Indonesian Journal of Global Health Research
Volume 6 Number S4, August 2024
e-ISSN 2715-1972; p-ISSN 2714-9749
http://jurnal.globalhealthsciencegroup.com/index.php/IJGHR

RELATIONSHIP OF MALARIA PARASITE DENSITY LEVEL IN BLOOD WITH APGAR SCORE OF NEWBORN BABIES

Eftyaningrum Dwi Wahyu Astutik
D3 Midwifery Study Program, Sekolah Tinggi Ilmu Kesehatan Jayapura, Jl. Youmakhe, Hinekombe, Sentani, Jayapura, Papua 99352, Indonesia
eft.princes@gmail.com

ABSTRACT

Placental malaria is a serious health problem that must be treated immediately. WHO data records that 12 million pregnant women were infected with malaria throughout the world in 2019. Of the pregnant women infected with malaria, it was reported that 40% experienced placental malaria during childbirth. At the national level, it was found that the prevalence of malaria in pregnant women was 525 from the 2018 Basic Health Research results. At the provincial level, the largest contributor was Papua with a total of 2816 cases in 2020. Jayapura Regency was in 4th position with 402 cases of pregnancy malaria. Disturbances in newborn baby oxygenation caused by placental malaria are the main-focus to be resolved immediately so that efforts are made to investigate the level of relationship between the level of placental malaria parasitemia and clinical signs of impaired newborn baby oxygenation (APGAR Score) needs to be developed in order to create a formula for handling and preventing these impacts. Objective: Analyzing the relationship between the level of malaria parasite density in the blood of mothers giving birth and APGAR Score of newborn babies. Method: This research is descriptive correlational research. The total population was 36 mothers with a history of malaria during their pregnancy and research samples were taken with technique Total Sampling. Data were analyzed using a correlation test Rank Spearman with a significance level <0,05. Results: Based on correlation test Rank Spearman sig value is obtained. (2-tailed) as large as 0.00 <0.05 so that there is a significant relationship between the level of malaria parasite density in the blood of the mother giving birth with APGAR Score of newborn babies. The correlation coefficient value between the two variables is -0.658 which is included in the strong correlation category with a negative or inverse correlation direction. The higher the density of malaria parasites in the mother's blood, the lower the APGAR of newborn baby value. Conclusion: Most of the malaria parasite density levels in mothers who gave birth were in the negative category with an average APGAR score for birth defects of 8.47. There is a relationship between the level of density of malaria parasites in the blood of pregnant women and APGAR Score of newborn babies.

Keywords: apgar score; malaria parasite; newborn babies

How to cite (in APA style)
Astutik, E. D. W. (2024). Relationship of Malaria Parasite Density Level in Blood with Apgar Score of Newborn Babies. Indonesian Journal of Global Health Research, 6(S4), 299-306. https://doi.org/10.37287/ijghr.v6iS4.4290.

INTRODUCTION

Malaria is a serious disease with a very high potential for death. Malaria, which is described as a disease of poverty and underdevelopment, remains a priority problem that continues to be treated to this day, especially malaria that occurs during pregnancy. Malaria in pregnancy has a greater risk than non-pregnancy. This is because the risk of a pregnancy infected with plasmodium can trigger a condition called placental malaria. Placental malaria is a syndrome of placental inflammation caused by erythrocytes infected with plasmodium accumulate in the intervillous space, resulting in disruption of utero-placental circulation (Aitken & Rogerson, 2022).According to the World Health Organization (WHO) in 2019, 12 million pregnant women were infected with malaria worldwide and more than a third (35%) of these infections occurred in West Africa (WHO, 2020). Despite the endemicity of malaria in sub-Saharan African countries, the prevalence of P.falciparum infection in pregnant women examined microscopically from peripheral blood is increasing as indicated by the increasing number of

visits antenatal care by 60%. Of the pregnant women infected with malaria, it was reported that 40% experienced placental malaria during delivery (Berry, Walker, Tagbor, & Al., 2018).

