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The Interplay of Biopsychosocial Determinants in Maternal Mental Health During Pregnancy: Evidence from Takalar Regency, Indonesia

Masyita Muis[*1], Rahayu Nurul Reski[2], Veni Hadju[3], Aminuddin Syam[3], Rahayu Indriasari[3], Ros Rahmawati[4]

[*1]Department of Occupational Health and Safety, Faculty of Public Health, Hasanuddin University, Makassar, Indonesia

[2]Department of Biostatistics and Reproductive Health, Faculty of Public Health, Hasanuddin University, Makassar, Indonesia

[3]Department of Nutrition, Faculty of Public Health, Hasanuddin University, Makassar, Indonesia

[4]Department of Midwifery, Health Polytechnic of The Ministry of Health, Makassar, Indonesia

[*]**Corresponding author:**

Masyita Muis

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ABSTRACT

Pregnancy is an important period in a woman's life that requires special attention to physical and mental health. Stress during pregnancy can arise from various sources, which can lead to health problems including postnatal depression. This study aimed to investigate the relationship between lymphocyte levels, employment status, and stress levels in pregnant women. An observational cross-sectional study was conducted among pregnant women in Takalar Regency, South Sulawesi. A total of 60 pregnant women participated in the study. Data collection involved structured interviews using the Kessler Psychological Distress Scale (K10) and the Depression, Anxiety, and Stress Scale (DASS-42). Statistical analyses included univariate and bivariate tests, with associations assessed using the Chi-Square test. Results showed that approximately 75% of the participants were at risk of stress, and 30% were at risk of combined stress, depression, and anxiety. Bivariate analysis revealed that pregnant women working in informal sectors, particularly as housewives, were significantly more likely to experience stress compared to those in formal employment ($p = 0.042$). Furthermore, abnormal lymphocyte levels (either low or high) were significantly associated with increased risk of stress, depression, and anxiety ($p = 0.035$). These findings highlight the need for targeted mental health interventions, especially for unemployed or informally employed pregnant women and those exhibiting immunological alterations during pregnancy. Strengthening psychological support and monitoring immune function during prenatal care may help mitigate adverse mental health outcomes among pregnant women during pandemic conditions.

Keywords: *Biopsychosocial, pregnant women, mental health, oxidative stress, maternal health.*

1. INTRODUCTION

Pregnancy is an important period in a woman's life that requires special attention to physical and mental health. One of the factors that can affect the health condition of pregnant women is work. Physically and mentally demanding work can be a source of stress, which can further impact the health of the mother and fetus.

Stress during pregnancy can arise from various sources, including work. Jobs that require great responsibility, long working hours, and a less supportive work environment can increase the stress levels of pregnant women [1]. Research has shown that high stress in pregnant women can have a negative impact on health, including increasing the risk of premature birth, low birth weight, and developmental problems in infants. According to a study in Europe by [2] mentioned about 25% of pregnant women reported significant stress, with the main causes including work problems and interpersonal relationships. Meanwhile, research conducted in West Java, Indonesia, found that more than a quarter of pregnant women (34%) experience high prenatal distress [3].

Chronic stress during pregnancy can lead to health problems such as high blood pressure, insomnia and postnatal depression. According to research by Wadhwa et al. [4] found that high prenatal stress can affect birth outcomes and general maternal health. In addition, excessive stress can affect fetal development, including the risk of premature birth and low birth weight.

Research by Dunkel Schetter and Tanner (2012) showed that prenatal stress can affect the neurological and cognitive development of infants [5].

Lymphocytes are a type of white blood cell that plays an important role in the immune system. Chronic stress can affect the immune system by changing the number and function of lymphocytes. In pregnant women, changes in lymphocyte levels can affect the body's ability to fight infection and keep the fetus healthy. Some studies have shown that psychological stress can decrease lymphocyte counts, which in turn can increase susceptibility to disease. Research has shown that high levels of stress in pregnant women can lead to decreased lymphocyte levels, which negatively affects the body's ability to fight infection. A recent study by Crovetto et al. (2023) found that high maternal stress during pregnancy was associated with decreased immune function, including lower lymphocyte levels [6].

Another study conducted on pregnant women with COVID-19 found that there were significant changes in the neutrophil to lymphocyte ratio (NLR). This study showed that in pregnant women with preeclampsia and COVID-19, there was a significant increase in NLR, indicating higher immunological stress. This suggests that the added stress of illness may exacerbate the decrease in lymphocyte levels caused by pregnancy stress.

