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Original Article

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Knowledge and practice of malaria prevention among residents of Ratuwamai Municipality, Nepal

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ABSTRACT

Objective: To assess the level of knowledge and practice on malaria prevention among the residents of Ratuwamai Municipality in Nepal.

Methods: A community-based cross-sectional study was carried out on Ratuwamai Municipality of Ward No. 8 in Morang District, Nepal. A total of 352 respondents with an age range from 15 to 70 years were interviewed from October 9 to October 31, 2022. Statistically significant differences between two or more categorical groups were measured using independent sample *t*-test, one-way ANOVA test, and Kruskal-Wallis *H* test.

Result: Out of the total sample, 57.7% of the respondents were 24 to 50 years old with a mean age of (36.9±14.3) years. In the knowledge test, 82% of the responses were accurate. Though 98.6% of people had heard of malaria, only 48.3% said it was a communicable disease. In practice, 84.9% always cleaned the surrounding area and trimmed the bushes around the house; 75.9% used insecticide-treated bed nets or normal bed nets for sleeping; only 7.4% used mosquito repellent creams on exposed body parts while staying outdoors at night, working in fields, and sleeping.

Conclusions: The majority had knowledge about malaria, but more than half had poor practice. We advise concerned authorities to promote the behavior change communication strategy to encourage individuals to adopt healthy, beneficial, and good behavioral practices.

KEYWORDS: Communicable; Knowledge; Malaria; Mosquito; Nepal

1. Introduction

Malaria is a major global cause of death and morbidity that is brought on by protozoan parasites of the genus *Plasmodium*[1]. In the nations where it is still endemic, malaria continues to be a significant cause of sickness and death in both children and adults[2]. Over 40% of the world's population is at risk for malaria in over 100 different nations, making it the most common infectious illness in tropical and subtropical areas and a major global health concern[3]. The number of malaria cases increased from 245 million in 2020 to 247 million in 2021, according to the most recent World Malaria Report[4]. In South Asian nations, including Nepal, it is still a major public health problem[5]. It is one of the 99 nations listed by the WHO as having malaria transmission[6]. In Nepal, 70% of people reside in malaria-prone areas, and most of these high-risk areas

Significance

Despite a 1954 malaria control project, the disease remains highly endemic in Nepal's southern plains. Yet, little research exists on malaria prevalence, knowledge, practice, and attitudes among Nepalese communities. This study fills a knowledge gap and identifies areas for targeted interventions. These findings have implications for public health policies and programs to reduce malaria not only in Ratuwamai but also in other regions, emphasizing the need for context-specific strategies.

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are lowlands in the Terai, which border India in the south[7]. Early detection, prompt treatment, and the use of preventative measures can all help to control the spread of malaria. Inadequate knowledge about mosquito bite prevention, treatment, and control measures can increase the number of cases of malaria. Therefore, it is essential to understand how the community perceives the cause, symptoms, and treatment of malaria. Despite this fact, very little research has been done on malaria prevalence, knowledge, practice, and attitudes among Nepalese residents[8,9]. Hence, the aim of this study was to identify the knowledge and practice regarding malaria prevention among residents in Ratuwamai, Morang.

2. Subjects and methods

2.1. Study design, area and population

A community-based cross-sectional study was carried out in Ratuwamai Municipality, Ward No. 8 of Province 1, Nepal, from October 9 to October 31, 2022. People between the ages of 15 and 70 years old were involved in the study.

2.2. Sample size estimation and sampling technique

The sample size for the study was calculated using two different methods. First, we estimated the sample size for an infinite population ($n= Z^2pq/e^2$), and then the final sample size was estimated using a finite population [$n =(n \circ)/(1+n \circ/N)$]. Assume adequate malaria prevention practice (p) = 66.1%[8], z=1.96 for a 95% confidence interval, and an acceptable sampling error (e) of 5%. For an infinite population, the sample size (n) was 344.32. There were (N) 4500 people in that ward, ranging from 15 to 60 years old. Now, the estimated sample size for a finite population was 319.85, and after adding a 10% non-response rate, the final sample size for the study was 352. The ward office provided the researchers with a voter list upon request. A random table was used to select the required sample.

2.3. Tools and technique of data collection

A questionnaire for measuring knowledge and practice was constructed by the researcher based on an earlier study conducted by Flatie *et al.* [10]and Erfani *et al*[11]. The questionnaire was validated by reviewing the literature and consulting with experts in the field of public health. The English version of the questionnaire was translated into Nepali, and researchers were involved in data collection. A Pearson correlation coefficient was used to test the validity of the questionnaire. The obtained value for each item of the questionnaire was compared to the critical value. The item was determined to be valid if the observed value (P) was greater than the critical value and significant at the 0.05 level.