Like African countries, Indonesia is also a tropical country that is not protected from malaria, including malaria in pregnancy. Based on the 2018 Basic Health Research results, the prevalence of malaria in pregnant women was 525, which was obtained from the results of RDT examinations and the type of plasmodium according to its characteristics (Indonesian Ministry of Health, 2019). If we look at the malaria morbidity rate based on indicators Annual Parasite Incidence (API), so in 2020 Indonesia was recorded as having an API of 0.9 per 1000 population. Even though this figure is below number one, as stated that one of the indicators for achieving malaria elimination is API <1 per 1000 population, there are still many regions in Indonesia that have not reached this figure, especially the eastern provinces of Indonesia (Ministry of Health of the Republic of Indonesia, 2021).At the provincial level, Papua is the province with the highest malaria API of 63.12 per 1000 population in 2020 (Indonesian Ministry of Health, 2021). Based on data processed from the SISMAL Papua Province report, it was found that the distribution of malaria cases according to age groups for malaria cases in pregnant women in 2020 was 2816 cases (Mabui, 2021). At the district level, Jayapura is the district with the 4th highest incidence of malaria in Papua Province. Based on the infographic on the malaria situation in Jayapura Regency in 2021 obtained from the 2021 Regmal1 Sismal data source, the total number of malaria cases was 27,691 cases and 402 of them occurred in pregnant women. If we look at the Health Facilities, Sentani Community Health Center is ranked 4th highest in reporting malaria cases with a total of 2,178 cases with 56 of them being cases of malaria in pregnancy (Jayapura District Health Office, 2021).

The high number of malaria cases in pregnancy is a priority that must be addressed immediately considering that the impact is very detrimental to both the mother and the fetus she is carrying. Several studies have described an association between the incidence of malaria and poor birth outcomes associated with the occurrence of placental malaria. A prospective cohort study on the risk of malaria in pregnancy on the growth and nutritional status of babies for 12 months from birth in Timika Papua from 2013 to 2017 found that babies of mothers with maternal malaria were more susceptible to malaria infection. Babies of mothers with maternal malaria are at greater risk of experiencing malnutrition at the ages of 3, 4, 9 and stunting at the ages of 4 and 9 months. In the Bayley III examination, the cognitive and motor scores of babies from mothers with maternal malaria were 5.5 and 6.26 points lower compared to babies from mothers without maternal malaria (Indrawati, Juffrie, Hakimi, & Wijayanti, 2018). So far it is known that the only type of parasite that can cause placental malaria is Plasmodium falciparum because it is thought to be an erythrocyte membrane protein from Plasmodium falciparum 1 (PfEMP1) VAR2CSA has been identified as the only parasite-derived protein capable of interacting with CSA in the placenta (Tomlinson & Semblat, 2021). Apart from this, Plasmodium falciparum It is also known to have a higher level of parasitemia compared to other plasmodium because it has great flexibility in its receptors so that it can enter all red blood cells including the placenta (Tomlinson & Semblat, 2021). Placental malaria caused by infection Plasmodium falciparum during pregnancy it can cause complications in several organs such as the brain, lungs, kidneys and gastrointestinal tract due to microvascular anoxia in these tissues (Miller LH; Baruch DI; Marsh K; Doumbo OK, 2020). Tissue anoxia occurs due to blockage of blood vessels in the microvasculature due to thickening of the trophoblast cell membrane (Kirchgatter, K; Portillo, 2018) (Lawford, Cc, Kumar, Liley, & Bora, 2019).

The lack of measuring instruments to determine the occurrence of oxygenation disturbances in the utero-placental circulation during pregnancy is one of the obstacles in determining the close relationship between the two. One technique that can be used is to measure the APGAR Score as a clinical sign of the presence or absence of respiratory disorders due to tissue anoxia. Considering the serious impact that malaria in pregnancy has on the child's condition, efforts to investigate the level of relationship between the two need to be developed in order to create a formula for handling and preventing this impact and analyzing the relationship between the level of malaria parasite density in the blood of mothers giving birth and APGAR Score of newborn babies. Based on the series of problems above, the researcher raised the research title "Relationship of malaria parasite density level in blood with APGAR Score of newborn babies"

