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Husband's behavior and early marriage as risk factors for hepatitis B virus infection among pregnant women in Karangasem, Bali, Indonesia

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ABSTRACT

Background and purpose: Indonesia is categorized as a country with moderate level of hepatitis B virus (HBV) infection, where the majority of HBV transmissions occur from mother to child, horizontal transmission during childhood and adulthood, and transmission in health services. This study aims to determine factors associated with HBV infection among pregnant women.

Methods: A case control study was conducted among 80 pregnant women with sero-positive HBsAg as cases and 80 pregnant women with sero-negative HBsAg as controls. The sources of cases and controls were the registers of pregnant women at 12 public health centers (PHCs) and Karangasem District Hospital from June 2017 to December 2018. Cases were selected by systematic random sampling from 129 pregnant women with sero-positive HBsAg and controls were selected through the same method from 1,408 pregnant women with sero-negative HBsAg. They were then matched based on village or residence. Data collected were including history of marriage, pregnancy, childbirth and abortion, history of health services relevant to HBV infection, use of contraception, mobility, permanent tattoos and history of injecting drug use. Data collection was carried out from June to August 2019 through face-to-face interviews with pregnant women as respondents in their respective homes using a pre-tested questionnaire. Bivariate data analysis was conducted with chi square test and multivariate analysis with logistic regression.

Results: The case and control groups were similar in terms of age, number of pregnancy and parity. Risk factors which found to be significantly associated with HBV infection in pregnant women were age at first marriage < 19 years with AOR=2.51 (95%CI: 1.13-5.60), history of husband's mobility with AOR=3.07 (95%CI: 1.13-8.34), husband has a permanent tattoo with AOR=2.77 (95%CI: 1.04-7.44) and low level of maternal education with AOR=2.47 (95%CI: 1.06-5.73).

Conclusion: Young marital age, low education, husband's mobility and husband with permanent tattoos increase the likelihood of HBV infection among pregnant women. The coverage of HBV examination among pregnant women and early detection of HBV among husbands ought to be increased, especially among those with associated risk factors.

Keywords: risk factors, hepatitis B, HBsAg, pregnant women, Bali

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INTRODUCTION

Globally, the prevalence of hepatitis B virus (HBV) infection in 2015 was reported to be 3.5%.¹ A higher prevalence was reported in the West Pacific (6.2%) and Africa (6.1%) while in Southeast Asia it was reported to be lower (2%).¹ The prevalence of HBV infection in Indonesia was reported to be 9.4% in 2007 and 7.1% in 2013.^{2,3} This indicates that HBV infection in Indonesia has shifted from high endemic to moderate endemic.⁴ In

moderate endemic areas, the majority of HBV transmission is through perinatal transmission, transmission in children and/or adults and in health services.⁵

In 2015, The Indonesian Ministry of Health established several measures to reduce HBV transmission including early detection of HBV among pregnant women and measures to control its risk factors.⁶ Early detection of HBV infection in pregnant women is carried out to detect chronic HBV infection through Hepatitis

B Surface Antigen (HBsAg) examination. In 2017, the national proportion of sero-positive HBsAg among pregnant women was reported as high as 2.21%. While the average proportion of sero-positive HBsAg in four districts/cities of Bali Province was reported at 1.59%,⁷ the proportion of sero-positive HBsAg among pregnant women in Karangasem District was the highest at 4.3%.⁸

Several studies on the risk factors of HBV infection among pregnant women

have been carried out with various findings. Studies in Africa showed that a history of first-time sexual intercourse within the age <19 years in women⁹⁻¹¹ and having multiple sexual partners^{9,10,12,13} increase the risk of HBV infection in pregnant women. In addition to sexual behavior, a study in India reported that the risk of HBV infection was higher among residents with a history of migration to find work,¹⁴ whereas in Ethiopia and Turkey was higher among pregnant women who had permanent tattoos.^{15,16} Another study in Kabul, Turkey showed that HBV infection was associated with injecting drug use.¹⁷

HBV infection among pregnant women is also widely associated with a history of receiving invasive health services. Several studies in other countries show that the risk of HBV infection is higher in pregnant women who have a history of surgery,^{15,18} have been hospitalized,^{18,19} have received treatment by injection,¹⁵ blood transfusions,^{15,20,21} have had tooth extraction,^{22,23} experienced abortion^{18,24} and used contraception.²⁵ Meanwhile, socio-demographic factors were also reported to be associated with HBV infection among pregnant women, wherein those with low levels of education were more at risk of HBV infection,^{24,26} while other studies show a link between education level and age of marriage.²⁷