To test the reliability of the questionnaire, pre-testing was conducted. It was tested in 10% of the sample size at the same municipality's ward number 7, and a few changes were made. The reliability was determined using Cronbach's alpha (α= 0.806). The researcher visited each sample household and obtained information from the head of the family. If the head of the family was not available, eligible respondents from the same household were selected for the study. A selected household was followed up with at least twice in circumstances where the respondent wasn't there during the first visit. Respondents who were unreachable even after a second attempt were excluded from the study, and the next household was included. All the data was collected using face-to-face interview techniques. Every completed questionnaire was examined daily for accuracy, completeness, and correctness.

2.3.1. Measurement of knowledge

Eighteen questions were prepared to assess the level of knowledge on malaria. A score was assigned to each question: true (3), no opinion (2), and false (1). The final total knowledge score was in the range of 18 to 54. Depending on each respondent's score, knowledge was further divided into three categories: low knowledge (18–46), moderate knowledge (47–50), and high knowledge (51–54)[11]. The knowledge section of the questionnaire consisted of the following parts: general characteristics of disease, signs and symptoms, risk factors, prevention and control.

Table 1. Socio-demographic characteristics of respondents.

Variables	Frequency (n=352)	Percentage (%)
Age, mean ±SD, years	36.9±14.3	
⩽23	74	21.0
24-50	203	57.7
⩾51	75	21.3
Sex		
Female	214	60.8
Male	138	39.2
Ethnicity		
Brahmin/ Chhetri	263	74.7
Janajati	49	13.9
Madhesi	29	8.2
Others*	11	3.1
Religion		
Hinduism	308	87.5
Buddhism	24	6.8
Others**	20	5.7
Educational Level		
Cannot read and write	25	7.1
Can just read and write	53	15.1
Basic level education	90	25.6
Secondary level education	68	19.3
University education	116	33.0
Occupation		
Farmer	97	27.6
Student	80	22.7
Business people	58	16.5
Servers	44	12.5
Teacher	39	11.1
Daily wages worker	34	9.7
Family income per month (in Nepalese Rupee)		
<20000	76	21.6
21000-40000	125	35.5
>41000	151	42.9
Types of houses		
Pakka	162	46.0
Semi-pakka	137	38.9
Kachha	53	15.1

*Muslim and Dalit, ** Islam and Christianity

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2.3.2. Measurement of practice

The Likert scale technique was used to determine the participants' practices. According to respondents, Likert's type scales had a scoring system that went from never (0) to sometimes (1) to always (2). Only for question No. 4, the score was reversed. Finally, practice was classified as "good" (score equal to or greater than the mean) or "poor" (score less than the mean) based on the observed score[10].

2.4. Data analysis

All data analysis was performed with SPSS version 26. The characteristics of the respondents were described using frequencies and percentages. To measure the level of knowledge and practice based on a score, means with standard deviations or frequency distributions were used. To compare the knowledge scores and practice scores among participants with different characteristics, the mean difference was used as an outcome and was analyzed using two-sided *t*-test or ANOVA test when appropriate. The Shapiro-Wilk test was used to analyze the normal distribution of the data to determine the selection of these statistics, and the Kruskal-Wallis *H* test was used if the normal distribution was violated. The Spearman's correlation coefficient was used to measure the strength of the relationship between knowledge and practice of malaria prevention. $P<0.05$ were considered statistically significant.

2.5. Ethical approval

The concerned municipality has given its approval for the study. Ethical approval was obtained from the Institutional Review Committee of the Yeti Health Science Academy (Ref No. 2079-80-158). The purpose of the study was clearly explained, and written consent was obtained from the participants before data collection. None of the participants were forced to take part in our study or given any financial incentives.

3. Results

3.1. Socio–demographic characteristics of the respondents

Of the total of 352 respondents, all of them participated in the study. The majority (57.7%, *n*=203) of the respondents were within the age range of 24-50 years, and the sampled population's mean age was (36.9±14.3) years. Similarly, among the respondents, 60.8% (*n*=214) were female and 39.2% were male. Only 7.1% were unable to read and write, with the majority (33%, *n*=116) having completed a university degree. The respondents' fields of occupation ranged from daily wage employees to business owners and farmers (Table 1).

3.2. Knowledge of malaria

In the knowledge test, 82% of the responses were accurate. However, only 48.3% and 44% of respondents, respectively, recognized that malaria was a communicable disease caused by a parasite (Table 2).

