated with reduced fetal heart rate variability (16,27).

### 3.4. The Effect of Pregnant Women's Anxiety Level on Fetal Heart Rate and Pregnancy Complications

**Tabel 4** The influence of pregnant women's anxiety on fetal heart rate and pregnancy complications

Anxiety Level	R Square	Sig
	0.745	0.000 <sup>b</sup>

b. Predictors: (Constant), Fetal heart rate, pregnancy complications

The ANOVA test results show a significance value of 0.000, which means the sig value is  $<0.05$ , so according to the basis for decision-making in the F test, it can be concluded that the hypothesis is accepted; in other words, fetal heart rate and pregnancy complications simultaneously influence maternal anxiety during pregnancy.

In the SPSS model summary output, the fetal heart rate variables and pregnancy complications, which are known to be associated with anxiety in pregnant women, show an R square value of 0.745. This figure means that the fetal heart rate and pregnancy complications are simultaneously influenced by maternal anxiety during pregnancy by 74.5%. The COVID-19 pandemic and its various potential impacts on health care, mental health and economic effects (28). Monitored maternal and fetal physiology while mothers' responded to a cognitive challenge to examine the relationship between pregnant women's acute stress responses and FHR and to determine the effect of differences in maternal state anxiety levels on these responses (13).

This research is in line with the 2023 study, which found that the more vulnerable the level of stress experienced by pregnant women, the more susceptible they are to preeclampsia and asphyxia in newborn babies. Stress in pregnant women is caused by an increase in the hormones adrenaline, noradrenaline, and epinephrine. Pregnant women experience physical tension due to the hormone norepinephrine, which causes biochemical dysregulation in the body. This physiological process can influence daily behavior. Pregnant women can become irritable or fussy, restless, unable to focus, indecisive, and even want to run away from the realities of life. This condition can exacerbate anxiety and tension, resulting in a feedback cycle that can increase overall emotional intensity. In other words, anxiety disorders are common during pregnancy and can have negative effects on both the mother and the fetus. A pregnant woman's anxiety will affect the fetus she is carrying (29). Many studies show that negative thoughts can harm pregnant women and the fetus they are carrying. Anxiety has a negative impact on pregnant women because it stimulates uterine contractions. As a result of this condition, blood pressure can rise, triggering preeclampsia and miscarriage (25).

Anxiety or stress causes the body to release the hormone corticotropin-releasing hormone (CRH), which produces an increase in the stress hormone cortisol. This mechanism can persist throughout pregnancy, and the placenta can also emit the stress hormone CRH. Anxiety makes pregnant women very vulnerable. As a result, small amounts of this hormone can enter the amniotic fluid and disrupt the fetus' metabolic processes. The risks of anxiety in pregnant women include causing premature birth and increasing the risk of asphyxia (30).

If anxiety during pregnancy is not addressed as soon as possible, it will have a negative impact on the mother and fetus. The impact on the mother is triggering uterine contractions, resulting in premature birth, miscarriage, and depression. The consequences of this condition can increase blood pressure, which can trigger preeclampsia and miscarriage (31). The fetal heart rate is influenced by various factors, including the mother's position, uterine activity, and the mother's gestational age, which is caused by the balance of maturity, sympathetic and parasympathetic nerves, fetal stress, and

anxiety felt by pregnant women. This anxiety can cause mothers to experience physical discomfort during pregnancy, which results in mothers not paying attention to their pregnancy, including inadequate nutritional intake. Insufficient nutritional intake in the mother will also result in the fetus not getting proper nutrition, resulting in reduced blood flow to the fetus, which can result in a low fetal heart rate (15,16,24,31).

This research is K.Sjostrom (2002) which states that fetal heart rate is considered a factor for measuring the well-being of the fetus in the womb. One of the factors that influences fetal heart rate is anxiety during pregnancy (27,29).

Prenatal stress can have a significant impact on pregnancy, maternal health, and fetal development throughout the life cycle. This impact can occur directly through the influence of physiological changes related to prenatal stress that affect the condition of the fetus, namely changes in fetal heart rate and other fetal development, or indirectly through the effects of prenatal stress on maternal health and baby development (30).

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#### **4. Conclusion**

There is a significant relationship between pregnant women's anxiety and fetal heart rate, with a p value of 0.007. There is no significant relationship between pregnant women's anxiety and fetal movement, with a p value of 0.960. Pregnancy complications and fetal heart rate are known to simultaneously influence maternal anxiety during pregnancy by 74.5%, while 25.5% are influenced by other factors, so further research and development are needed regarding factors that influence pregnancy, especially psychological factors (32).

