

## Original Research Article

# Spatial Analysis Risks of Chronic Kidney Failure with Hemodialysis in the Drylands of East Nusa Tenggara

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**Abstract:** This study aims to analyze drinking habits, staying-up-late behavior, and unhealthy eating habits as risk factors for non-communicable diseases among communities in four regions of East Nusa Tenggara. A cross-sectional design was employed with 80 respondents. Data were collected using questionnaires and analyzed descriptively as well as spatially using QGIS and GeoDa. The results showed that inadequate water intake, high consumption of energy drinks, alcohol, coffee, and dietary supplements were most prevalent in Sumba and Alor. Unhealthy eating habits included excessive salty food consumption, frequent fast-food intake, and low fruit and vegetable consumption, with the highest prevalence found in Alor and Sumba. Additionally, 51% of respondents reported staying up late regularly, mostly 2–3 times per week, with the highest frequency in Sumba (79%) and Timor (55%). These lifestyle patterns contribute to an increased risk of non-communicable diseases such as hypertension, obesity, and metabolic disorders. This study highlights the need for community-based health education, campaigns to reduce risky beverage consumption, promotion of balanced nutrition, and initiatives encouraging healthy sleep patterns to mitigate future health risks.

**Keywords:** Drinking Habits, Staying Up Late, Poor Eating Habits, Chronic Kidney Disease, Hemodialysis.

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## INTRODUCTION

Chronic Kidney Disease (CKD) is a major global problem due to its difficulty in treatment as well as the high cost of care and medication (Setyoningsih & Ismasari, 2024; Supriyadi *et al.*, 2011). Studies estimate that GSK will be the leading cause of death globally by 2040 if not properly addressed (Bikbov *et al.*, 2020). Data from BPJS shows that nationally, the number of cases reached 1,501,016 in 2023 (Fajrin *et al.*, 2025; Kementerian Kesehatan Republik Indonesia, 2024). Data from the East Nusa Tenggara Provincial Health Office (Dinkes NTT) in 2024 shows that the total number of new CVD patients was 250 (58.3%) aged 19-68 years, with 41.7% in the 56-65 age group (BPS Provinsi Nusa Tenggara Timur, 2025). This significant problem highlights the urgent need for patients with chronic kidney disease to receive proper treatment, with the main focus being on diseases that are risk factors, namely hypertension, diabetic nephropathy (diabetes), and glomerulopathy.

A number of studies report that as the body ages, the kidneys become less efficient at filtering blood due to the complex process of renal aging, causing structural and functional changes in the kidneys (Denic *et al.*, 2016; Fang *et al.*, 2020). The impact on microscopic lesions that began to accumulate until the patient developed CKD in elderly respondents (Zhang *et al.*, 2024). Respondents aged 19 years old experienced CKD due to unhealthy lifestyles and lack of physical activity, leading to kidney failure at a young age. For example, unhealthy lifestyles characterized by high consumption of sweet processed foods, fast food, foods high in sodium, alcohol consumption, and low water intake contribute to kidney failure at a young age (Avesani *et al.*, 2023; Dai *et al.*, 2024). Furthermore, CKD patients generally are not immediately treated with hemodialysis (HD) because the decision-making process involves the extended family, in line with the cultural values of the people of East Nusa Tenggara. That leads to the patient's condition worsening until they reach stage 5 when they return for HD (Hussain *et al.*, 2015; Mongkolrattanakul & Chienwichai, 2025). Medically

speaking, men are twice as likely to suffer from kidney disease as women. This is because women tend to pay more attention to their health and healthy lifestyle habits. On the other hand, men are more likely to have habits that can affect their health, such as smoking, drinking coffee, alcohol, and supplements that can trigger systemic diseases that can cause a decline in kidney function. This lifestyle can trigger prolonged hypertension, which can lead to CKD. Besides lifestyle, men also have a higher risk of developing rapid-onset CKD than women due to differences in hormone levels. Men have higher testosterone levels, which can lead to kidney failure (Harvey & De La Rosa, 2025).

CKD patients who undergo hemodialysis show an epidemiological transition in the region, with about 85% coming from rural areas (Wu *et al.*, 2024). This condition is influenced by limited facilities and health workers for routine screening, high exposure to unhealthy consumption patterns, and strong local wisdom that is still embraced by most communities, making the process of community education and decision-making more complex (Hidayangsih *et al.*, 2023; Nur *et al.*, 2025). The province of East Nusa Tenggara (NTT) has 64 hospitals ranging from type B to type D, but hemodialysis services are only available in a few referral hospitals (Avitalia Health, 2024). CKD represents the end stage of chronic diseases in the body such as hypertension, diabetes mellitus, polycystic kidney disease, cancer, and autoimmune diseases, with unhealthy lifestyles contributing significantly to the onset of CKD (Arna *et al.*, 2025; Mount Elizabeth, 2022).