3.3. Practice towards malaria prevention

The majority of respondents (84.9%, *n*=299) and more than half (52.6%, *n*=185) always cleaned or trimmed the bushes and drain stagnant water around the house, respectively. Nearly half (46%, *n*=162) of respondents always screened doors and windows at night,

Table 2. Respondents' knowledge of the causes, risk groups, risk factors, signs and symptoms, transmission of malaria, and preventive measures.

Variables	Frequency %(*n*=352)		
	True*	False	No-opinion
I've heard of malaria.	347 (98.6)	4 (1.1)	1 (0.3)
Malaria is a communicable disease.	170 (48.3)	154 (43.7)	28 (8.0)
Malaria is curable and treatable.	302 (85.8)	30 (8.5)	20 (5.7)
Malaria is caused by the bites of infected mosquitoes.	341 (96.9)	8 (2.3)	3 (0.8)
Malaria is caused by a parasite.	155 (44)	109 (31)	88 (25)
The monsoon season is malaria transmission season.	280 (79.5)	62 (17.6)	10 (2.8)
Young children and pregnant women are vulnerable groups.	261 (74.1)	58 (16.5)	33 (9.4)
The main symptoms are fever and excessive sweating.	293 (83.2)	35 (9.9)	24 (6.8)
Headache and muscle ache are other symptoms	289 (82.1)	40(11.4)	23 (6.5)
Malaria may cause anemia and jaundice.	217 (61.6)	29 (8.2)	106 (30.1)
Kidney failure, seizures, coma, and death are the complications of malaria.	286 (81.3)	28 (8.0)	38 (10.8)
Risk factors are an unclean environment, stagnant water sites, and staying outside overnight	331 (94)	15 (4.3)	6 (1.7)
Other risk factors are low utilization of bed nets and opening doors and windows at night.	304 (86.4)	41(11.6)	7 (2.0)
The preventive measure is to wear long-sleeved clothing while staying outside in the evenings and working in field areas.	345 (98)	4 (1.1)	3 (0.9)
Using bed nets and mosquito coils while sleeping is the best preventive measure.	347 (98.6)	2 (0.6)	3 (0.9)
Using repellent creams while staying outside and closing windows and doors at night are preventive measures.	329 (93.5)	16 (4.5)	7 (2.0)
Spraying insecticides in the house, surroundings, and sheds are the control measures.	322 (91.5)	21 (6)	9 (2.6)
Plastering the house with cow dung and mud within three months of spraying insecticides reduces the effectiveness of insecticides.	240 (68.2)	44 (12.5)	68 (19.3)

*Correct answer

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Table 3. Respondents' practices toward malaria prevention.

Practice questions	Frequency %(n=352)		
	Never	Sometimes	Always
Clean the surrounding area and trim the bushes around the house.	0	53 (15.1)	299 (84.9)
Drain stagnant water around the house.	0	167 (47.4)	185 (52.6)
Screen doors and windows at evening.	53 (15.1)	137 (38.9)	162 (46)
Stay outdoors in the evening.	117 (33.2)	147 (41.8)	88 (25)
Wear long sleeves cloths when working in the field, going into the forest, or spending the evening outside.	5 (1.4)	108 (30.7)	239 (67.9)
Use mosquito repellent creams on exposed body parts while sleeping, working in fields, or staying outside at night.	145 (41.2)	181 (51.4)	26 (7.4)
In the house, surrounding areas, and sheds, spray insecticides.	20 (5.7)	138 (39.2)	194 (55.1)
To avoid mosquito bites, use smoke or a fumigant.	47 (13.4)	115 (32.7)	190 (54)
Use insecticide-treated bed nets or normal bed nets for sleeping.	2 (0.6)	83 (23.6)	267 (75.9)
Use mosquito coils while sleeping at night.	150 (42.6)	117 (33.2)	85 (24.1)

and 41.8% (n=147) of respondents occasionally stayed outside in the evening. Although the majority (67.9%, n=239) always wore long sleeves when going out in the evening, in the forest, or working in the field, only 7.4% (n=26) used mosquito repellent creams on exposed body parts. More than half (55.1%, n=194) and 54% (n=190), respectively, sprayed insecticides in their homes, surrounding areas, and sheds, or used smoke or fumigant to combat mosquito bites. While the majority (75.9%, n=267) of the respondents always used insecticide-treated or normal bed nets, interestingly, 42.6% (n=150) of respondents never used mosquito coil while sleeping at night (Table 3).

