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Mapping Hepatitis B Infection in Cap Tikus Consumers in South Minahasa, North Sulawesi

Linda Augustien Makalew[1a*], Indra Elisabet Lalangpuling[1b], Muhammad Ali Makaminan[1c]

[1] Department of Medical Laboratory Technology, Politeknik Kesehatan Kementerian Kesehatan Manado, Manado, North Sulawesi, Indonesia

[a] Email address: lindamakalew756@gmail.com
[b] Email address: indra_elisabet@yahoo.com
[c] Email address: nersali8@gmail.com

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Abstract
Risk factors for alcohol consumption can accelerate the development of hepatitis B infection leading to liver fibrosis, cirrhosis, and even Hepatocellular Carcinoma (HCC). North Sulawesi is the second province with the highest number of alcohol drinkers in Indonesia. Cap Tikus is a traditional community drink which is traditionally made from palm tree liquid. The tradition of drinking Cap Tikus is usually done by consuming it together in the same glass; where this behavior is risky behavior for the transmission of hepatitis B infection. Therefore, this research was conducted to determine the distribution of hepatitis B infection based on the results of the HBsAg examination in the South Minahasa area. The research design is quantitative with a descriptive research type. The population of the study was Cap Tikus drinkers in six locations in South Minahasa Regency. The sample consisted of 309 respondents, found through a random sampling technique based on inclusion and exclusion criteria. The research variable was the result of the HBV examination using the Enzyme Link Immunosorbent Assay (ELISA) method. The results showed that 67.6% of respondents were in the age range of 30-50 years, and 50.1% worked as farmers. The majority of respondents (31.7%) consumed Cap Tikus 3 times a week, with an alcohol level of 45-50% as many as 47.9 respondents; 41.1% of respondents consumed 250-350 ml in one drink. The results of the ELISA reader examination showed that 4 respondents (1.3%) gave results above the cut-off value of 1.007. Based on the results of the research conducted, this study concludes that as many as 1.3% of respondents were declared positive for HBsAg through the ELISA examination and were only found in Ranomea Village, South Minahasa Regency. It is hoped that the government and health workers will be able to provide health education about the dangers of drinking alcohol excessively and educate about the risk factors for transmission of the hepatitis B virus.

Keywords: Hepatitis B, Cap Tikus Drinkers, ELISA, South Minahasa.

Corresponding Author:

Linda Augustien Makalew
Department of Medical Laboratory Technology, Politeknik Kesehatan Kementerian Kesehatan Manado, Manado, North Sulawesi, Indonesia
Email: lindamakalew756@gmail.com

1. INTRODUCTION

Hepatitis B is a global health problem that infects around 1.2 million people worldwide per year. In 2022, WHO estimates that 254 million people will suffer from chronic hepatitis B with a death rate of 1.1 million cases. Indonesia is included in the 3 countries contributing to hepatitis B cases, representing 50% globally. The number of people infected with hepatitis B in Indonesia is 17.5 million people with more than 60 thousand deaths in 2022. Indonesia itself is included in the 3 countries contributing to hepatitis B cases, representing 50% globally. The number of people infected with hepatitis B in Indonesia is 17.5 million people with more than 60 thousand deaths in 2022 (World Health Organization, 2024). The prevalence of hepatitis B in North Sulawesi in 2022 will reach 0.17% (Badan Kebijakan Pembangunan Kesehatan, 2023).

Hepatitis is inflammation of the liver which can be caused by infectious agents (viruses) and non-infectious agents (autoimmune and drugs). However, hepatitis is often found to be caused by viruses, called "viral hepatitis" (Mehta et al., 2024). There are five viruses that cause hepatitis, namely hepatitis A virus (HAV), hepatitis B virus (HBV), hepatitis C virus (HCV), hepatitis D virus (HDV) and hepatitis E virus (HEV). Among the five viruses, HBV and HCV are the two types of hepatitis that often occur and can become chronic, leading to liver cirrhosis (World Health Organization, 2024).