Therefore, researchers want to see the relationship between formal and informal maternal employment on stress levels and lymphocyte levels of pregnant women during the Covid-19 period. So that after this research is carried out, it is hoped that the results of this study will become preliminary data to make interventions for stress levels and lymphocyte levels in pregnant women.

2. METHODS

Study Design and Population

This study employed an observational cross-sectional design involving 60 pregnant women who were successfully recruited during the COVID-19 pandemic. Participants were selected from the North Polongbangkeng Sub-district, Takalar District, located near Makassar City, South Sulawesi, Indonesia. Inclusion criteria comprised pregnant women who provided informed consent and were willing to complete the study questionnaires. Pregnant women with incomplete questionnaire data or experiencing severe pregnancy complications were excluded from the study.

Data Collection

Data collection was conducted through structured face-to-face interviews using validated instruments. The Kessler Psychological Distress Scale (K10) was used to assess general psychological distress among participants. Additionally, the Depression, Anxiety, and Stress Scale (DASS-42) was employed to evaluate the severity of depression, anxiety, and stress symptoms. The DASS-42 contains 42 items divided into three subscales, each scored on a four-point Likert scale ranging from 0 (did not apply to me at all) to 3 (applied to me very much or most of the time). Severity categories were determined based on the total scores for each domain, as shown in Table 1.

Table 1. Categories of Depression, Anxiety, and Stress Based on Questionnaire Measurement

Levels	Score Levels		
	Depression	**Anxiety**	**Stress**
Normal	0–9	0–7	0–14
Mild	10–13	8–9	15–18
Moderate	14–20	10–14	19–25
Severe	21–27	15–19	26–33

Statistical Analysis

Statistical analyses were conducted using IBM SPSS Statistics, version 25 (IBM Corp., Armonk, NY, USA). Descriptive statistics were applied to summarize demographic and clinical characteristics, with categorical variables presented as frequencies and percentages, and continuous variables presented as means and standard deviations. Associations between independent variables (e.g., maternal occupation, lymphocyte levels) and psychological outcomes (stress, depression, and anxiety categories) were assessed using the Chi-Square (χ^2) test. When expected cell counts were less than five, Fisher's exact test was utilized to ensure valid inference. For significant associations, effect sizes were estimated using Cramér's V coefficient. Statistical significance was set at a two-tailed p-value of less than 0.05.

Missing data were handled through complete case analysis, with participants who had incomplete responses excluded from the final analysis. Although no formal a priori sample size calculation was performed, a sample size of 60 was considered acceptable for exploratory analysis given the observational study design and the operational limitations during the COVID-19 pandemic.

3. RESULTS

Frequency distribution of characteristics of pregnant women presented in Table 2. The table illustrates the frequency distribution of housing and environmental characteristics among pregnant women. Regarding house ownership, the majority of participants (80.0%) reside in their parent's house, while only 16.7% own their home, and 3.3% live in a relative's house. In terms of house construction, over half (55.0%) live in permanent houses, followed by 20.8% in wooden houses, and 11.7% in semi-permanent structures. The predominant wall material is brick, used by 58.3% of participants, while 28.3% live in houses with wood or bamboo walls, and 13.3% use zinc walls. For flooring, 46.7% have tile floors, 40.0% use wood or board, and 13.3% have cement floors.

Nearly all participants (98.3%) use household latrines, with only 1.7% relying on public latrines. In terms of drinking water sources, 48.3% rely on protected wells, while smaller proportions use other sources such as unprotected wells (8.3%), natural spring water (10.0%), tap or piped water (15.0%), and others (18.3%). This data highlights variations in living conditions, reflecting a mix of adequate and suboptimal environmental factors among the participants.