According to our findings, the mean score for the 10 questions about the practice of malaria prevention was 13.56 (SD=3.12, range: 7–20). More than half of the participants (52.6%, n=185) had poor practices for preventing malaria. The 18 questions about knowledge of malaria had a mean score of 48.68 (SD = 4.63; range: 27–54). The majority of respondents (41.2%, n=145) had high knowledge of malaria, 31.8% (n=112) had moderate knowledge, and 27% (n=95) had low knowledge (Table 4).

3.4. Comparison of knowledge and practice between socio–demographic variables

An independent sample t-test was conducted to compare the knowledge and practice scores for males and females. There is no statistical significant difference in the knowledge score between sexes (male and female) (t=-1.372, P=0.171). The male mean equals the female mean. Similarly, there was a statistically significant difference (t=-3.619, P<0.001) in the practice score, with the mean score for females (14.04±3.11) being higher than males (12.83±3.00) (Table 5). Results of the ANOVA showed a statistically significant difference between age group (F=15.042, P<0.001; F=13.930, P< 0.001), Family income (F=50.544, P<0.001; F=26.015, P<0.001), and type of house (F=36.846, P<0.001; F=47.795, P<0.001) on knowledge and practice score (Table 5). A Kruskal-Wallis H test revealed a statistically significant difference in knowledge and practice scores based on Ethnicity group [$\chi^2(3) = 26.311$, P<0.001; $\chi^2(3) = 44.312$, P<0.001], Religion[$\chi^2(2) = 18.838$, P<0.001; $\chi^2(2) = 16.040$, P<0.001], Educational level [$\chi^2(4) = 157.782$, P<0.001; $\chi^2(4) = 116.112$, P<0.001] and occupation [$\chi^2(5) = 176.511$, P<0.001; $\chi^2(5) = 179.213$, P<0.001] (Table 6).

3.5. Correlation between knowledge and practice regarding malaria prevention

There is significant relationship between knowledge and practice at the level of significant P<0.05, where r= 0.563, P<0.001. The relationship is considered to be moderately positive.

Table 4. Respondents' scores, level of knowledge, and level of practice on malaria.

Variables	Category	Frequency (n=352)	Percentage (%)
Level of knowledge	High (⩾51 score)	145	41.2
	Moderate (47-50 score)	112	31.8
	Low (⩽46 score)	95	27.0
Total score	(mean±SD)	48.68±4.63	
	Median (min–max)	49.00(27-54)	
Level of practice	Good (⩾mean score)	167	47.4
	Poor (<mean score)	185	52.6
Total score	(mean±SD)	(13.56±3.12)	
	Median (min–max)	13.00 (7-20)	

Table 5. Comparison of knowledge and practice score between selected variables using t-test and ANOVA test.

Variables	Knowledge			Practice		
	Mean ± SD	F	P	Mean ± SD	F	P
Age						
⩽23	49.55±3.90	15.042		14.50±3.46	13.930	
24-50	49.27±4.33		<0.001	13.79±2.96		<0.001
⩾51	46.17±5.23			12.03±2.65		
Sex						
Male	48.25±4.61	-1.372*	0.171	12.83±3.90	-3.619*	<0.001
Female	48.94±4.64			14.04±3.11		
Income						
<20 000	45.76±5.55			11.63±3.35		
21 000-40 000	47.54±4.19	50.544	<0.001	13.38±3.00	26.015	<0.001
>41 000	51.06±3.02			14.68±3.02		
Type of house						
Pakka	50.63±3.50	36.846		14.77±2.81	47.795	
Kachha	44.77±5.60		<0.001	10.53±2.87		<0.001
Semi-pakka	47.85±4.20			13.31±2.68		

*t-statistic value

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4. Discussion

To our knowledge, this is the first study to assess how residents in Ratuwamai Municipality, Nepal, understand and practice malaria prevention. The majority (57.7%) of respondents in this study was between the ages of 24 and 50, was females (60.8%), and had a university education (33.0%). This is in line with earlier research done in Ethiopia[10] and a study done in Ghana's Ho Municipality[12], both of which found comparable results. In the knowledge test, 82% of the responses were accurate. This finding is higher than that of Northern Italy's migrants [13] and the women of Burkina Faso[14], who had 73% and 56.1% correct knowledge of malaria, respectively.

In studies conducted in rural Mangalore, India[15], and south-western Saudi Arabia[16], 98.4% of respondents said they had heard of malaria. In South Africa, 93% of the respondents had heard about malaria[17]. Similar to this, the current study found that 98.6% of respondents had heard of malaria. According to our research, 96.9% of respondents were aware that mosquito bites cause malaria, which was comparable with previous published literatures[15, 18]. Also, a study conducted in Peninsular Malaysia revealed that around half of the aboriginal participants thought malaria was transmitted via mosquito bites[19].