Published research on risk factors for HBV infection in pregnant women in Indonesia remains very limited. Similar research in West Nusa Tenggara Province shows that the husband's history of working abroad, age at first marriage ≤ 19 years and the frequency of husband marriage >1 time as the risk factors of HBV infection in pregnant women.²⁸ Meanwhile, 2017 data shows that Karangasem District has the lowest average literacy rate of the population aged ≥ 15 years in Bali Province.²⁹ Statistical data shows that residents of Karangasem District who are ≥ 25 years of age have an average length of schooling of 5.42 years.³⁰ A study shows that low rates of schooling are associated with higher rates of young marriage.²⁷ This suggests that there are factors that may contribute to the high rate of HBV infection in pregnant women in Karangasem District. Therefore, this study

was conducted to determine whether high risk behaviors in the mother or her partner and the history of receiving health services are risk factors for HBV infection in pregnant women.

METHODS

This case control study was conducted in Karangasem District which is located at the eastern tip of Bali Province. In this district there are 12 public health centers (PHCs) and one district hospital. The early detection program of HBV infection in Karangasem District began in 2017 by conducting voluntary HBsAg examinations in pregnant women during antenatal care (ANC) at the PHCs or hospital.

A total of 80 pregnant women with sero-positive HBsAg were selected as cases and 80 pregnant women with sero-negative HBsAg as controls (1:1). The sample size was calculated to test the two proportion differences using the proportion of pregnant women with sero-positive HBsAg who had a sexual partner >1 of 58.5% (P1) and the proportion of pregnant women with HBsAg sero-negative HBsAg who had a sexual partner >1 of 37% (P2),¹⁰ with a significance level of 95% and an estimated OR of 2.40. Cases and controls were sourced from registers of pregnant women at 12 PHCs and Karangasem District Hospital from June 2017 to December 2018. The number of registered pregnant women was 2,811. Cases were selected by systematic random sampling from 129 pregnant women with sero-positive HBsAg who were reside in 44 villages. Controls were selected based on the village of residence which were the same as the cases, 80 controls were selected of the 1,408 pregnant women with sero-negative HBsAg in those villages.

The data were collected using a questionnaire with 64 questions and had been tested on 10 pregnant women in the Karangasem I PHC to test the content validity of the instruments. The socio-demographic characteristics data collected were age, education level, parity and *gravida*/pregnancy. Meanwhile, age of first marriage, frequency of maternal marriage, history of maternal mobility, history of having tattoos and history of injecting drug use were grouped as variables of maternal

behavior. In addition, the husband's behaviors were also explored, namely the frequency of marriage, mobility, having a tattoo and a history of injecting drug use. Another variable studied was history of health care services relevant to HBV infection including surgery, blood transfusion, dental care, receiving injection, abortion, hospitalization, and insertion of contraception. Interviews were conducted at the home of the pregnant women (respondents) from June to August 2019 by village midwives who had been trained as enumerators.

The similarity of case and control groups in terms of socio-demographic characteristics was tested with chi-square. Bivariate analysis with chi-square test was conducted to determine the association between mother's and husband's behaviors, as well as history of health services with HBsAg sero-status. Variables with p value <0.25 in the bivariate analysis were entered into the multivariate analysis model using backward logistic regression LR to obtain the adjusted odds ratio.

This research has obtained an ethics clearance from the Ethics Committee of the Faculty of Medicine, Udayana University/Sanglah General Hospital with Number: 1806/UN14,2,2,VII, 14/LP/2019 dated 17 June 2019.

RESULTS

In **Table 1**, the proportions of cases and controls are presented based on several variables. It can be seen that there were no significant differences between cases and controls based on age, parity and number of pregnancy/*gravida* ($p>0.05$), but there were significant differences based on education level ($p=0.016$).

Table 2 shows the maternal behavior which significantly associated with HBV infection in pregnant women was the age of first marriage of below 19 years. While, husband's behaviors which significantly associated with HBV infection in pregnant women were history of mobility (not going home/staying at other places while working) and having a permanent tattoo ($p<0.05$). In addition, all history of receiving health service were not associated with HBV infection in pregnant women (**Table 3**).