Table 2. Frequency Distribution of Characteristics of Pregnant Women

Characteristics	Subject	
	n	%
House Ownership		
Own house	10	16.7
Parent's house	48	80.0
Relative's house	2	3.3
Type of house construction		
Permanent	33	55.0
Semi-permanent	7	11.7
Wooden house	20	20.8
Type of wall		
Brick	35	58.3
Zinc	8	13.3
Wood/bamboo	17	28.3
Floor type		
Tile	28	46.7
Cement	8	13.3
Wood/board	24	40.0
Type of toilet		
Household latrine	59	98.3
Public latrine	1	1.7
Drinking water source		
Protected well	29	48.3
Unprotected well	5	8.3

Natural spring water	6	10.0
Tap water/piped water	9	15.0
Other	11	18.3

Several methods have been used to measure different aspects of stress including psychological measures, often measured by questionnaires, and physiological markers, measured by saliva or blood. These biological samples are difficult to obtain, expensive to analyze, and vaguely associated with stress. Overall, questionnaires are a more cost-effective way to measure stress. Questionnaires are relatively easy to complete, can be completed by an interviewer or by yourself, and can be taken remotely by telephone, computer, or in person. Instruments are usually short, which allows for a balance of time during the study. Minimizing interview time is important because of the risk of respondent fatigue, which can lead to participants not paying attention to the questions and their answers [7]. In this study, the measurement of stress levels in pregnant women used two types of questionnaires, namely the Kessler Psychological Distress Scale questionnaire and the DASS-42 questionnaire, the results of which can be seen in Figures 1 and 2.

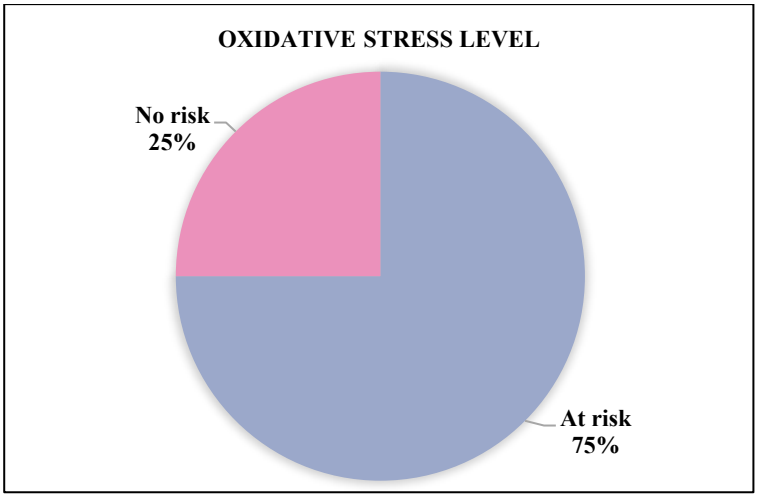

Figure 1. Percentage of oxidative stress levels experienced by pregnant women.

The pie chart in Figure 1 illustrates the distribution of oxidative stress levels among pregnant women. The data reveal that 75% of the participants are at risk of experiencing oxidative stress, while only 25% fall into the no risk category. This indicates that the majority of pregnant women in the study are potentially exposed to oxidative stress levels that could pose health risks. Consequently, there is a clear need for preventive measures or targeted interventions to mitigate these risks and promote better maternal and fetal health outcomes.

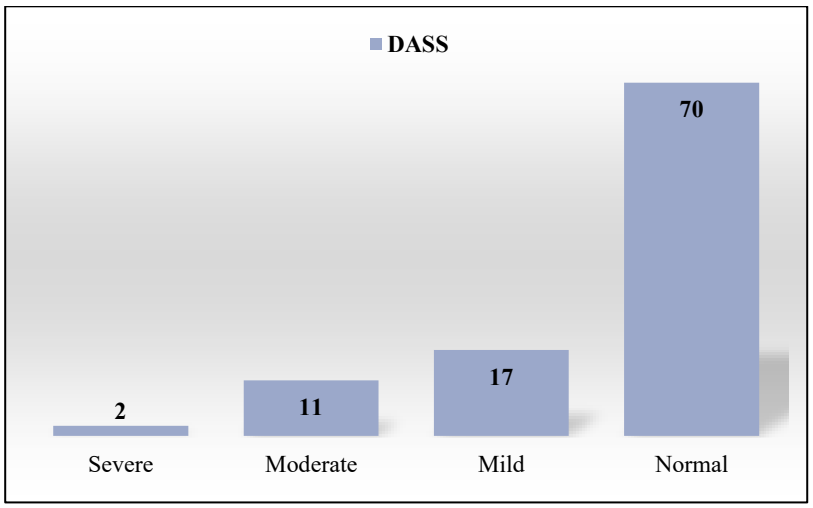

Figure 2. Percentage of depression, anxiety and stress scales in pregnant women.