Spatial analysis is a strategic approach in supporting surveillance and disease control decision-making because it can systematically describe the distribution of disease events, at-risk populations, temporal patterns, and potential future case developments (Crispin *et al.*, 2023). In the context of an archipelagic region such as East Nusa Tenggara, this approach is essential for mapping the relationship between environmental conditions, local wisdom, availability and affordability of health services that support kidney disease screening, distribution of health workers, and community lifestyles as multicausal determinants of chronic kidney failure (CKF). Spatial mapping enables the identification of the accumulation and interaction of risk factors that exacerbate the progression of chronic diseases to an advanced stage. Therefore, this study aims to identify and spatially analyze the collaboration of potential risk factors that influence the incidence of CKD in hospitals with hemodialysis units.

## METHODS

The purposive sampling method was used to select four hospitals (minimum) from 11 hospitals based on the criteria of willingness to participate in the sample and represent each island in East Nusa Tenggara (Timor,

Alor, Sumba, Flores). A total of 80 patients with chronic kidney disease were sampled. Data were collected using a quantitative approach with a cross-sectional study design. Primary data as attribute data was collected directly from CKD patients undergoing HD, including variables on lifestyle (eating and drinking habits, diet, physical activity, consumption of natural herbal products), existing local cultural practices (drinking moke, mete, smoking, coffee), and use of health facilities. Secondary data collected included spatial data of the area to be mapped, diagnoses of diseases triggering CKD in patients, availability of health facilities supporting CKD screening, availability of human resources, and living environment conditions (water sources used for eating and drinking). Data processing using Excel and spatial data analysis using the GEODA application. The results of the analysis will then be mapped in QGIS and presented in the form of maps and analysis matrices. This research involves the Provincial Health Office of East Nusa Tenggara, the District Health Offices of Alor, Sumba, and Flores, the City Health Office of Kupang, four selected hospitals as samples, patients/patients' families, doctors and nurses in the HD ward, and the Regional Development Planning Agency of East Nusa Tenggara (spatial data). The results of the analysis, namely the overlay of risk factors for CKD in the Nusa Tenggara Timur islands, will be presented in an attractive map layout and disseminated in the form of publications, textbooks, monographs, and seminars to all healthy kidney advocates.

The study obtained ethical clearance from the UNDANA Faculty of Public Health Research Ethics Committee (Approval ID No: 001480/KEPK FKM UNDANA/2025). The study also requires research implementation permits from several relevant agencies. In addition, the study will use informed consent forms provided to participants involved in the study. Researchers guarantee the confidentiality of all interview information and that it will only be used for research purposes.

## RESULT AND DISCUSSION

### Respondent Characteristics

Table 1 shows the results of the study that 80 respondents came from four regions, namely Timor (41%), Flores (25%), Sumba (18%), and Alor (16%). In terms of age groups, the majority were aged 61–70 years (41%), followed by those aged 41–50 years and 51–60 years, each accounting for 18%, and those aged 21–30 years accounting for 14%. The smallest proportion was in the 71–80 age group (3%) and the 11–20 and 31–40 age groups, each accounting for 4%. The duration of hemodialysis varied, with most patients undergoing therapy for 1 year (21%), followed by 2 years and 4 years, each accounting for 16% and 3 years accounting for 15%. A small proportion had undergone hemodialysis for 6 years (9%), while the longest duration recorded was 12 years (5%). There were no patients with a hemodialysis duration of 5 years or 10 years.

**Table 1: Respondent Characteristics**

Characteristics	Frequency	Percentage (%)
<b>Region</b>		
Alor	13	16
Flores	20	25
Sumba	14	18
Timor	33	41
<b>Age (years)</b>		
11-20	3	4
21-30	11	14
31-40	3	4
41-50	14	18
51-60	14	18
61-70	33	41
71-80	2	3
<b>Duration of Hemodialysis (years)</b>		
<1	4	5
1	17	21
2	13	16
3	12	15
4	13	16
5	0	0
6	7	9
7	3	4
8	3	4
9	2	3
10	0	0
11	2	3
12	4	5
<b>Total</b>	<b>80</b>	<b>100</b>

**Drinking Habits**

Table 2 shows the results of the study that 48% of respondents do not drink enough water, especially in Sumba (79%). 30% of respondents consume energy drinks, with the highest percentage in Sumba (64%) and Alor (46%). 33% of respondents consume supplements, with the highest percentage in Alor (69%). 40% of

respondents consume herbs, with the highest rate in Sumba (57%). 25% of respondents consume alcohol, with the highest rate in Sumba (64%). 36% of respondents consume coffee, with the highest rate in Sumba (79%). The distribution map shows a high concentration of unhealthy drinking habits in Sumba and Alor.