Table 4 presents the results of

Table 1. Proportions of cases and controls by age, parity, *gravida* and education level

Variable	Case		Control		p
	n	%	n	%	
Mother's age (years)					
<20	5	6.2	5	6.2	0.345
20-35	50	62.5	58	72.5	
>35	25	31.2	17	21.2	
Parity					
0	18	22.5	22	27.5	0.438
1-2	24	30.0	28	35.0	
≥3	38	47.5	30	37.5	
Number of pregnancy					
1	18	22.5	18	22.5	0.388
2-4	52	65.0	57	71.2	
≥5	10	12.5	5	6.2	
Education level					
Low	46	57.5	30	37.5	0.016
Medium	30	37.5	48	60.0	
High	4	5.0	2	2.5	

multivariate analysis with logistic regression of the variables with p value <0.25 in the bivariate analysis. It can be seen that the variables that are significantly associated with HBV infection in pregnant women are age at first marriage <19 years with AOR=2.51 (95%CI: 1.13-5.60), history of mobility (husband does not come home/stay at another place while working) with AOR=3.07 (95%CI: 1.13-8.34), husband has a permanent tattoo with AOR=2.77 (95%CI: 1.04-7.44) and low education level with AOR=2.47 (95%CI: 1.06-5.73).

DISCUSSION

HBV infection among pregnant women in a moderate endemic areas become a concern since it will increase the risk of HBV transmission to the babies, hence

Table 2. The association between maternal and husband behavioral factors with HBV infection among pregnant women

Variables	Case	Control	Crude OR	95%CI	p
	n (%)	n (%)			
Mother's behaviour					
Age of first marriage (years)					
<19	51 (63.8)	18 (22.5)	6.06	3.02-12.14	<0.001
≥19	29 (36.2)	62 (77.5)			
Frequency of marriage*					
≥2 times	1 (1.2)	3 (3.8)	0.33	0.03-2.19	0.620
1 time	79 (98.8)	77 (96.2)			
History of mobility					
Yes	30 (37.5)	28 (35.0)	1.11	0.59-2.12	0.742
No	50 (62.5)	52 (65.0)			
Tattoos*					
Yes	0 (0.0)	3 (3.8)	-	-	0.245
No	80 (100.0)	77 (96.2)			
History of injecting drug use					
Yes	0 (0.0)	0 (0.0)	-	-	-
No	80 (100.0)	80 (100.0)			
Husband's behaviour					
Frequency of marriage*					
≥2 times	7 (8.8)	2 (2.5)	3.74	0.75-18.59	0.167
1 time	73 (91.2)	78 (97.5)			
History of mobility					
Yes	19 (23.8)	8 (10.0)	2.80	1.15-6.85	0.020
No	61 (76.2)	72 (90.0)			
Tattoos					
Yes	19 (23.8)	9 (11.2)	2.46	1.04-5.83	0.037
No	61 (76.2)	71 (88.8)			
History of injecting drug use*					
Yes	1 (1.2)	0 (0.0)	-	-	1.000
No	79 (98.8)	80 (100.0)			
Total	80 (100.0)	80 (100.0)			

*Statistical testing with *Fisher's Exact*

Table 3. Association between health services and HBV infection in pregnant women

Variable	Case	Control	Crude OR	95%CI	p
	n (%)	n (%)			
Injecting history					
Yes	29 (36.2)	24 (30.0)	1.33	0.69-2.57	0.401
No	51 (63.8)	56 (70.0)			
Surgery history					
Yes	17 (21.2)	13 (16.2)	1.39	0.63-3.09	0.418
No	63 (78.8)	67 (83.8)			
Dental history					
Yes	32 (40.0)	29 (36.2)	1.17	0.62-2.22	0.625
No	48 (60.0)	51 (63.8)			
Hospital stay history					
Yes	9 (11.2)	8 (10.0)	1.14	0.42-3.12	0.798
No	71 (88.8)	72 (90.0)			
Blood transfusion history					
Yes	0 (0.0)	0 (0.0)	-	-	-
No	80 (100.0)	80 (100.0)			
Abortion history*					
Yes	6 (7.5)	3 (3.8)	2.08	0.50-8.63	0.495
No	74 (92.5)	77 (96.2)			
Contraceptive history					
Risk	50 (62.5)	43 (53.8)	1.43	0.76-2.69	0.262
No risk	30 (37.5)	37 (46.2)			
Total	80 (100.0)	80 (100.0)			

*Statistical testing with *Fisher's Exact*

understanding factors associated with HBV infection among pregnant women is essential. Our study shows that the age of the mother for the first time marriage at <19 years, the history of the husband not coming home or staying overnight while working, the husband having a permanent tattoo and a low level of education are risk factors for HBV infection in pregnant women.