Figure 2 presents a bar chart illustrating the percentage distribution of depression, anxiety, and stress levels among pregnant women based on the Depression, Anxiety, and Stress Scale (DASS). The majority of pregnant women (70%) fall into the normal category, indicating the absence of significant symptoms of depression, anxiety, or stress. A smaller percentage exhibit mild symptoms (17%), followed by those with moderate levels (11%). Only a minimal proportion (2%) experience severe symptoms. These findings suggest that the majority of participants maintain normal emotional well-being during pregnancy, while a minority exhibit varying levels of psychological distress.

Table 3. The relationship between the characteristics of pregnant women with stress levels using the Kessler Psychological Distress Scale questionnaire

Characteristics	Oxidative Stress Level		P-Value
	Risk	No Risk	
	n (%)	n (%)	
Age			
< 20 year	8 (17.8)	2 (13.3)	0.689
20-30 year	37 (82.2)	13 (86.7)	
Mother's Employment			
Formal	19 (42.2)	2 (13.3)	**0.042***
Informal	26 (57.8)	13 (86.7)	
Husband's Employment			
Self-employed	21 (46.7)	6 (40.0)	0.957
Farmer	10 (22.2)	4 (26.7)	
Civil Servant	12 (26.7)	4 (26.7)	
Doesn't Work	2 (4.4)	1 (6.7)	
Mother's Education			
6-9 year	3 (6.7)	0 (0.0)	
10-12 year	30 (66.7)	12 (80.0)	0.476
>12 year	12 (26.7)	3 (20.0)	
Family Income			
< 2 million	37 (82.2)	13 (86.7)	0.689
>2 million	8 (17.8)	2 (13.3)	
Hemoglobin levels			
Anemia	10 (22.2)	2 (13.3)	0.456
Normal	35 (77.8)	13 (86.7)	
Lymphocyte Levels			
Low	12 (26.7)	6 (40.0)	
Normal	29 (64.4)	8 (53.3)	0.258
High	4 (8.9)	1 (6.7)	

Table 3 examines the relationship between the characteristics of pregnant women and oxidative stress levels using the Kessler Psychological Distress Scale questionnaire. The results show that age, husband's work, mother's education, family income, Hemoglobin levels, and lymphocyte levels are not significantly associated with oxidative stress, as indicated by p-values

above 0.05.

However, the type of work performed by the mother shows a significant relationship with oxidative stress levels (p = 0.042). Mothers engaged in informal work are more likely to experience oxidative stress (57.8%) compared to those in formal work (42.2%). This finding suggests that occupational factors might contribute to oxidative stress during pregnancy, highlighting the need for further investigation and potential workplace interventions to support maternal health.

Table 4 explores the relationship between various characteristics of pregnant women and their stress levels as assessed by the DASS-42 questionnaire. The findings show no statistically significant association between stress levels and factors such as age, mother's work, husband's work, mother's education, family income, or hemoglobin levels, as indicated by p-values greater than 0.05.

Table 4. Relationship between characteristics of pregnant women and stress level using DASS-42 questionnaire

Characteristics	DASS Category				*P*-Value
	Severe	Moderate	Mild	Normal	
	n (%)	n (%)	n (%)	n (%)	
Age					
<20 year	2 (16.7)	1 (12.5)	1 (9.1)	6 (20.7)	0.827
20-30 year	10 (83.3)	7 (87.5)	10 (90.9)	23 (79.3)	
Mother's Work					
Formal	5 (41.7)	3 (37.5)	3 (27.3)	10 (34.5)	0.908
Informal	7 (58.3)	5 (62.5)	8 (72.7)	19 (65.5)	
Husband's Work					
Self-employed	0 (0.0)	2 (28.6)	4 (40.0)	21 (50.0)	0.603
Farmer	0 (0.0)	3 (42.9)	1 (10.0)	10 (23.8)	
Civil Servant	1 (100)	2 (28.6)	4 (40.0)	9 (21.4)	
Doesn't Work	0 (0.0)	0 (0.0)	1 (10.0)	2 (4.8)	
Mother's Education					
6-9 year	1 (8.3)	1 (12.5)	1 (9.1)	0 (0.0)	0.759
10-12 year	8 (66.7)	5 (62.5)	8 (72.7)	21 (72.4)	
>12 year	3 (25.0)	2 (25.0)	2 (18.2)	8 (53.3)	
Family Income					
<2 million	9 (75.0)	7 (87.5)	8 (72.7)	26 (89.7)	0.489
>2 million	3 (25.0)	1 (12.5)	3 (27.3)	3 (10.3)	
Hemoglobin levels					
Low (Anemia)	3 (25.0)	3 (37.5)	3 (27.3)	3 (10.3)	0.287
Normal	9 (75.0)	5 (62.5)	8 (72.7)	26 (89.7)	
Lymphocyte Levels					
Low	4 (33.3)	1 (12.5)	5 (45.5)	8 (27.6)	
Normal	7 (58.3)	4 (50.0)	5 (45.5)	21 (72.4)	**0.035***
High	1 (8.3)	3 (37.5)	1 (9.1)	0 (0.0)	