METHOD

This research uses a descriptive correlational research design. The research was carried out from June to August 2023 at the Sentani Community Health Center, Jayapura Regency. The population in this study were mothers giving birth at the Sentani Community Health Center with a history of malaria during their pregnancy, namely 36 respondents to measure the density level of malaria parasites in the blood of women giving birth using the APGAR Score of newborn babies. Sampling in this research was carried out using the Total Sampling technique. The data collection technique uses primary data with the observation method. In this research, researchers collected data by observation, identification, interviews and filling out questionnaires. The collected data was analyzed using the IBM SPSS version 24.0 program, and continued with a correlation test (test rank spearman). The processed data is used as a basis for discussing problem statements, which are then presented in table form so that conclusions can be drawn.

RESULTS

In this study, the characteristics of the respondents studied were gestational age, history of malaria during pregnancy, BBL body weight for 36 respondents. The results of these characteristics are presented in the following table.

Table 1.
Description of respondents' characteristics based on gestational age, history of malaria during pregnancy and body weight newborn babies

Variable	f	Minimum	Maximum	Mean	Std. Deviation
Gestational Age	36	36	42	38.89	1.410
History of Malaria	36	1	4	1.69	0.822
BB Born	36	2300	3700	2963.89	365.007
Valid N (listwise)	36				

**Descriptive Analysis test*

Based on table 1 above, it can be seen that respondents with a total of 36 respondents had an average gestational age of 38.89 or in other words the average gestational age of mothers ranged from 38 to 39 weeks at birth with the lowest gestational age being 36 weeks and the highest is 42 weeks. Meanwhile, the characteristics of respondents based on the history of malaria that they had suffered during pregnancy had an average of 1.69 times or around 1 to 2 times they had suffered from malaria during their pregnancy with a history of at least 1 time and a maximum of 4. Meanwhile for the characteristics of respondents Based on body weight newborn baby, the average body weight was 2963.89 grams, with the lowest body weight being 2300 grams and the highest body weight newborn baby being 3700 grams.

Table 2.
Description of the frequency distribution of malaria parasite density levels

Parasitemia Level Variables	f	%
Negative	30	83.3
Positive 1	2	5.6
Positive 2	2	5.6
Positive 3	1	2.8
Positive 4	1	2.8
Total	36	100

[*]*Descriptive Analysis test*

Based on table 2 above, it can be seen that the majority of respondents had parasite levels in the negative category or did not have malaria parasites at the time of the examination, 30 respondents or 83.3%. Meanwhile, there were 2 respondents with positive 1 and positive 2 malaria results each (5.6%), while respondents with positive 3 and positive 4 malaria results were 1 respondent each (2.8%).

Table 3.
Overview of results APGAR Score of newborn babies

Variable	f	Minimum	Maximum	Mean	Std. Deviation
APGAR score	36	5	10	8.47	1.362
Valid N (listwise)	36				

[*]*Descriptive Analysis test*

Based on table 3 above, it can be seen that the babies born to respondents have an average APGAR Score amounting to 8.47 or in other words the average APGAR Score of newborn baby ranges from 8 to 9 with the lowest APGAR Score being 5 and the highest being 10.

Table 4.
Analysis of the relationship of malaria parasite density level in blood with APGAR score of newborn babies

Correlations

			Malaria Parasitology	APGAR score
Spearman's rho	Malaria Parasitology	Correlation Coefficient	1.000	-.658**
		Sig. (2-tailed)	.	.000
		N	36	36
	APGAR score	Correlation Coefficient	-.658**	1.000
		Sig. (2-tailed)	.000	.
		N	36	36

**Correlation is significant at the 0.01 level (2-tailed).

[*]*Spearman Rank Correlation test*

Based on the SPSS test output results Rank Spearman presented in table 4 above, the significance value or sig. (2-tailed) of 0.000. Because the sig value. (2-tailed) 0.000 is smaller than 0.05 so it can be concluded that there is a relationship between the variable level of malaria parasite density in the blood and APGAR Score of newborn babies. From the table above, the correlation coefficient value (Correlation Coefficient) of -0.658 which can be interpreted as the level of strength of the relationship/correlation between the variable level of malaria parasite density in the blood and APGAR Score of newborn baby is 0.658 which is included in the strong correlation category. The correlation coefficient figure in the results above was found to be -0.658, which means it is negative or the direction of the relationship

between the variable level of density of malaria parasites in the blood and APGAR Score of newborn baby is inversely proportional. Based on the results of the direction of the correlation coefficient, it can be concluded that the higher the level of malaria parasites, the lower the APGAR value on newborn babies.