Although some people will recover from acute hepatitis, certain factors, such as alcohol abuse, make HBV persist chronically putting patients at high risk of fibrosis, cirrhosis, and even hepatocellular carcinoma (HCC) (Li et al., 2019). The combination of HBV infection and alcohol abuse increases the progression of liver damage, especially to HCC, which is the 5th most common type of cancer and the 2nd cause of cancer death worldwide. Furthermore, the risk of developing HCC is six times higher in alcoholics (Ganesan et al., 2020). Another study concluded that patients with chronic HBV infection and excessive alcohol drinking habits activate HBV-DNA which increases liver inflammation, thereby accelerating the development of liver cirrhosis (Zhou et al., 2021).

Alcoholic drinks are psychoactive and toxic substances which have caused around 2.6 million deaths worldwide in 2019 (World Health Organization, 2024). An estimated 400 million people, or 7% of the world's population aged 15 years and over, live with an alcohol use disorder. The prevalence of consuming alcoholic beverages in Indonesia will reach 2.2% in 2022. North Sulawesi Province is the second highest province after East Nusa Tenggara (NTT), as the province consuming alcoholic beverages with a figure of 11.4%. The 2023 Indonesian Health Survey shows that of all types of alcoholic drinks, 65.9% of the people of North Sulawesi consume a type of traditional clear alcoholic drink known as Cap Tikus (Badan Kebijakan Pembangunan Kesehatan, 2023).

Risk factors for HBV transmission in developing countries include: transmission from mother to baby (perinatal transmission), unscreened blood transfusion, use of non-sterile injection needles, unsafe sexual behavior, tattooing or medical procedures without hygiene standards (Hossain et al., 2024). HBV can be detected in body fluids such as blood, tears, cerumen, semen, breast milk, sweat, urine, amniotic fluid and saliva (Ghosh et al., 2015). Research conducted by Onyia et al., (2024) found that saliva can be used to screen for hepatitis B virus (Onyia et al., 2024).

Cap Tikus is a traditional drink made by the people of North Sulawesi. This drink is produced from the fermentation and distillation process of the white liquid from the enau or "seho" tree (Tambayong, Laoh & Porajouw, 2016). Cap Tikus is made from sap juice which in local language is called "saguer". The alcohol content in rat caps ranges from 30 – 38%. Research by Rintjap found that the processed Cap Tikus drink on the market with the brand "Kasagaran" had an ethanol content of 21.50% and the one branded "Segaran" had 25.71% (Rintjap et al., 2023). The tradition of drinking Cap Tikus is usually done by consuming it together in the same glass; where this behavior is risky behavior for the transmission of hepatitis B infection.

The South Minahasa area is one of the Cap Tikus producing areas in North Sulawesi. Therefore, people from teenagers to the elderly consume Cap Tikus. There has been no specific research conducted to see Hepatitis B infection in Cap Tikus consumers; however, indirectly, consuming alcohol can worsen the liver organ that is attacked by the hepatitis B virus. The 2018 Riskesda report states that the prevalence of hepatitis B in South Minahasa Regency is 0.25% (Badan Penelitian dan Pengembangan Kesehatan, 2019). The purpose of this study is to identify the distribution of hepatitis B infection in South Minahasa.

2. RESEARCH METHOD

This research is descriptive and was conducted from January to May 2024. Specimens were taken from six villages in South Minahasa Regency, namely Pinaling Village, Ranomea Village, Motoling Village, Motoling Mawale Village, Motoling Satu Village, and Motoling Dua Village. Blood specimens were taken aseptically using a serum separator tube. The specimen was placed in a safety box at 4°C, and the examination was carried out at the Immunoserology Laboratory, TLM Department, Ministry of Health, Manado Health Polytechnic. The population in this study were local people who consumed alcohol and were willing to be respondents. A total of 309 respondents were found through random sampling techniques based on inclusion and exclusion criteria. All those who met the inclusion criteria were included in a table and drawn.