However, lymphocyte levels are significantly associated with stress levels ($p = 0.035$). Pregnant women with low lymphocyte levels appear to experience higher proportions of severe and moderate stress compared to those with normal or high lymphocyte levels. This suggests that immune function, as reflected by lymphocyte levels, might play a role in influencing stress levels during pregnancy.

Overall, while most socio-demographic and occupational factors do not show a significant relationship with stress levels, the association with lymphocyte levels highlights the potential biological impact on mental health during pregnancy. This finding warrants further exploration into the role of immune response in mitigating stress among pregnant women. Research shows that chronic stress and other mental health disorders can result in decreased lymphocyte counts, which can impact maternal and fetal health during pregnancy [8].

4. DISCUSSION

Maternal health during pregnancy is influenced by a complex interplay of biological, environmental, and occupational factors. In the context of Takalar sub-district, Indonesia, the role of maternal occupation emerges as a critical determinant of health outcomes, particularly oxidative stress and lymphocyte levels, which can significantly impact maternal mental well-being. Occupational demands, especially in informal sectors, may expose pregnant women to physical and psychological stressors, exacerbating oxidative stress and altering immune responses. These physiological changes can, in turn, influence mental health, potentially increasing the risk of anxiety, depression, and other psychological challenges during pregnancy. Understanding this interconnected relationship is essential for developing targeted interventions that address occupational stressors and support the overall health of pregnant women in this region.

This study highlights a mix of adequate and suboptimal housing and environmental conditions among pregnant women. While many benefit from permanent housing and good sanitation practices, challenges persist, such as reliance on shared housing, use of less durable construction materials, and limited access to safe drinking water. These factors underscore the need for targeted interventions to improve living conditions and promote maternal health.

Pregnancy inherently increases susceptibility to oxidative stress, a condition triggered by a systemic inflammatory response culminating in an increased presence of reactive oxygen species (ROS) and reactive nitrogen species (RNS) in the circulatory system [9]. An imbalance between pro-oxidant and antioxidant factors can lead to oxidative stress, which contributes to the development of many diseases [10]. Oxidative stress has been implicated in many reproductive and pregnancy disorders [11]. Extreme oxidative stress disrupts maternal and placental function and can cause multiple damages, leading to Intrauterine Growth Restriction (IUGR), preterm labor, gestational diabetes, preeclampsia and aortic dissection during pregnancy [1].

Furthermore, this study found that the informal category of mother's work in this case means that housewives are more prone to stress with a p value of <0.05. Household chores are one of the main gender roles assigned to women and can cause mental problems [12]. The heavier workload for women is often referred to as women's stress-related disorders such as sleep disturbances, fatigue and emotional exhaustion [13]. Stay-at-home mothers experience high levels of stress. Research has documented that housework is one of the determinants of housewives' chronic stress.

Housewives experience chronic stress when they face multiple roles (cooking, shopping, tidying the house) in their daily lives [14] in addition to doing most of the housework and caring for children, mothers are also the ones who most often organize, plan, anticipate, and manage routine and unexpected household tasks and family events, as well as support the daily well-being of family members [15]. Every mother faces difficult and demanding times because she has to ensure the health of all family members and control all children's activities [16].

Pregnant mothers who work as homemakers face unique challenges that may increase the risk of oxidative stress, a condition that occurs when the amount of free radicals in the body exceeds the body's ability to neutralize them with antioxidants. Oxidative stress can negatively impact maternal and fetal health, and is associated with pregnancy complications such as preeclampsia and stunted fetal growth. Physical activity, excessive household responsibilities, and emotional demands that are often invisible can trigger mental and physical stress in housewives, which in turn increase the production of free radicals and cause oxidative stress [17].