DISCUSSION

Based on the research results, it was fund that there was no relationship between gestational age and the APGAR score of newborn babies. According to researchers' assumptions, low gestational age does not necessarily affect the APGAR Score of newborn babies because there are still many other factors that can influence the APGAR score of newborn babies. Even though the gestational age is low, if the respiratory organs are compatible for extra-uterine function, the APGAR score will also be good. Normal newborn babies birth weight means those who have a low level of education but always take part in knowledge increasing activities, for example from counseling activities, frequent interaction with the media can cause changes in the level of knowledge related to child development. Even though the mother's education level is low, she does not necessarily have low knowledge, and vice versa. So the length of the mother's formal education period cannot describe the mother's knowledge and awareness regarding child development, especially language development. The results of this research are supported by Marni (2013) who shows that there is a relationship between mother's knowledge and the language development of toddler-aged children at the Nisrina School. Jatiasih Bekasi City, with a significance value of 0.004. This research was similar to that carried out by Oktarina in Sumatra in a group of toddlers and by Eunice in Sarawak, Malaysia which showed that father's education and mother's education did not show significant results on the incidence of children's language delays because in this study access to information was relatively easy. However, this research contradicts research conducted by Paramitha in Depok which shows that low education is a risk factor for language development disorders in toddlers.

Based on parents' employment status, it was found that there was no relationship between parents' employment and the incidence of language development disorders in children under five, both receptive language development and expressive language development in children. The results of this research are in line with previous research conducted by Cheuk and Wong (2018) and research by Sylvestre and Merette (2020) which showed that there was no relationship between working mothers and children's speech delays. Things that influence the outcomes of working mothers with speech delays in children are the quality of the child's caregivers, the allocation of time given by the mother, and the quality of the mother's own care. The qualities of a good caregiver can have a positive impact on a child's development, such as better communication skills, the ability to remember and solve problems better. Meanwhile, care by helpers can increase the risk and severity of speech disorders in children. Another risk factor for speech delays is a family history of speech delays. This is in accordance with the theory that one of the factors that can influence speech delays is genetics. Specific Language Impairment Consortium found a linkage between language disorders and two separate loci on chromosomes 16 and 19. The chromosome 16 locus was linked to poor performance on tests of word repetition and short-term memory. Meanwhile, the chromosome 19 locus is associated with poor performance on expressive language tests. This is also supported by the opinion of Hidajati and Chaimay that a family history of late speaking is a risk factor for late speaking in children. Research by Cheuk and Wong also says the same thing.

Based on the number of siblings the respondent had, it was found that there was no relationship between the number of siblings and the incidence of language development disorders in children under five, both receptive language development and expressive language development. According to research conducted by Mutmainah (2012), the number of children does not affect the language development of children under five as long as the parenting style of the parents is said to be positive. Positive parenting patterns occur when parents are able to be positive towards children who will need positive concepts and thoughts as well as self-respect. And it is said to be a negative parenting style if parents often do negative things, such as hitting, ignoring, paying little attention, harassing, insulting, being unfair, never praising and being angry, which is considered a punishment due to shortcomings, mistakes or stupidity. himself. Parenting is the interaction between children and parents who educate, guide and discipline and protect their children to reach maturity in accordance with the norms that exist in society. Children's interactions with adults and each other in the family environment can stimulate the child's development. Apart from parenting factors, another factor that is closely related to the number of siblings is the close relationship between family members. This relationship is interpreted as a process of experience interacting and communicating with the family environment, especially with parents who teach, train and provide language examples to children (Syamsu, 2011). Because language mastery depends on stimuli from the external environment. In general, children are introduced to language from the beginning of their development, one of which is called motherse, which is the way mothers or adults teach children to learn language through a process of imitation and repetition from the people around them (Susanto, 2011). A healthy relationship between parents and children and other family members with full attention and affection facilitates children's language development, while unhealthy relationships result in children having difficulties or delays in language development.