The materials used in this research were washing solution, distilled water, chromogen A, chromogen B, HRP-conjugate, stop solution, positive control, and negative control. The tools used are SST tube, tube rack, tourniquet, alcohol swab, plaster, disposable syringe, labeling/marker, dry cotton, centrifuge, micropipette, timer, ELISA reader, incubator, microwell, micro tube, coolbox and ice pack.

HBsAg examination was carried out based on the ELISA method using the Elisa Reader Vidas tool. The inspection procedure uses the KIT Inser tool. A cut-off value of more than 0.107 is considered positive, and less than 0.107 is considered negative. The data obtained are presented in tables and explained descriptively. The research has been declared to have passed the research ethics commission by the Ministry of Health, Manado Health Polytechnic with number KEPK.01/07/145/2024.

3. RESULTS AND DISCUSSION

A total of 309 Cap Tikus consumers in South Minahasa Regency were willing to be respondents who met the criteria and provided the following results:

Table 1. Respondent characteristics based on age and occupation

Characteristic	HbsAg Examination Results				Total	
	Positive		Negative			
Age (years)	**n**	**%**	**n**	**%**	**n**	**%**
< 30	0	0.0	48	15.6	48	15.6
30 – 50	2	0.7	207	66.9	209	67.6
> 50	2	0.7	50	16.1	52	16.8
Total	4	1.4	305	98.6	309	100
Occupation						
Employee	0	0	21	6.7	21	6.7
Self-employed	1	0.3	28	9	29	9.3
Private	0	0	5	1.6	5	1.6
Civil Servants	0	0	10	3.2	10	3.2
Teacher	0	0	1	0.3	1	0.3
Police	0	0	1	0.3	1	0.3

Characteristic	HbsAg Examination Results				Total	
	Positive		Negative			
College Student	0	0	45	14.5	45	14.5
Student	0	0	6	1.9	6	1.9
Driver	0	0	2	0.6	2	0.6
Laborer	0	0	5	1.6	5	1.6
Fisherman	1	0.3	28	9	29	9.3
Farmer	2	0.6	153	49.5	155	50.1
Total	4	12	305	98.8	309	100

Table 1 shows the distribution of respondents based on age and occupation regarding the results of the HBsAg examination. The majority of Cap Tikus drinkers are in the 30-to-50-year age group with a percentage of 67.6% (n=209). Similar results were also obtained from previous research that out of 400 respondents, the 30-49 age group had the largest percentage in terms of alcohol consumption (Kishore et al., 2019). Other studies also report the highest prevalence of alcohol consumption in the 30-to-50-year group (Firdayanti et al., 2024). The purpose of drinking alcohol at this age range is associated with relaxation, socializing, and maintaining friendships and is seen as an expression of masculinity (Parke et al., 2018).

Based on table 1, 1.29% of Cap Tikus drinkers had positive HBsAg results (n=4/309). Cap Tikus is a traditional alcoholic beverage obtained through a distillation process. The alcohol content contained in it depends on how it is processed. Similar results were also reported by other studies where the percentage of alcohol drinkers who had positive HBsAg results was 0.62% (n=43/6881) (Öner et al., 2022). Another study also found that the percentage of positive HBsAg results in alcohol drinkers was 6.7% (n=2/30) (Firdayanti et al., 2024). Alcohol has a negative impact on hepatitis B virus infection in the liver by increasing viral replication, increasing oxidative stress, suppressing the viral immune response, and increasing HBV DNA (Xu et al., 2021). Alcohol consumption significantly increases the risk of liver cirrhosis in HBV-infected patients. Alcohol acts synergistically with HBV infection in causing chronic inflammation and fibrosis. This effect is evident even in moderate alcohol consumers (Abassa et al., 2022).