People in the Rautuwamai municipality under study here showed a greater knowledge and practices toward malaria prevention compared to a study concerning knowledge and practices for malaria prevention among the community population of a different place in earlier studies. In Sudan[20], 75.8% of respondents identified fever with shivering as a symptom of malaria, while in our study, 83.2% of respondents correctly responded regarding malaria signs and symptoms. Furthermore, in a study conducted in Mozambique[21], 70% of respondents had knowledge regarding malaria preventive measures, whereas 98.3% in our study did. A study conducted by Khairy *et al.*[16] reported that only 30.2% of respondents responded that it was a treatable disease, while in the current study, 85.8% had knowledge that it was a treatable and curable disease. The size of the samples and the location of the study may be the underlying causes of these inconsistencies.

In our study, 84.9% of participants regularly cleaned their surroundings and cut the bushes around their homes, and 75.9% used either regular bed nets or nets treated with insecticide, which is greater than in a prior study[22]. Similarly, non-medical students at the University of Nigeria, Nsukka, reported that 42.3% of them slept under a treated mosquito net, despite the fact that more than half (53.5%) of the respondents had treated mosquito nets in their rooms[23]. Additionally, one study in the South African province of KwaZulu-Natal reported that only nine (2%) of the 400 participants reported having bed nets[24]. This variation could be due to differences in the sample size, respondents, and research area. Based on age, occupation, education, and income level, we found a statistically significant variation in knowledge scores. This is comparable to earlier published literature[25].

In our analysis, nearly half of the respondents (47.4%) had good practice, and 41.2% and 31.8% had high and moderate levels of knowledge, respectively. This is in line with previous findings[26,27]. However, the majority of participants in the study carried out in

Table 6. Comparison of knowledge and practice score between selected variables using Kruskal-Wallis *H* test.

Variables	Knowledge			Practice		
	Mean rank	Statistics(χ^2)	*P*	Mean rank	Statistics (χ^2)	*P*
Ethnicity						
Brahmin/Chhetri	187.20	26.311		190.70	44.312	
Janajati	175.94		<0.001	181.84		<0.001
Madhesi	127.59			74.81		
Others	52.05			81.41		
Religion						
Buddhism	180.22	18.838		180.73	16.040	
Hinduism	205.35		<0.001	194.63		<0.001
Others	84.58			89.65		
Education						
Can not read and write	77.82	157.782		69.16	116.112	
Can only read and write	84.41			96.46		
Basic level education	144.12		<0.001	150.01		<0.001
Secondary level education	183.27			211.21		
University education	261.00			236.41		
Occupation						
Farmer	101.39	176.511		110.97	179.213	
Business people	160.41			175.93		
Server	291.68		<0.001	203.41		
Teacher	257.71			299.96		<0.001
Daily wages worker	84.63			52.16		
Not currently working (Students)	215.34			234.23		

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Cameroon had good knowledge (55.93%) and good habits (71.67%) [28]. This is better than what we found. Surprisingly, the majority of participants (64.6%) in a study of two remote communities in Uganda's Wakiso District had little knowledge of malaria prevention measures[29]. Overall, in our study, there was a good understanding of malaria, but this knowledge did not translate into behavior. This is comparable to earlier research[30,31].

This is a community-based cross-sectional study conducted only in one selected ward. Generally, there are nine wards in the municipality of Nepal. So, due to the limited sample size and study area, the findings of the study may not be generalizable to a large population.

5. Conclusions

The majority of respondents had knowledge about malaria, but of those, more than half were unaware that malaria is a communicable disease. In comparison to their knowledge, the practice of malaria prevention was poor. The most common preventive practices were cleaning bushes and surrounding areas, using a bed net, wearing long sleeves while working in the field, or going out in the evening or forest. We advise municipal offices and stakeholders to promote the behavior change communication strategy. Use of mass media, training, capacity-building, community open-air sessions, community participation, etc., will be effective. Behavior change communication strategy, along with other public health interventions, will be a helpful technique for individuals, groups, or communities to develop positive health behaviors and in the prevention of malaria.

Conflict of interest statement

The authors claim there is no conflict of interest.

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Authors' contributions

Karki R, the principal investigator of the study, thought about the particular study design. Bartoula N and Shah SK assisted and supervised data collection. Karki R and Bartoula N performed statistical analysis and prepared the first draft of the manuscript. Kaphle M and Shah SK helped in reviewing and editing the first draft manuscript. All the authors contributed to the literature review, writing the final version of the manuscript, and approving the final manuscript.

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