Based on the research results, it has been found that a history of plasmodium falciparum infection in pregnancy is not associated with impaired development of receptive language with a significance value of 0.673 or expressive language with a significance value of 0.395. In theory, disease status is a manifestation of a person's health condition. According to Syamsu (2016) health is a factor that greatly influences children's language development, especially in the early stages of life. If during the first two years of age, a child experiences constant pain, the child is likely to experience delays or difficulties in language development. Children with chronic otitis media with decreased hearing will experience delays in the ability to receive or express language. Language development disorders in children are also found in hearing disorders caused by genetic and metabolic disorders (primary deafness), neurosensorial deafness (intrauterine infections: syphilis, rubella, toxoplasmosis, cytomegalovirus, plasmodium, etc.).One of the plasmodium infections that can cause disorders in children's language development is plasmodium falciparum infection which causes malaria. The impact on the child's developmental stage is estimated from the 25(OH)D concentration in the blood of the mother and umbilical cord exposed to placental malaria. IQ in 7 year old children is associated with maternal and umbilical cord blood 25(OH)D concentrations. The results of the study found that congenital microcephaly that lasts up to 2 years is at risk of cognitive impairment. It is known that infants with severe anemia at birth to mothers exposed to malaria exhibit white matter injury, which is associated with global developmental delays, behavioral and learning problems. The effects of malaria in pregnancy on fetal cortical brain development indicate differences in fetal cortical development or brain volume during pregnancy between malaria-infected and uninfected women.

The results of this study are unable to answer existing theories which state that exposure to Plasmodium falciparum in pregnancy can have an impact on cognitive impairment and child development. The researcher's assumption regarding the research results is that there are other factors that influence the occurrence of language development disorders in toddlers which are related to a history of plasmodium falciparum infection in pregnancy. These factors include the parity status of the mother because based on the theory presented by the Minister of PF, it is stated that primigravida mothers have a much higher susceptibility to being infected with malaria than multigravidas. This is because antibodies obtained after multiple pregnancies cause a reduction in the number of infected erythrocytes undergoing sequestration in the placenta, thereby reducing the severity in subsequent pregnancies (Mens et al., 2019).Another factor that was not examined in this study was the frequency or amount of exposure to plasmodium infections that occurred during pregnancy, so it was not possible to analyze the severity of the infection which influenced the impact on the fetus. This is in accordance with the theory which states that, if a child is continuously ill, the child will experience delays or difficulties in the child's language development.

CONCLUSION

Based on the results of research on the relationship between the density level of malaria parasites in the blood of pregnant women and APGAR Score of newborn babies shows that the majority of malaria parasite density levels in the blood of mothers in labor are in the negative (-) category with an average APGAR score for newborns born to mothers who have or are currently suffering from malaria of 8.47. In conclusion, there is a relationship between the level of density of malaria parasites in the blood of pregnant women and APGAR Score of newborn babies.

REFERENCES

Aitken, E. H., & Rogerson, S. J. (2022). Placental Malaria Tackling Variants With Antibodies. Elife Insight, 10–12. https://doi.org/https:// doi. org/ 10. 7554/ eLife. 77751

Berry, I., Walker, P., Tagbor, H., & Al., E. (2018). Seasonal Dynamics of Malaria in Pregnancy in West Africa: Evidence for Carriage of Infections Acquired Before Pregnancy Until First Contact with Antenatal Care. Am J Trop Med Hyg, 98(2), 534–42.

Christine M; Cserti; Walter H; Dzik. (2017). ABO blood group system and Plasmodium falciparum malaria. Bloodjournal, 110(7), 2250–2258.