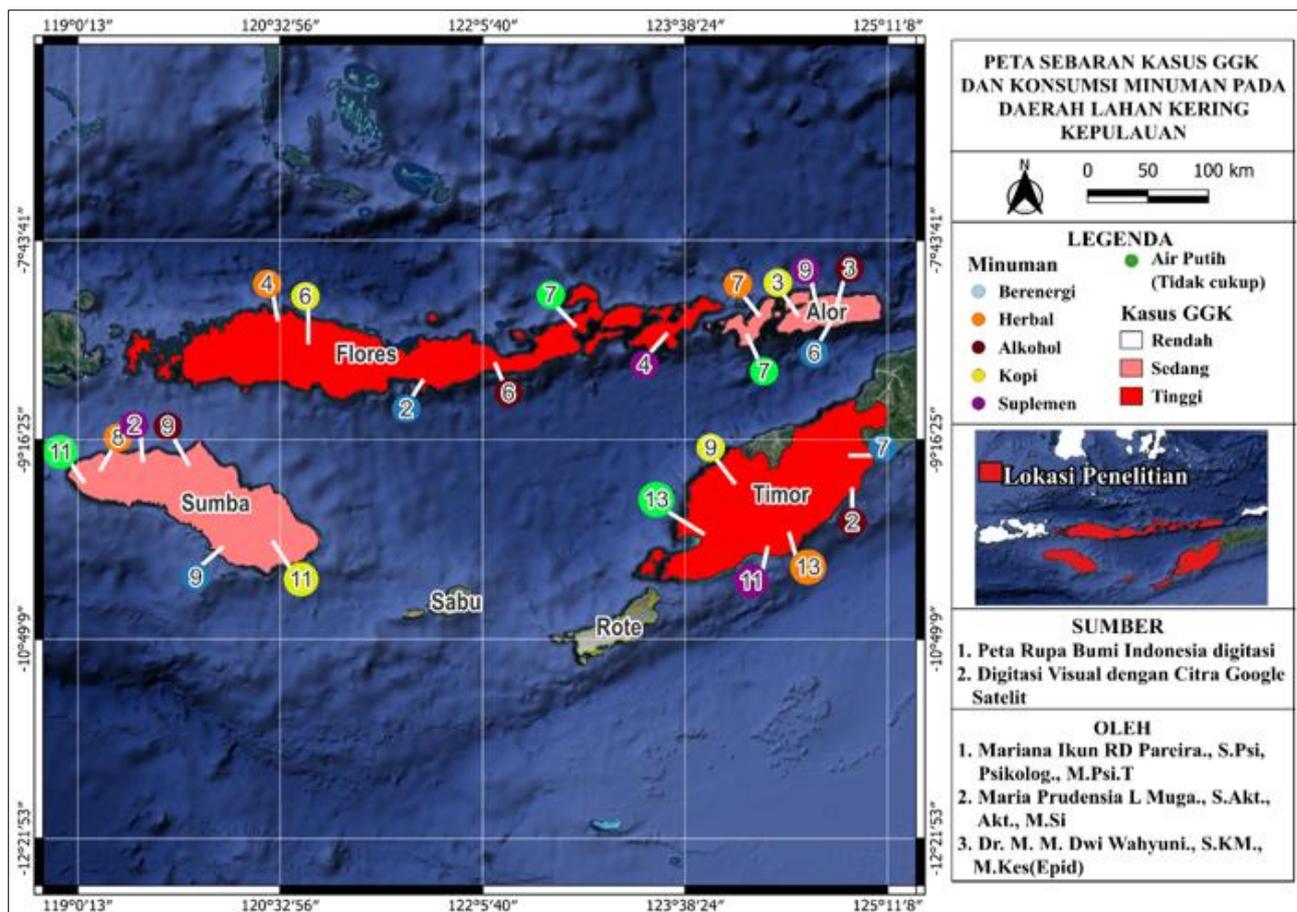
**Table 2: Drinking Habits**

Variable	Region								N	%
	Alor		Flores		Sumba		Timor			
	n	%	n	%	n	%	n	%		
<b>Drink water</b>										
Not enough	7	54	7	35	11	79	13	39	38	48
Enough	6	46	13	65	3	21	20	61	42	53
<b>Total</b>	<b>13</b>		<b>20</b>		<b>14</b>		<b>33</b>		<b>80</b>	<b>100</b>
<b>Drink energy drinks</b>										
Yes	6	46	2	10	9	64	7	21	24	30
No	7	54	18	90	5	36	26	79	56	70
<b>Total</b>	<b>13</b>		<b>20</b>		<b>14</b>		<b>33</b>		<b>80</b>	<b>100</b>
<b>Frequency</b>										
0,1 mL – 1,3 mL	0	0	0	0	0	0	2	29	2	8
1,3 mL – 450 mL	0	0	2	100	3	33	3	43	8	33
>450 mL	6	100	0	0	6	67	2	29	14	58
<b>Total</b>	<b>6</b>		<b>2</b>		<b>9</b>		<b>7</b>		<b>24</b>	<b>100</b>
<b>Taking supplements</b>										
Yes	9	69	4	20	2	14	11	33	26	33