Table 1 also shows that positive HBsAg results were found in the age group 30 to 49 years and the age group over 50 years, with the same percentage, namely 0.7% (n=2/309). Similar results were also reported by other studies where the age group 30 to more than 50 years had a percentage of 1.89% (n=130/6881) (Öner et al., 2022). There are three factors that are the reason; the first is increased risk exposure, such as casual sex or sharing needles. The second factor is the decline in the immune system with age. The third factor is the development of a chronic infection, which was originally asymptomatic (Ganesan et al., 2020).

The majority work as farmers, with a percentage of 50.1% (n=155/309). The farmers in this research are palm tree farmers who usually produce Cap Tikus. Due to work factors, they often consume Cap Tikus which is their own product. Plus, they no longer need to buy Cap Tikus, thereby increasing the likelihood of repeated drinking. The same thing is done by the Community in Talaitat Utara Village, Suluun Tareran District, South Minahasa Regency. They produce Cap Tikus and as consumers with certain purposes, the results of their production become the main source of income (Lintong, Deeng & Mamosy, 2022). Cap Tikus is a symbol of masculinity and social solidarity in the Minahasa community. Alcohol consumption is normalized in family events and traditional gatherings and as a means of strengthening social relations. However, there is a shift in values with increasing consumption outside the cultural context (Dolonseda & Palangda, 2023).

Positive HBsAg results were obtained in those who worked as farmers, with a percentage of 0.65% (n=2/309). Similar results were reported by Chen et al., 2021 where the percentage of farmers who tested positive for HBsAg was 7.01% (n=27,431/386,286) (Chen et al., 2021). Farmers who in fact live in areas tend to have limited access to health services and lack of health

education, which can contribute to the increasing prevalence of hepatitis B (Tripathi & Mousa, 2023). The farmers in this study are also the majority of farmers who make Cap Tikus, which is a factor in accelerating the severity of HBV infection.

Table 2. Characteristics of "Cap Tikus" consumed by respondents

Characteristic	**HbsAg Examination Results**				**Total**	
	Positive		**Negative**			
Frequency	**n**	**%**	**n**	**%**	**n**	**%**
1 Time	1	0.3	56	18.1	57	18.4
2 Times	2	0.7	92	29.5	94	0.4
3 Times	1	0.3	97	31.8	98	31.7
Every day	0	0	60	19.3	60	19.4
Total	4	1.3	305	98.7	309	100
Alcohol Level (%)						
10 – 20	0	0	6	1.5	6	1.9
30 – 35	0	0	44	14.2	44	14.2
40 – 45	4	1.2	111	35.6	107	35.9
45 – 50	0	0	148	47.5	148	47.9
Total	4	1.2	29	98.8	309	100
Alcohol Volume (mL)						
50 – 100	0	0	29	9.1	29	9.4
150 – 200	2	0.7	117	36.4	119	38.5
250 – 300	2	0.7	125	40.2	127	41.1
350 – 500	0	0	34	11	24	11
Total	4	3.3	305	96.7	309	100

Table 2 shows the distribution of respondents based on factors related to drinking "Cap Tikus" alcohol on HBsAg examination results. From the aspect of the frequency of drinking alcohol, all three frequencies were found to be positive for HBsAg. Studies have shown that alcohol consumption can lead to increased levels of HBsAg and HBV DNA in serum. For example, studies in mice show that ethanol intake can increase HBsAg levels up to 7-fold compared to mice on a control diet (Ganesan et al., 2020).

From the aspect of alcohol content in Cap Tikus, positive HBsAg results were identified at alcohol levels of 40 to 45%. In the 2023 Indonesian Health Survey (Badan Kebijakan Pembangunan Kesehatan, 2023). Traditional clear drinks contained an average of 10 g (between 8 – 13 g) of pure ethanol in 100 mL. The alcohol content in Cap Tikus depends on the time and temperature of the distillation process, but usually ranges from 30 to 38% (Tambayong et al., 2016). Research shows that moderate alcohol consumption (less than 50 grams per day) can increase the risk of oxidative stress threefold, while large alcohol consumption (more than 50 grams per day) can increase the risk by 13 to 24 times (Ganesan et al., 2020). The dose of alcohol can affect liver damage, thereby making it more severe in hepatitis B patients (Xu et al., 2021). The risk of liver damage depends not only on the total amount of alcohol but also on the frequency. Daily consumption carries a higher risk than weekly consumption of the same amount because liver recovery is impaired (Roerecke et al., 2019).