Age at first marriage is usually associated with first sexual intercourse, but these two events may not occur at the same time.³¹ Previous studies have shown that women who have had their first sexual intercourse at young age of below 19 are likely to have more sexual partners during their lifetime.^{9,28,32} While not directly testing the association with HBV infection, other studies have also linked young age at sexual intercourse with an increased risk of both sexually transmitted diseases and HIV transmission.²⁷

In addition, it was found that there was a correlation between the age of marriage

Table 4. Adjusted OR of risk factors for HBV infection in pregnant women

Variable	AOR	95%CI		p
		Lower	Upper	
Age of mother at first marriage (years)				
≥19	ref			
<19	2.51	1.13	5.60	0.024
Frequency of husband's marriage				
1 time	ref			
≥2 times	4.88	0.53	44.86	0.161
History of mobility of husband				
No	ref			
Yes	3.07	1.13	8.34	0.027
Husband has tattoos				
No	ref			
Yes	2.77	1.04	7.44	0.043
Mother has tattoos				
No	ref			
Yes	0.00	0.00	-	0.999
Education level				
High	ref			
Medium	0.69	0.19	2.51	0.575
Low	2.47	1.06	5.73	0.035

and the level of education where the more mature the age at marriage, the higher the education level and vice versa, the younger the age of marriage, the lower the level of education.^{27,31} We found mothers with lower level of education had a higher risk of HBV infection, and similar result was also found in another study which shows that HBV infection prevalence was higher among illiterate pregnant mothers.³³ Education level has been frequently associated with the probability of infectious diseases transmission.³⁴ Population with higher level of education had better knowledge, attitude, belief and practice towards HBV transmission particularly the sexual transmission compared to those with lower level of education.^{34,35}

Our study found that the risk of HBV infection was almost 5 times higher in pregnant women whose husbands had a history of frequency of marriage ≥ 2 times, but this finding was not statistically significant. Previous studies of acquiring HBV infection were associated with a history of the mother having several sexual partners,⁹ the frequency of married husbands more than one time²⁸ or polygamous marriages.³⁶

We also found that pregnant women who had husbands with higher mobility reflected by a history of not going home or staying overnight at work were found to be more at risk of contracting HBV infection. Usually married male workers rarely involve the nuclear family when working in other areas. Male workers often spend a long time in other areas alone or in groups with male co-workers and often in areas where there are potential commercial sex available.³⁷ Male construction workers and long-distance drivers such as truckers are more likely to buy sex than other occupational workers, and therefore have a higher risk of contracting sexually transmitted infections and hepatitis.³⁸ Moreover, our study found 22.5% of pregnant women with sero-positive HBsAg had husbands who work as construction laborers and 33.3% of those pregnant women said their husbands often did not go home or stay somewhere else while working. The results of a study in India showed that higher sero-positive HBsAg cases were found in adults with a

history of migration.¹⁴ Other studies have shown that the risk of sero-positive HBsAg is higher in pregnant women with a history of having their husbands working abroad.

In this study, pregnant women whose husbands have permanent tattoos are more at risk of experiencing HBV infection. A similar study in Iran found that tattoos increased the risk of HBV transmission.³⁹ A meta-analysis study showed a significant association between tattooing and HBV transmission and that the risk was increased in high-risk groups.⁴⁰ In the city of Dili, Timor-Leste, there was an association between the use of permanent tattoos and HBV infection⁴¹ and in Cimahi, West Java, HBV infection was found in people with tattoos.⁴²

In our study, it appears that HBV infection in pregnant women is mostly related to husband's behavior. Therefore, it is very important to involve the husband when the mother is undergoing antenatal care. Involving husbands is an opportunity for health workers to provide education to partners related to HBV, HIV and syphilis and carry out screening or detection of HBV infection and provide appropriate treatment. Furthermore, this effort can also prevent HBV transmission in the family which is the goal in the triple elimination.⁴³

This study subject to some limitations. The HBsAg sero-status examined during pregnancy did not show HBV infection onset, however it is beyond the study purpose. Another limitation is the possibility of recall bias against several risk factors that were difficult to remember by respondents. This research was conducted only in one district and caution was needed to generalize the results to a wider area.

CONCLUSION

The factors associated with HBV infection in pregnant women are the age of first marriage < 19 years, low education levels, history of husband's mobility, and husband has permanent tattoo. Meanwhile, in our study, the history of receiving health services, the frequency of marriage between mothers and husbands, mothers having permanent tattoos, history of maternal mobility and history of mother and husband using injectable narcotics

were not found to be associated with HBV infection in pregnant women.

The HBV examination in pregnant women and early detection of husbands should be escalated, especially in groups with risk factors found in this study. In addition, education for prevention of HBV transmission in the community needs to be carried out more intensively, especially in populations at risk of contracting and transmitting HBV.

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AUTHOR CONTRIBUTION

INAS designed the study, collected and analyzed the data and prepared the first draft of the manuscript. DNW and AASS involved in the conception of the study, data analysis, review and conducted thorough edits on the manuscripts

CONFLICT OF INTEREST

The authors declare no conflict of interest

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