Variable	Region								N	%
	Alor		Flores		Sumba		Timor			
	n	%	n	%	n	%	n	%		
No	4	31	16	80	12	86	22	67	54	68
<b>Total</b>	<b>13</b>		<b>20</b>		<b>14</b>		<b>33</b>		<b>80</b>	<b>100</b>
<b>Frequency</b>										
0,1 mL – 1,3 mL	3	33	4	100	0	0	7	64	14	54
1,3 mL	0	0	0	0	2	100	2	18	4	15
>1,3 mL	6	67	0	0	0	0	2	18	8	31
<b>Total</b>	<b>9</b>		<b>4</b>		<b>2</b>		<b>11</b>		<b>26</b>	<b>100</b>
<b>Drink natural herbs</b>										
Yes	7	54	4	20	8	57	13	39	32	40
No	6	46	16	80	6	43	20	61	48	60
<b>Total</b>	<b>13</b>		<b>20</b>		<b>14</b>		<b>33</b>		<b>80</b>	<b>100</b>
<b>Frequency</b>										
0,1 mL – 1,3 mL	3	43	0	0	2	25	6	46	11	34
1,3 mL	0	0	4	100	0	0	5	38	9	28
>1,3 mL	4	57	0	0	6	75	2	15	12	38
<b>Total</b>	<b>7</b>		<b>4</b>		<b>8</b>		<b>13</b>		<b>32</b>	<b>100</b>
<b>Drink alcohol</b>										
Yes	3	23	6	30	9	64	2	6	20	25
No	10	77	14	70	5	36	31	94	60	75
<b>Total</b>	<b>13</b>		<b>20</b>		<b>14</b>		<b>33</b>		<b>80</b>	<b>100</b>
<b>Frequency</b>										
0,1 mL – 1,3 mL	0	0	2	33	0	0	0	0	2	10
1,3 mL	0	0	2	33	0	0	0	0	2	10
>1,3 mL	3	100	2	33	9	100	2	100	16	80
<b>Total</b>	<b>3</b>		<b>6</b>		<b>9</b>		<b>2</b>		<b>20</b>	<b>100</b>
<b>Drink coffee</b>										
Ya	3	23	6	30	11	79	9	27	29	36
Tidak	10	77	14	70	3	21	24	73	51	64
<b>Total</b>	<b>13</b>		<b>20</b>		<b>14</b>		<b>33</b>		<b>80</b>	<b>100</b>
<b>Frequency</b>										
0,1 mL – 1,3 mL	0	0	2	33	2	18	2	22	6	21
1,3 mL	0	0	0	0	0	0	0	0	0	0
>1,3 mL	3	100	4	67	9	82	7	78	23	79
<b>Total</b>	<b>3</b>		<b>6</b>		<b>11</b>		<b>9</b>		<b>29</b>	<b>100</b>

Drinking habits are a person's fluid consumption patterns, including the types, frequency, and amount of beverages consumed each day. These habits include drinking water, energy drinks, supplements, natural herbs, alcohol, and coffee. According to the Indonesian Ministry of Health, the average daily fluid requirement for adults is around 2 liters per day, with a priority on water (Kementerian Kesehatan RI, 2025). Excessive consumption of sweetened, alcoholic, or caffeinated beverages can increase the risk of metabolic diseases, kidney disorders, and cardiovascular disease. Researchers found that the high percentage of respondents who drink less than the recommended daily amount of water in Sumba and Timor can increase the risk of dehydration and kidney dysfunction. The results of this study are supported by research finding that low water consumption is associated with the prevalence of chronic kidney disease in the East Nusa Tenggara region (Wang *et al.*, 2021).

The consumption of high-energy drinks in Sumba is in line with the increasing trend of caffeinated product consumption in rural areas. The findings of this study are consistent with previous studies that reported a relationship between energy drink consumption and increased blood pressure in adolescents (Oberhoffer *et al.*, 2022). Researchers also found that the high consumption of supplements in Alor may be due to the promotion of health products and the public's perception that supplements are a substitute for a healthy diet. The discussion contains interpretation of research results, linking research results with relevant theories, literature and previous findings. The discussion is not repeating the results. Aspirations of insight are universal, preferably sources on an international scale compared to national scale and do not come from the related university environment because they are considered to have very local aspirations. Writing on the results and discussion ± 55% of the total page.



**Figure 1: Map Distribution of Chronic Kidney Disease Cases and Drinking Habits in Dry Land Areas of the Islands**

The results of the study show that 48% of respondents do not drink enough water, especially in Sumba (79%). 30% of respondents consume energy drinks, with the highest percentage in Sumba (64%) and Alor (46%). 33% of respondents consume supplements, with the highest percentage in Alor (69%). Forty percent of respondents consume herbs, with the highest rate in Sumba (57%). Twenty-five percent of respondents consume alcohol, with the highest rate in Sumba (64%). Thirty-six percent of respondents consume coffee, with the highest rate in Sumba (79%). The distribution map shows a high concentration of unhealthy drinking habits in Sumba and Alor. The findings of this study are consistent with previous research indicating that supplement use is frequently not accompanied by adequate knowledge of appropriate dosage and potential side effects (Alshehri *et al.*, 2025).

Natural herbs are popular in Sumba and Alor, often used as traditional medicine. Natural herbal remedies remain widely used as part of traditional health practices. In East Nusa Tenggara, herbal consumption predominantly relies on locally sourced plants; however, some contain bioactive compounds that may pose health risks when consumed excessively or without appropriate dosage guidance (Soimin & Marilyn, 2024; Yuri Pradika, 2025). The highest alcohol consumption in

Sumba (64%) has the potential to increase the risk of liver disease. This study is corroborated by prior evidence indicating a link between alcohol intake and liver dysfunction in populations of East Nusa Tenggara (Djuma *et al.*, 2020). The high consumption of coffee in Sumba (79%) may be related to local culture and the availability of coffee as a regional commodity. Although coffee has benefits, excessive consumption can increase the risk of sleep disorders and high blood pressure.