From the aspect of alcohol volume, positive HBsAg results were identified in volumes of 150 to 200 mL and 250 to 300 mL. The volume of alcohol is directly related to the dose of alcohol. The greater the volume of alcohol consumed, the greater the chance of liver damage. A damaged liver will facilitate HBV infection and worsen the condition of hepatitis B patients

(Xu et al., 2021). Alcohol abuse makes HBV persist chronically so that patients are at high risk of experiencing fibrosis, cirrhosis, and even hepatocellular carcinoma (HCC) (Li et al., 2019).

In addition, the results of researchers' observations found that the habit of drinking Cap Tikus in six locations, namely gathering together and using the same glass in turns. This behavior is a potential factor in the transmission of HBV infection. HBV transmission can occur in two ways, horizontal and vertical. Horizontal transmission is related to infection between people, through body fluids (saliva, blood, etc.). Vertical transmission relates to infections carried by babies from infected mothers (Tripathi & Mousa, 2023).

Chronic alcohol consumption affects liver structure and function. Alcohol metabolism is catalyzed by alcohol dehydrogenase and cytochrome P450 2E1 (CYP2E1) to acetaldehyde, and this major metabolite is the cause of most of the toxic effects associated with alcohol use. Acetaldehyde is highly toxic and carcinogenic. CYP2E1 is involved in the induction of ROS, which interacts with lipid molecules to cause lipid peroxidation. In addition, acetaldehyde and CYP2E1 induce oxidative stress. Overall, the effects of alcohol metabolism on protein function, DNA, changes in the immune system and oxidative stress affect hepatocytes and other liver cells (Ganesan et al., 2020).