Conroy, A. L., Silver, K. L., Zhong, K., Rennie, M., Ward, P., Sarma, J. V., … Kain, K. C. (2013). Article Complement Activation and the Resulting Placental Vascular Insufficiency Drives Fetal Growth Restriction Associated with Placental Malaria. CHOM, 13(2), 215–226. https://doi.org/10.1016/j.chom.2013.01.010

Costa F, TM; Lopes S, CP; Ferrer M; Leite J, A; Jaular, L. M. B. M., Nogueira P, A; Mourao P, G; Becerra Fernandez, C; , RioLacerda M, V. A. M., & Nogeira; Gysin, J. (2016). Cytoadhesion of Plasmodium falciparum-Infected Erythrocytes and the Infected Placenta : a Two-Way Patway. Brazilian Journal of Medical and Biological Research, 39, 1525–1536.

Dinkes Kabupaten Jayapura. (2021). Situasi Malaria Kabupaten Jayapura, Papua Tahun 2021. Jayapura. Retrieved from linktr.ee/siagamalaria

Doritchamou, J. Y. A., Renn, J. P., Jenkins, B., Mahamar, A., Dicko, A., Fried, M., & Duffy, P. E. (2022). A single full- - length VAR2CSA ectodomain variant purifies broadly neutralizing antibodies against placental malaria isolates, 1–16.

Ghosh A, Srinivasan P, Abraham EG, F. H. and J.-L. M. (2017). Molecular Strategies to Study Plasmodium-mosquito Interaction. Trends Parasitol, 19(2), 94–101.

Indrawati, R. R. R., Juffrie, M., Hakimi, M. S., & Wijayanti, M. (2018). Efek Malaria Maternal Terhadap Kerentanan Infeksi Malaria Pada Bayi Selama 1 Tahun Pertama Kehidupan. Gadjah Mada University. Retrieved from http://etd.repository.ugm.ac.id/home/detail_pencarian/155400

Kementerian Kesehatan RI. (2019). Laporan Nasional Riskesdas 2018. Jakarta: Badan Penelitian dan Pengembangan Kesehatan. Retrieved from http://labdata.litbang.kemkes.go.id/images/download/laporan/RKD/2018/Laporan_Nasional_RKD2018_FINAL.pdf

Kementerian Kesehatan RI. (2021). Profil Kesehatan Indonesia Tahun 2020. Jakarta.

Lawford, H. L. S., Cc, A., Kumar, S., Liley, H. G., & Bora, S. (2019). International Journal of Infectious Diseases Establishing a conceptual framework of the impact of placental malaria on infant neurodevelopment. International Journal of Infectious Diseases, 84, 54–65. https://doi.org/10.1016/j.ijid.2019.04.019

Mabui, S. (2021). Strategi Perscepatan Penurunan Kasus Malaria Provinsi Papua. Jayapura.

Mens, P. F., Bojtor, E. C., & Schallig, H. D. F. H. (2019). European Journal of Obstetrics & Gynecology and Reproductive Biology Molecular interactions in the placenta during malaria infection. European Journal of Obstetrics and Gynecology, 152(2), 126–132. https://doi.org/10.1016/j.ejogrb.2010.05.013

Miller LH; Baruch DI; Marsh K; Doumbo OK. (2020). The Pathogenic Basis of Malaria Nature, 415(5), 673–679.

Tomlinson, A., & Semblat, J. (2021). VAR2CSA-Mediated Host Defense Evasion of Plasmodium falciparum Infected Erythrocytes in Placental Malaria. Frontiers In Immunology, 11(February), 1–10. https://doi.org/10.3389/fimmu.2020.624126

Vignali M; Speake C; Duffy PE. (2017). Malaria sporozoite proteome leaves a trail. Genome Biology, 10(216). https://doi.org/10.1186/gb-2017-10-4-216)

WHO. (2020). World Malaria Report 2019. Genesis of placental sequestration in malaria and pos- sible targets for drugs for placental malaria. Birth Defects Res. Clark RL, 111(10), 83–569. Retrieved from https://www.who.int/publi cations- detail/world- malaria-report- 2019

Zakama, A. K., Ozarslan, N., & Gaw, S. L. (2020). Placental Malaria, 162–171.