Oxidative stress is often associated with ongoing psychological and physical stress, a condition often experienced by stay-at-home moms who have to handle multiple responsibilities simultaneously without adequate support. The dual role of household manager and child caregiver puts them at a higher risk of mental and physical fatigue, which in turn increases oxidative stress in the body [18].

In addition, unfavorable household environmental conditions, such as heavy household workload and lack of rest time, may exacerbate oxidative stress in pregnant women. The inability to manage stress effectively in domestic situations is also associated with an increased risk of metabolic and cardiovascular disorders in pregnant women [16]. Housewives often have limited access to adequate social and emotional support, which may exacerbate oxidative stress conditions. Lack of social support may increase susceptibility to oxidative stress, ultimately increasing the risk of complications during pregnancy.

Effective social support is essential to help housewives cope with the psychological distress they experience during pregnancy [20].

On the other hand, a study by Wadhwa et al. [4] showed that good nutrition and a healthy lifestyle can help housewives reduce the risk of oxidative stress during pregnancy. Consumption of foods rich in antioxidants such as vitamins C and E can reduce free radical levels in the body and protect pregnant women from the negative effects of oxidative stress. Thus, it is important to pay attention to the balance between household responsibilities and mental and physical health needs for pregnant housewives.

Based on the results, age, husband's occupation, mother's education, income, HB, and Lymphocytes did not have a significant relationship. Although factors such as age, husband's occupation, mother's education, income, hemoglobin (Hb), and lymphocyte levels in pregnant women are often associated with general health during pregnancy, research shows that these variables do not always have a significant relationship with oxidative stress in pregnant women. Oxidative stress, which involves an imbalance between the production of free radicals and the antioxidant capacity in the body, appears to be influenced more by other biological and environmental factors, rather than social and economic factors as mentioned above [21].

A study by Agarwal et al. [18] confirmed that maternal age does not necessarily correlate with oxidative stress levels. Although older age is often associated with a higher risk of pregnancy complications, there is no consistent evidence that age directly affects oxidative stress levels. Similarly, the husband's occupation, which is generally considered an important factor in the economic well-being of the family, did not show a significant association with oxidative stress. Research suggests that socio-economic conditions do not directly affect oxidative processes in the body of pregnant women. Although maternal education may affect knowledge about health and access to health services, there is no consistent evidence that education level directly affects the level of oxidative stress in pregnant women. This research suggests that biological factors such as inflammation and cell damage play a greater role in determining oxidative stress levels than socio-economic factors such as education [22].

Family income, although important in determining access to healthy food and health services, also had no significant association with oxidative stress in pregnant women. Oxidative stress conditions are more influenced by biological factors and not by family income. In other words, although income may affect other aspects of pregnancy health, there is no strong evidence that it directly influences oxidative stress levels [19].

Hb level, which is related to anemia, also showed no significant association with oxidative stress in pregnant women. Although anemia can lead to other complications during pregnancy, the study by Bodnar et al. (2007) found no clear association between Hb levels and oxidative stress. Instead, oxidative stress is more likely to be related to factors such as systemic inflammation and other more specific health conditions than simply Hb levels.

Lymphocyte levels, which reflect the immunological status of pregnant women, also had no significant association with oxidative stress according to existing studies. Although the immune system plays an important role in maintaining health during pregnancy, research by Agarwal et al. [18] found no evidence that variations in lymphocyte counts were directly related to oxidative stress in pregnant women. Instead, oxidative stress is influenced more by factors such as free radicals and antioxidant activity than by changes in the immune system.

Thus, pregnant women who work as housewives tend to be more susceptible to oxidative stress compared to other factors such as age, husband's occupation, mother's education, income, hemoglobin (HB) level, and lymphocyte count, which showed no significant association with the level of oxidative stress. This indicates that the burdens and demands associated with motherhood during pregnancy may have a greater impact on oxidative health, while other factors did not have a significant effect.

Depression and anxiety during pregnancy affect hormonal balance in the body, including increased production of the hormone cortisol, known as the "stress hormone". Cortisol has immunosuppressive effects, which can suppress overall immune function, including decreased lymphocyte counts. Research by Christian et al. [23] found that pregnant women who were depressed often showed an impaired immune response, including decreased lymphocyte counts, which made them more susceptible to infection.