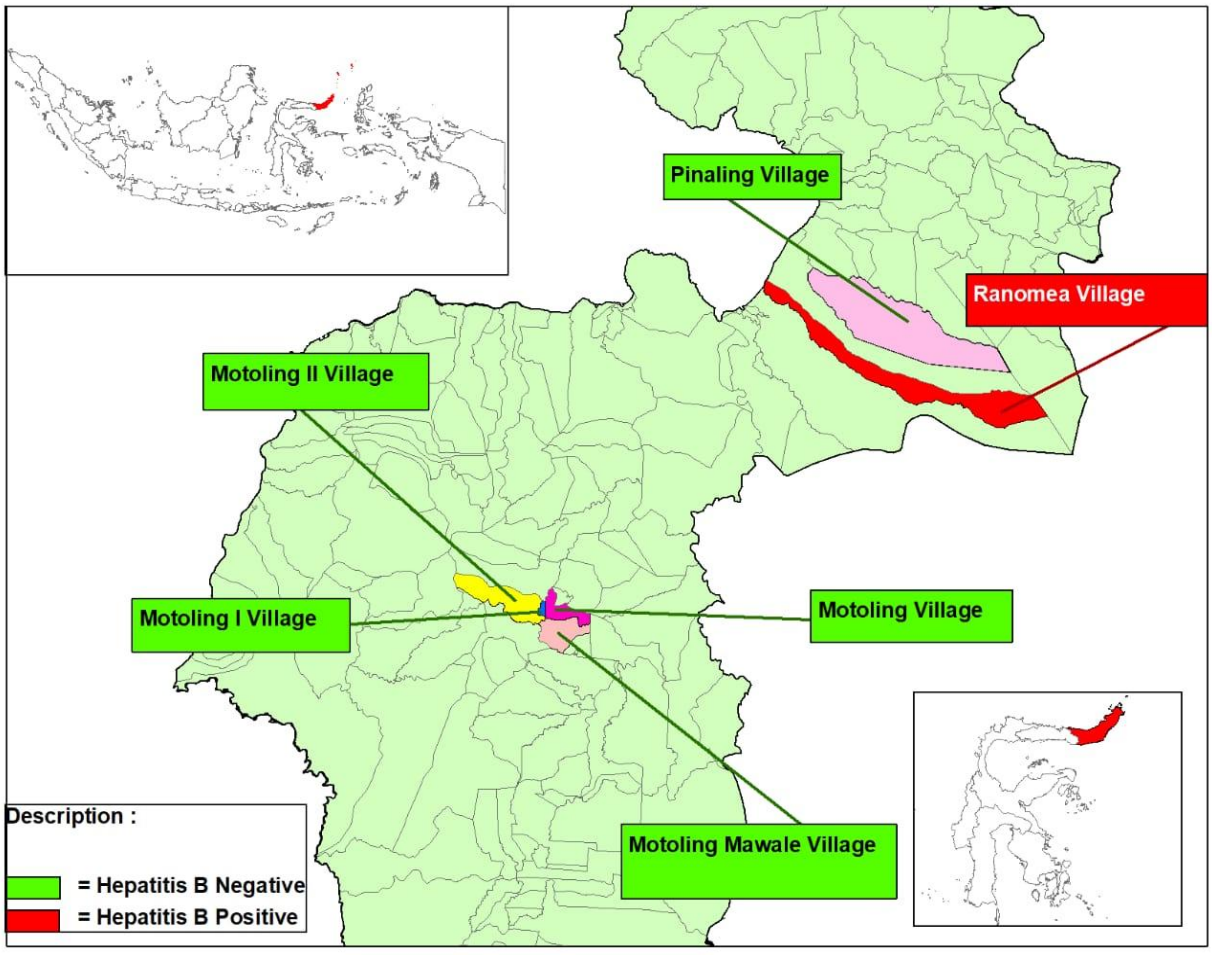

Figure 1. Mapping hepatitis B infection at six sampling locations.

Figure 1 shows the distribution of Hepatitis B infection in Cap Tikus consumers in South Minahasa Regency. The map shows that respondents who showed positive results from the ELISA examination were just in Ranomea Village. Respondents who were positive for HBsAg were found to be in the age range of 30 to 50 years, and the type of work was farmers; habit of consuming alcohol more than twice a week, alcohol content of 40 to 50%, and drink volume of 150 to 300 mL. There are no specific characteristics of alcohol drinkers in this place compared to other areas, but important mapping is made for predicting and mapping prevention strategies

and early warning of infectious diseases (Zinszer et al., 2012). Spatial mapping is also useful for intervention and resource planning to address problems in the area (Hay & Snow, 2006).

Several methods can be used for HBV examination, including Rapid Diagnostik Test (RDT), Polymerase Chain Reaction (PCR) and ELISA (Serikova et al., 2021). Pemeriksaan RDT digunakan untuk skrining HBV (World Health Organization, 2017). HBsAg examination in this study used the ELISA method. The advantage of the ELISA method is that it has quite high sensitivity and specificity due to specific antigen and antibody binding. This method is the gold standard for HBsAg examination. This method has disadvantages, including requiring sophisticated equipment and being expensive, time consuming and requires trained laboratory personnel (Andayani et al., 2023). The ELISA method used is sandwich ELISA. It is called a "sandwich" because the antigen is sandwiched between two layers of antibodies (capture antibodies and detection antibodies). Sandwich ELISA has the highest sensitivity among all types of ELISA. The main disadvantages of this type of ELISA are the time and cost as well as the required use of “matched pairs” (divalent/multivalent antigens) and secondary antibodies (Alhajj et al., 2023).

4. CONCLUSION

This study concludes that as many as 1.3% of respondents were declared positive for HBsAg through the ELISA examination and were only found in Ranomea Village, South Minahasa Regency. It is hoped that the government and health workers will be able to provide health education about the dangers of drinking alcohol excessively and educate about the risk factors for transmission of the hepatitis B virus.

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