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#### **Compliance with ethical standards**

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##### *Disclosure of conflict of interest*

We warrant that the article is the Authors' original work and ensure no conflicts of interest to declare. All co-authors have seen and agree with the contents of the manuscript and there is no financial interest to report. We certify that the submission is not under review at any other publication.

##### *Statement of ethical approval*

This research also has an ethical permit issued by the Health Research and Development Ethics Commission, Sint Carolus School of Health Sciences, with ethical approval number 010/KEPPKSTIKSC/I/2023.

##### *Statement of informed consent*

Informed consent was obtained from all respondents in this study, including an accurate understanding of the study requirements, procedures, and potential risks.

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#### **References**

- [1] Husain RN, Setiawati D, Suryaningsih R. Risk Factor Analysis of Anxiety Disorder in Third Trimester Pregnant Women Open Access. *Green Med J*. 2023;5(2):2686–6668.
- [2] Graham RM, Jiang L, McCorkle G, Bellando BJ, Sorensen ST, Glasier CM, et al. Maternal anxiety and depression during late pregnancy and newborn brain white matter development. *Am J Neuroradiol*. 2020 Oct 1;41(10):1908–15.
- [3] Asselmann E, Kunas SL, Wittchen HU, Martini J. Maternal personality, social support, and changes in depressive, anxiety, and stress symptoms during pregnancy and after delivery: A prospective-longitudinal study. *PLoS One*. 2020 Aug 1;15(8 August).

- [4] Jin Y, Murray L. Perinatal mental health and women's lived experience of the COVID-19 pandemic: A scoping review of the qualitative literature 2020-2021. Elsevier. 2023;(January).
- [5] Dhama K, Khan S, Tiwari R, Sircar S, Bhat S, Malik YS, et al. Coronavirus Disease 19 (COVID-19). *Sustain Dev Goals Ser.* 2023;33(4):137–42.
- [6] Muyasaroh H, Fadjrin NN, Pradana TA, Ridwan M. *Kajian Jenis Kecemasan Masyarakat Cilacap dalam menghadapi Pandemi Covid 19.* Cilacap; 2020.
- [7] Tuta Setiani F, Candra Resmi D. PENGARUH TERAPI NON FARMAKOLOGI DALAM MENGURANGI KECEMASAN PADA IBU HAMIL DI ERA PANDEMI COVID 19 : LITERATUR REVIEW. *J Ilm Kesehat.* 2020;10(2).
- [8] Chang F, Fan X, Zhang Y, Tang B, Jia X. Prevalence of depressive symptoms and correlated factors among pregnant women during their second and third trimesters in northwest rural China: a cross-sectional study. *BMC Pregnancy Childbirth [Internet].* 2022;22(1):1–10. Available from: <https://doi.org/10.1186/s12884-021-04340-0>
- [9] Thornton CA. Immunology of pregnancy. In: *Proceedings of the Nutrition Society.* 2010. p. 357–65.
- [10] Wulandari P, Sofitamia A, Kustriyani M. The Effect of Guided Imagery to The Level of Anxiety of Trimester III Pregnant Woman in The Working Area of Mijen Health Center in Semarang City. *Media Keperawatan Indones.* 2019 Feb 21;2(1):29.
- [11] Roziika A, Santoso MB, Zainuddin M. Penanganan Stres Di Masa Pandemi Covid-19. *J Pekerj Sos.* 2020;3(2):121–30.
- [12] Silva MM de J, Serrano TB de M, Porcel G da S, Monteiro BB, Clapis MJ. Risk of depression during pregnancy in usual risk antenatal care. *Rev Lat Am Enfermagem.* 2023;31.
- [13] Preis H, Mahaffey B, Heiselman C, Lobel M. Pandemic-related pregnancy stress and anxiety among women pregnant during the coronavirus disease 2019 pandemic. *Am J Obstet Gynecol MFM.* 2020;2(3).
- [14] Thapa SB, Mainali A, Schwank SE, Acharya G. Maternal mental health in the time of the COVID-19 pandemic. *Acta Obstet Gynecol Scand.* 2020 Jul 1;99(7):817–8.
- [15] Sze Y, Brunton PJ. How is prenatal stress transmitted from the mother to the fetus? *J Exp Biol.* 2024;227.
- [16] Chen X, Liu M, Min F, Tong J, Liu Y, Meng Q, et al. Effect of biological, psychological, and social factors on maternal depressive symptoms in late pregnancy: a cross-sectional study. *Front Psychiatry.* 2023;14.
- [17] Issakhanova A, Issanov A, Ukybassova T, Kaldygulova L, Marat A, Imankulova B, et al. Depression, Anxiety, and Stress in Kazakhstani Women with Recurrent Pregnancy Loss: A Case–Control Study. *J Clin Med.* 2023;12(2).
- [18] Abahussain E, Al-Otaibi M, Al-Humaidi K, Al-Mutairi S, Al-Khatir A, Abualnaja A, et al. Pregnancy Complications in Pandemics: Is Pregnancy-Related Anxiety a Possible Physiological Risk Factor? *Int J Environ Res Public Health.* 2022;19(19).
- [19] Kotlar B, Gerson E, Petrillo S, Langer A, Tiemeier H. The impact of the COVID-19 pandemic on maternal and perinatal health: a scoping review. Vol. 18, *Reproductive Health.* BioMed Central Ltd; 2021.
- [20] Durankuş F, Aksu E. Effects of the COVID-19 pandemic on anxiety and depressive symptoms in pregnant women: a preliminary study. *J Matern Neonatal Med.* 2020;1–7.
- [21] Rudiyantri N, Raidartiwi E, Jurusan Kebidanan Poltekkes Tanjungkarang D. TINGKAT KECEMASAN PADA IBU HAMIL DENGAN KEJADIAN PRE EKLAMPSIA DI SEBUAH RS PROVINSI LAMPUNG. Vol. XIII, *Jurnal Keperawatan.* 2017.
- [22] Saddam M, Yunus P, Fitriani R, Galib M, Studi Pendidikan Dokter P, Kedokteran dan Ilmu Kesehatan F. Analisis Korelasi antara Kecemasan dan Kejadian Preeklamsia pada Ibu Hamil. Vol. 8, *UMI Medical Journal.* Juni; 2023.
- [23] Campos-Garzón C, Riquelme-Gallego B, de la Torre-Luque A, Caparrós-González RA. Psychological impact of the covid-19 pandemic on pregnant women: A scoping review. Vol. 11, *Behavioral Sciences.* MDPI; 2021.
- [24] Shi Y, Wang CC, Wu L, Zhang Y, Xu A, Wang Y. Pathophysiological Insight into Fatty Acid-Binding Protein-4: Multifaced Roles in Reproduction, Pregnancy, and Offspring Health. *Int J Mol Sci.* 2023;24(16).
- [25] Abu-Raya B, Michalski C, Sadarangani M, Lavoie PM. Maternal Immunological Adaptation During Normal Pregnancy. *Front Immunol.* 2020;11(October):1–18.