Research by Mary Coussons-Read and Simms [24] also showed that high levels of stress in pregnant women can impair immune function by reducing the number of immune cells such as lymphocytes. Prolonged psychological stress during pregnancy is known to increase systemic inflammation, which also has an impact on reducing the number of lymphocytes in the body. This decrease in lymphocytes has the potential to exacerbate complications during pregnancy and affect fetal development.

Furthermore, Black [25] states that psychological stress and depression can lead to maladaptive activation of the immune system, resulting in decreased lymphocyte function and increased susceptibility to disease. In addition, Kiecolt-Glaser et al. (2003) showed that chronic stress and depression not only affect mental health, but also significantly disrupt immunological balance in pregnant women. This study confirms that the relationship between mental health and the immune system is an

important factor that needs to be considered during pregnancy [26].

Moreover, a study by Dunkel Schetter [27] found that lack of social support during pregnancy can exacerbate the impact of stress on the immune system. This lack of support increases the risk of decreased lymphocyte levels as pregnant women experience greater emotional distress, which in turn negatively affects their immunological balance. Interventions involving social support and counseling can help reduce these psychological impacts and improve immune function. A study by Wadhwa et al. [4] concluded that managing stress, anxiety and depression in pregnant women is crucial to maintaining immunological balance. Programs focused on cognitive behavioral therapy, meditation, and moderate physical activity can help reduce stress and improve immune responses, including maintaining healthy lymphocyte counts.

Low lymphocyte counts have a significant association with levels of depression, anxiety, and stress. Various social, economic, and biological factors such as age, mother's occupation, husband's occupation, mother's education, family income, and hemoglobin levels of pregnant women have been found to have a significant association with levels of depression, anxiety, and stress during pregnancy. Pregnancy is a period fraught with physical and psychological changes, and these factors can either exacerbate or alleviate the emotional burden felt by pregnant women. Maternal age, for example, plays a significant role in the risk of depression and anxiety. Older mothers are likely to face additional stress related to physical health and pregnancy complications, while younger mothers may feel more emotionally distressed due to inexperience and uncertainty about motherhood [28].

In addition, the occupations of mothers and husbands are also closely related to stress and anxiety levels. Research by Leigh dan Milgrom [29] showed that mothers who work in environments with high levels of stress tend to experience more significant symptoms of depression and anxiety during pregnancy. This can be influenced by a lack of social support at work or excessive work demands. On the other hand, the husband's job also has an impact, as the instability of the husband's job or income can lead to economic uncertainty, which increases stress and anxiety in pregnant women [30].

Maternal education also has an important role in mental health during pregnancy. The study by Lancaster et al. [31] found that mothers with lower levels of education tend to have a higher risk of depression and anxiety. Low education levels are often associated with limited access to health information and adequate health services, which can exacerbate feelings of anxiety and stress. In addition, family income is a key factor, where lower income is associated with an increased risk of mental health problems in pregnant women, as financial limitations can increase uncertainty and tension in the household [32].

Pregnant women's hemoglobin levels are also one of the important factors associated with depression and anxiety during pregnancy. Research by Bodnar et al. [33] showed that anemia characterized by low hemoglobin levels can exacerbate symptoms of depression during pregnancy. This condition may be caused by decreased oxygen supply to the brain and other organs, leading to fatigue, lethargy, and decreased quality of life, thus worsening the psychological state of pregnant women.

By understanding the impact of these factors, it is important for healthcare providers to provide holistic support to pregnant women. Interventions involving social support, health status monitoring, and psychological counseling can help pregnant women deal with the challenges they face during pregnancy and reduce the risk of depression, anxiety, and stress.

5. CONCLUSION

Maternal health during pregnancy in the Takalar subdistrict of Indonesia is significantly influenced by occupational factors, particularly for the stay-at-home mother. The physical and emotional demands of household responsibilities increase the risk of oxidative stress, which impacts mental health, leading to anxiety and depression. While socio-economic factors like age, education, and income showed no significant association with oxidative stress, the burden of domestic roles emerged as a key contributor. Therefore, it is essential to implement interventions to reduce household stress, improve social support, and promote stress management in order to enhance maternal well-being during pregnancy.

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