South India Journal of Social Sciences, September'24, Vol. 22 - No. 3
ISSN : 0972-8945 (Print) | 3048-6165 (Online)

MALARIA INCIDENCE AND TREATMENT FACTORS AMONG THE PEOPLE OF ONGOLE CITY, PRAKASAM DISTRICT, ANDHRA PRADESH, INDIA

G.Sivanna *

Introduction

Malaria is a disease caused by parasites of the genus Plasmodium, which is transmitted by the bite of an infected female mosquito of the genus Anophele[1]. The disease has been identified in different ecotypes classified as forest, industrial, border, migration, urban and rural malaria[2]. According to data from the World Health Organization (WHO), in 2017 there were 219 million cases that caused 435,000 deaths[3]. For India, until week 24 of 2019, 40,031 cases occurred, which represents 34% more compared to the same period in 2018, in which the rural area was the area of occurrence of 48% of the cases. According to the National Institute of Health, the department of Health was one of the two departments in which an alert situation occurred in 20193.

Pharmacological treatments have been used to treat the disease, although in some situations they may not be effective. However, the community has identified medicinal plants that are used as a therapeutic alternative, even valued economically[4]. This has contributed to ethnobotanical studies being carried out that establish its popular use and although metabolites with possible activity have been identified, these require special studies to evaluate their antimalarial efficacy.

There are aspects related to knowledge of the cause, signs and symptoms of malaria, prevention methods at home, as well as aspects such as the number of people in the home, the lack of knowledge of the mosquito that transmits the disease, the formulation of medications, carrying out tests for diagnosis, visits by vector control units, cleaning ditches around the house, community prevention and control activities, which have been carried out taken into account for malaria control[5].

Ongole is a town in Prakasam district, which is a municipality on the Pacific coast of the Department of Health[6]. This is an endemic area for malaria, with difficult access and a very poor population, in which access to health centres is complex. For these reasons, the objective is to establish the factors that are associated with the presence of malaria and identify the plants used for its treatment in inhabitants of Ongole, in the department of Health in India.

* State Disaster Response and fire service

Materials and methods

This constitutes a cross-sectional and observational study. The population was the inhabitants of Ongole, which is a town located in the lower part near the sea. A validated survey[7] was used as an instrument, consisting of questions related to having had malaria, sociodemographic questions, housing characteristics, knowledge and attitudes towards malaria. In addition to this, another instrument was used with questions related to the use of medicinal plants for the treatment of the disease. The research team was introduced to all the houses in the community and one person per household was requested to participate. If the latter accepted, the survey was applied, while if not, it was discarded and presented to the next house, until the total number of households were addressed, so no sample size was calculated.

After administering the surveys, they were processed into an Excel file. Percentages were calculated for qualitative questions, while for quantitative questions normality was evaluated with the chi-square test. If they had normal behavior, the average and standard deviation were used, while if they had non-normal behavior, the median and interquartile range were estimated. The frequency of malaria was determined as the proportion of households with malaria and as the proportion of malaria cases out of the total number of people. The main analysis variable or dependent variable was established as the fact whether there was malaria in the house or not. This variable was associated with the other questions collected as qualitative variables, establishing the association through the Odds ratio (OR), setting as significant a value of $p<0.05$ and a 95% confidence interval that excluded one as a value. null. For the quantitative variables, the average discriminated by the presence of malaria or not in the house (dependent variable) was determined, establishing whether the differences in the averages were statistically significant with the t test and its value of $p<0.05$.

Based on the average value, the quantitative variable was dichotomized, to subsequently evaluate its bivariate association with the dependent variable.

Those that were statistically significant associated were included in multivariate models through multiple logistic regression. The models were validated by analysing Pearson's standardized residuals and his influence. Also, for validation and model selection, McFadden's pseudo R^2, the proportion of correct predictions (adjusted Count R^2), the Akaike Information Criterion (AIC) and the Bayesian Information Criterion (BIC) were estimated.

Results

All the homes in the community were visited, corresponding to a total of 105, however,

of these 10 were uninhabited, 2 were schools, 1 was a coconut warehouse, 1 was a gasoline warehouse, 1 was a communal house and 1 was a food stall. health, with 89 homes finally included in the study. Most of the respondents were women (62%), their place of birth was Ongole city (26%), they were mothers of a family (48%), their marital status was common law (47%), they knew how to read and write (83%), had a secondary education level (57%), the majority worked (90%), shell making was the most frequent work activity (40%) and the average age was 44 years (22 to 85 years) (table 1).