Drinking habits in the study area show consumption patterns that could potentially be harmful to health, particularly low consumption of water and high consumption of energy drinks, alcohol, and coffee. Educational interventions on the types and amounts of healthy beverages need to be strengthened, especially in areas with high prevalence.

**Poor Eating Habits**

The results of the study (table 3) show that the highest consumption of salty foods is in Alor (100%), followed by Sumba (79%), Timor (58%), and Flores (30%). Consumption of highly seasoned foods is almost uniform across all regions (63–100%). Low fruit and vegetable consumption was found in 63% of respondents. Fast food consumption was high in Sumba (79%), Alor (77%), and Timor (76%). Almost all

respondents consumed meat (98%), with variations in frequency and portion size. The habit of consuming betel nut was found in 21% of respondents, highest in Sumba (43%). The map shows that areas with high intensity of

unhealthy eating habits are concentrated in Sumba and Alor. The following is a map of the distribution of CKD cases and unhealthy eating habits in arid island regions.

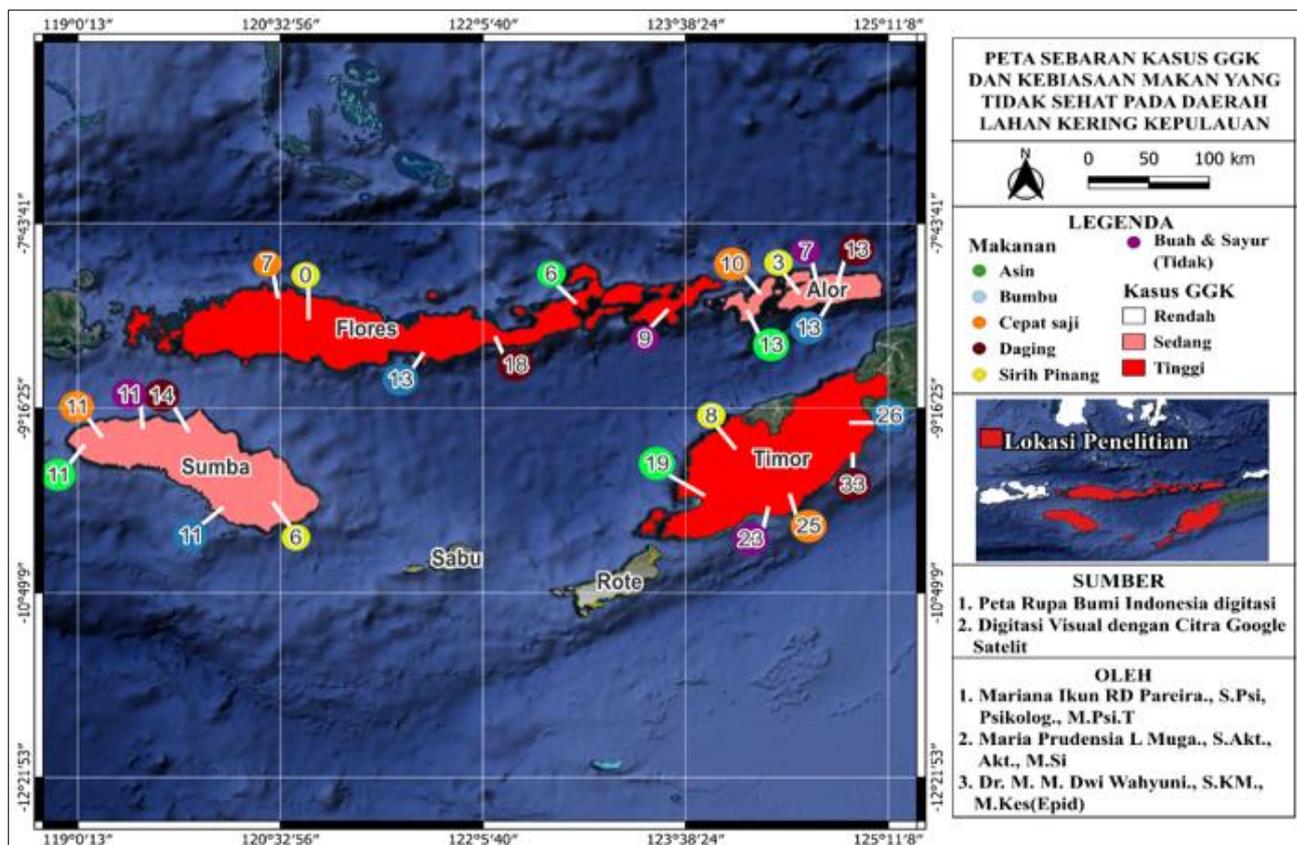
**Table 3: Poor Eating Habits**

Variable	Region								N	%
	Alor		Flores		Sumba		Timor			
	n	%	n	%	n	%	n	%		
<b>Salty food consumption</b>										
Yes	13	100	6	30	11	79	19	58	49	61
No	0	0	14	70	3	21	14	42	31	39
<b>Total</b>	<b>13</b>		<b>20</b>		<b>14</b>		<b>33</b>		<b>80</b>	<b>100</b>
<b>Weekly frequency</b>										
1	0	0	2	33	2	18	7	37	11	22
2	3	23	2	33	3	27	6	32	14	29
3	10	77	0	0			2	11	12	24
4	0	0	0	0	3	27			3	6
5	0	0	0	0			2	11	2	4
6	0	0	0	0					0	0
7	0	0	2	33	3	27	2	11	7	14
<b>Average (grams) per week</b>										
<50	7	54	6	100	0	0	11	58	24	49
50-100	3	23	0	0	3	27	6	32	12	24
101-200	3	23	0	0	5	45	0	0	8	16
201-300	0	0	0	0	3	27	0	0	3	6
>300	0	0	0	0	0	0	2	11	2	4
<b>Total</b>	<b>13</b>		<b>6</b>		<b>11</b>		<b>19</b>		<b>49</b>	<b>100</b>
<b>Consumption of seasoned foods</b>										
Yes	13	100	13	65	11	79	26	79	63	79
No	0	0	7	35	3	21	7	21	27	34
<b>Total</b>	<b>13</b>		<b>20</b>		<b>14</b>		<b>33</b>		<b>80</b>	<b>100</b>
<b>Weekly frequency</b>										
1	0	0	0	0	6	55	7	27	13	21
2	3	23	0	0	0	0	2	8	5	8
3	0	0	2	15	0	0	2	8	4	6
4	0	0	0	0	0	0	4	15	4	6
5	3	23	2	15	0	0	3	12	8	13
6	0	0	0	0	0	0			0	0
7	7	54	9	69	5	45	8	31	29	46
<b>Average (grams) per week</b>										
<50	3	23	8	62	4	36	17	65	32	51
50-100	3	23	2	15	2	18	7	27	14	22
101-200	0	0	0	0	3	27	2	8	5	8
201-300	7	54	0	0	2	18	0	0	9	14
>300	0	0	3	23	0	0	0	0	3	5
<b>Total</b>	<b>13</b>		<b>13</b>		<b>11</b>		<b>26</b>		<b>63</b>	<b>100</b>