- [26] Reissland N, Millard AR, Wood R, Ustun B, McFaul C, Froggatt S, et al. Prenatal effects of maternal nutritional stress and mental health on the fetal movement profile. *Arch Gynecol Obstet*. 2020 Jul 1;302(1):65–75.
- [27] Sjöström K, Valentin L, Thelin T, Maršál K. Maternal anxiety in late pregnancy: effect on fetal movements and fetal heart rate [Internet]. Available from: [www.elsevier.com/locate/earlhumdev](http://www.elsevier.com/locate/earlhumdev)
- [28] Hübner T, Wolfgang T, Theis AC, Steber M, Wiedenmann L, Wöckel A, et al. The impact of the COVID-19 pandemic on stress and other psychological factors in pregnant women giving birth during the first wave of the pandemic. *Reprod Health* [Internet]. 2022;19(1):1–17. Available from: <https://doi.org/10.1186/s12978-022-01493-9>
- [29] Gullon-Scott P, Longstaff L. The prevalence of depression, anxiety, stress and their relationship to length of service in the UK police force. *Police J*. 2024;97(1):131–49.
- [30] Abajobir AA, Maravilla JC, Alati R, Najman JM. A systematic review and meta-analysis of the association between unintended pregnancy and perinatal depression. *J Affect Disord* [Internet]. 2016;192:56–63. Available from: <http://dx.doi.org/10.1016/j.jad.2015.12.008>
- [31] Aria Ningsih F. HUBUNGAN KARAKTERISTIK TERHADAP KECEMASAN IBU HAMIL SELAMA PANDEMI COVID-19. [Surakarta]: Universitas Kusuma Husada ; 2022.
- [32] Ott TL. Immunological detection of pregnancy: Evidence for systemic immune modulation during early pregnancy in ruminants. *Theriogenology* [Internet]. 2020;150:498–503. Available from: <https://doi.org/10.1016/j.theriogenology.2020.04.010>