<b>Fruit and vegetable consumption</b>										
Yes	6	46	11	55	3	21	10	30	30	38
No	7	54	9	45	11	79	23	70	50	63
<b>Total</b>	<b>13</b>		<b>20</b>		<b>14</b>		<b>33</b>		<b>80</b>	<b>100</b>
<b>Fast food consumption</b>										
Yes	10	77	7	35	11	79	25	76	53	66
No	3	23	13	65	3	21	8	24	27	34
<b>Total</b>	<b>13</b>		<b>20</b>		<b>14</b>		<b>33</b>		<b>80</b>	<b>100</b>
<b>Weekly frequency</b>										
1	0	0	2	29	8	73	11	44	21	40
2	0	0	0	0	0	0	4	16	4	8

Variable	Region								N	%
	Alor		Flores		Sumba		Timor			
	n	%	n	%	n	%	n	%		
3	6	60	3	43	0	0	6	24	15	28
4	0	0	0	0	3	27	2	8	5	9
5	4	40	0	0	0	0	0	0	4	8
6	0	0	0	0	0	0	0	0	0	0
7	0	0	2	29	0	0	2	8	4	8
<b>Average (grams) per week</b>										
<50	3	30	7	100	0	0	8	32	18	34
50-100	3	30	0	0	8	73	7	28	18	34
101-200	4	40	0	0	3	27	5	20	12	23
201-300	0	0	0	0	0	0	5	20	5	9
>300	0	0	0	0	0	0	0	0	0	0
<b>Total</b>	<b>10</b>		<b>7</b>		<b>11</b>		<b>25</b>		<b>53</b>	<b>100</b>
<b>Meat consumption</b>										
Yes	13	100	18	90	14	100	33	100	78	98
No	0	0	2	10	0	0	0	0	2	3
<b>Total</b>	<b>13</b>		<b>20</b>		<b>14</b>		<b>33</b>		<b>80</b>	<b>100</b>
<b>Weekly frequency</b>										
1	0	0	0	0	3	21	4	12	7	9
2	3	23	7	39	3	21	11	33	24	31
3	4	31	2	11	3	21	12	36	21	27
4	3	23	2	11	5	36	0	0	10	13
5	0	0	0	0	0	0	2	6	2	3
6	0	0	0	0	0	0	2	6	2	3
7	3	23	7	39	0	0	2	6	12	15
<b>Average (grams) per week</b>										
<50	3	23	7	39	3	21	14	42	27	35
50-100	4	31	2	11	0	0	7	21	13	17
101-200	3	23	0	0	6	43	5	15	14	18
201-300	3	23	0	0	0	0	2	6	5	6
>300	0	0	9	50	5	36	5	15	19	24
<b>Total</b>	<b>13</b>		<b>18</b>		<b>14</b>		<b>33</b>		<b>78</b>	<b>100</b>
<b>Betel nut consumption</b>										
Yes	3	23	0	0	6	43	8	24	17	21
No	10	77	20	100	8	57	25	76	63	79
<b>Total</b>	<b>13</b>		<b>20</b>		<b>14</b>		<b>33</b>		<b>80</b>	<b>100</b>
<b>Weekly frequency</b>										
1	0	0	0	0	0	0	6	75	6	35
2	0	0	0	0	3	50	0	0	3	18
3	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	0
7	3	100	0	0	3	50	2	25	8	47
<b>Total</b>	<b>3</b>		<b>0</b>		<b>6</b>		<b>8</b>		<b>17</b>	<b>100</b>

Unhealthy eating habits are patterns of food consumption that contain high levels of salt, sugar, or saturated fat, are low in fiber, or lack the nutrients needed by the body. These habits can take the form of excessive consumption of salty foods, fast food, high-fat meats,

processed foods, and low consumption of fruits and vegetables (Al-Jawaldeh & Abbass, 2022; Almorae *et al.*, 2021). Unhealthy eating habits contribute to an increased risk of non-communicable diseases such as hypertension, diabetes mellitus, and heart disease.



**Figure 2: Map Distribution of Chronic Kidney Disease Cases and Unhealthy Eating Habits in Dry Land Areas of the Islands**

Researchers found that the habit of consuming high levels of salt in Alor and Sumba reflects traditional eating patterns that use a lot of salt for food preservation. A study supports the findings of researchers who state that excessive salt consumption in the eastern coastal regions of Indonesia is associated with low awareness of the risks of hypertension (Farapti *et al.*, 2020).

Researchers also found that high consumption of fast food in Sumba, Alor, and Timor indicates a shift in dietary patterns toward Westernization, where highly seasoned foods and fried foods have become popular. Research states that urbanization has triggered an increase in fast food consumption in various regions (Habibi *et al.*, 2024). Low consumption of fruits and vegetables among 63% of respondents has the potential to reduce their intake of fiber, vitamins, and essential minerals. Almost all respondents consume meat, but the proportion and type of meat consumed can affect health. A research links excessive red meat consumption to the risk of hypertension and obesity (Allen *et al.*, 2022). The habit of consuming betel nut, although considered a tradition in some areas, poses health risks to the teeth and mouth, including oral cancer due to its arecoline content. A study found that betel nut chewing is

associated with increased tooth decay in East Nusa Tenggara (Ngadilah & Eki, 2022). The distribution map shows a concentration of unhealthy eating habits in the Sumba and Alor regions. The contributing factors include a traditional diet high in salt and spices, limited access to fresh fruit, and the influence of high-calorie modern foods.

The unhealthy dietary patterns found require intervention based on balanced nutrition education, particularly in Sumba and Alor. Local governments need to improve access to healthy food, reduce the distribution of fast food, and strengthen the promotion of fruit and vegetable consumption.

**The Habit of Staying Up Late**

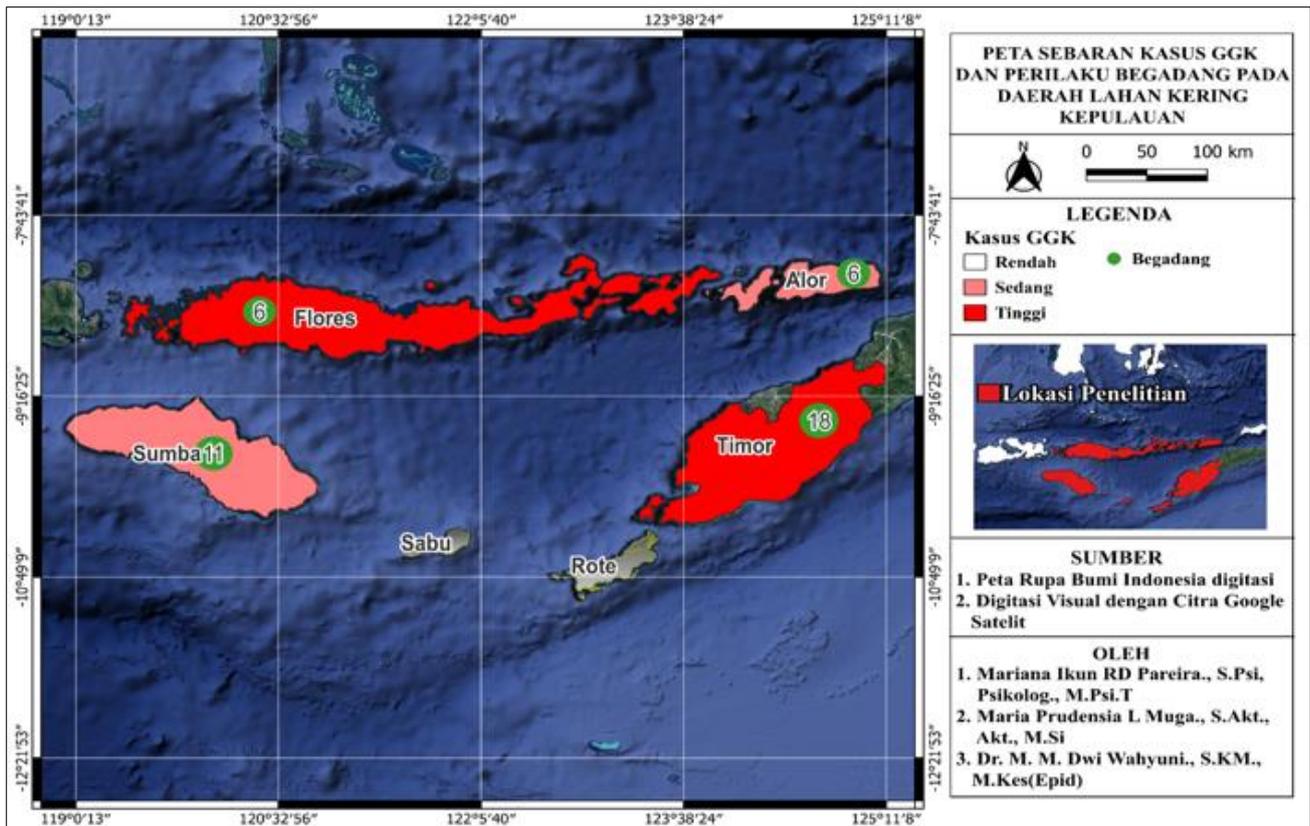
The results (table 4) showed that 51% of respondents had a habit of staying up late. The highest percentage was found in Sumba (79%), followed by Timor (55%), Alor (46%), and Flores (30%). The most frequent habit of staying up late was 2–3 times per week. The distribution map shows the highest concentration of night owl habits in Sumba and Timor. The following is a map of the distribution of CKD cases and staying up late behavior in the dry land areas of the islands.

**Table 4: Habits of Staying Up Late**

Variable	Region								N	%
	Alor		Flores		Sumba		Timor			
	n	%	n	%	n	%	n	%		
<b>Staying up late</b>										
Yes	6	46	6	30	11	79	18	55	41	51
No	7	54	14	70	3	21	15	45	39	49
<b>Total</b>	<b>13</b>		<b>20</b>		<b>14</b>		<b>33</b>		<b>80</b>	<b>100</b>
<b>Frequency</b>										
1	0	0	2	33	0	0	0	0	2	5
2	3	50	2	33	3	27	2	11	10	24
3	0	0	2	33	3	27	5	28	10	24
4	0	0	0	0	0	0	2	11	2	5
5	0	0	0	0	0	0			0	0
6	3	50	0	0	0	0	3	17	6	15
7	0	0	0	0	5	45	6	33	11	27
<b>Total</b>	<b>6</b>		<b>6</b>		<b>11</b>		<b>18</b>		<b>41</b>	<b>100</b>

Staying up late is the habit of staying awake until late at night or repeatedly getting insufficient sleep at night, whether due to work, entertainment, or other factors. According to the Indonesian Ministry of Health, adults need 7-8 hours of sleep per night. Lack of sleep

can interfere with brain function, lower immunity, and increase the risk of chronic diseases such as hypertension, diabetes, and heart disease (Kementerian Kesehatan RI, 2023).



**Figure 3: Map of the Distribution of CKD Cases and Staying Up Late Behavior in Dry Land Areas of the Islands**

The results show that 51% of respondents have a habit of staying up late. The highest percentage was found in Sumba (79%), followed by Timor (55%), Alor (46%), and Flores (30%). The most frequent habit of staying up late was 2-3 times per week. The distribution map shows the highest concentration of staying up late

in Sumba and Timor. The high prevalence of staying up late in Sumba and Timor may be influenced by cultural factors, night work, or social activities. Chronic sleep deprivation can increase the risk of heart disease, obesity, and metabolic disorders. The results of the study are supported by research conducted in Central Java, which

shows a significant relationship between sleeping less than 6 hours and the incidence of hypertension. Staying up late has an impact on decreased work productivity and concentration (Fanani *et al.*, 2021).

Researchers found that using gadgets late into the night is one of the main factors contributing to staying up late, especially among young people. A study supports the researchers' findings that the duration of social media use at night is directly related to the habit of staying up late. Differences in the prevalence of staying up late between regions are likely influenced by the type of work and community activity patterns (Abdullah *et al.*, 2025; Kortesoja *et al.*, 2023). For example, regions with agricultural work usually have earlier bedtimes than regions with service or night trade work. The map shows a high concentration of staying up late in Sumba and Timor, which has the potential to affect long-term public health. This indicates the need for healthy sleep education and restrictions on non-essential nighttime activities.

Researchers say that high rates of staying up late in some areas indicate the need for public health interventions to promote healthy sleep patterns. Education about the benefits of adequate sleep and the risks of staying up late should be part of health promotion at the village and school levels.

## CONCLUSION

The discussion of three variables (smoking behavior, unhealthy eating habits, and exercise) leads to the conclusion that the lifestyle patterns of communities in the study areas, particularly in Sumba, Timor, Alor, and Flores, indicate significant health risk factors for noncommunicable diseases. The high prevalence of smoking in Sumba and Timor is influenced by local social and cultural norms that are permissive towards cigarette consumption, with the majority of respondents starting as teenagers and smoking for long periods of time. Unhealthy eating habits, especially excessive salt consumption, fast food, low intake of fruits and vegetables, and the tradition of chewing betel nut, are commonly found in Alor and Sumba, increasing the risk of hypertension, obesity, and oral diseases. Low physical activity in Alor and Timor, influenced by limited facilities, work factors, and low awareness, further exacerbates health risks.

This situation highlights the urgency of implementing integrated community-based health interventions, including nutrition education and smoking awareness, controlling access to risky products, increasing the availability of physical activity facilities, and involving community leaders in promoting changes in health norms and behaviors at the local level.

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