Table 1. Sociodemographic characterization of the participants

Qualitative Variables			
Variable	Options	Volume	Percentage
Sex	Man	3.04	0.38
	Women	55	0.62
Relationship with family	Mother	43	0.48
	Father	29	0.33
	Son	17	0.19
Civil status	Single	17	0.19
	Married	24	0.27
	Free Union	42	0.47
	Widower	6	0.07
Knows how to read and write	No	15	0.17
	Yes	74	0.83
Education level	Primary	30	0.34
	Secondary	51	0.57
	Technical	8	0.09
Works	Yes	80	0.9
	No	9	0.1
Activity you work on	Agriculture	20	0.22
	Self	36	0.4
	Labourer	1	0.01
	Fisherman	25	0.28
Quantitative variables			
Variable	Minimum to Maximum	Average* /	SD*/ Range
		Median	Interquartile
Age	22 to 85	41	32 to 55
Time living in Corozal	3 to 45	18	12 to 25
Number of adults in the household	2 to 7	3.6*	1.32 *
Number of children in the home	0 to 7	3.2 *	1.67 *
Total people in the home	2 to 12	6.8*	2.16 *
Total people with malaria of the total number of houses	0 to 7	1	1 to 2

*Average as a measure of central tendency and Standard Deviation (SD) as a measure of dispersion.

Regarding the characteristics of the houses, all of them had wooden walls and floors, most of them had zinc roofs (73%), for lighting they had both electricity and candles (90%), for water supply They used both rainwater and river water (81%) and used latrines to dispose of organic waste (55%) (table 2).

Most of them claim to have treated malaria with the drug Lumefantrine/Artemetro (35%), followed by the use of medicinal plants (31%) and finally the combination between these two (17%). According to these responses, for the treatment of malaria, at least 48% use medicinal plants exclusively or combined with medicine. Most of them affirm that to prevent malaria, awnings should be used and water tanks covered (44%), they identified Anopheles as the name of the mosquito that transmits malaria (60%) and its bite as the source of the disease (60%). Most of them say that the first symptom of the disease is fever, chills and headache (61%).

Table 2. Housing characteristics

Variable	Options	Amount	Percentage
Roof type	Mud roof	24	27%
	Zinc	65	73%
Wall type	Wood	89	100%
	Cement	0	0%
Floor type	Wood	89	100%
	Cement	0	0%
Energy supply	Electric-Candle;	80	90%
	Electrical	9	10%
Water supply	Rain-river water	72	81%
	Water rain	17	19%
Waste Disposal	Septic tank	40	45%
Organic	Latrines	49	55%

Those who turn to the microscopist are more frequent (42%) when they have had malaria, 81% indicate that they have not received a visit from health personnel to attend to the cases and 75% recognize the healer as the ideal person for their treatment. About half of those surveyed affirm that they take care of the disease by using selected plants, burning tow and egg combs, draining lagoons, ponds and stagnant water, filling puddles around the home with earth or sand and using insecticides. 73% of those surveyed carry out prevention activities occasionally (table 3).

Table 3. Knowledge and attitudes related to malaria and its management

Relatad to malaria and itstreatment			
Variable	Options	Quantity	%
Householdswhere malaria has occurred		72	0.84
Treatmentreceived	Medicinal plants	28	0.31
	Medicinal Plants and Lumefantrine/Artemeter	15	0.17
	Lumefantrine/Artemetro	31	0.35
	Malaria Knowledge		
Malaria Mosquito Name	Anopheles	53	0.6
What do youthinkshould be done to	Sleeping with a canopy	28	0.31
prevenir la malaria	Sleeping withawning-manual laborer	11	0.12
	Sleeping withawnings - Coverwatertanks	39	0.44
	Sleeping withawnings– Coverwatertanks-manual laborer	7	0.08
	Sleeping withawnings and fumigation	4	0.04
How do youthinkthe			
malaria	Anopheles mosquito bites	53	0.6
What do youthinkisthefirstsymptom	Fever, chills, and headache	54	0.61
When Malaria IsAcquired	Fever, chills, and weakness	18	0.2
	Headache, fever, and diarrea	16	0.18
	Attitudesabout malaria		
Whenyougot malaria, whodidyougetHealth Center		6	0.07
Consult? Traditional Doctor		28	0.31
Microscopist		37	0.42
TraditionalMicroscopist-Physician		5	0.06
Notaplicable		13	0.15
Haveyoureceivedvisitsfrom Yes		14	0.16
salud toattend Malaria cases? In		75	0.84
Are therepeople in thecommunitywhoHealers		67	0.75
cure malaria and other Nurses		11	0.12
diseases? Microscopist		11	0.12
How do youtake care nottoacquiretheUsing Angeo and Awning, BurningTow and EggCombs		13	0.15
Malaria?Using angeo and awning, drainingpits. Ponds& Waters			
Stagnant		14	0.16
Fillingpuddlesaroundyour home withdirtorsand,			
insecticides (Raid and others), to be sprayedinsidethehouse		18	0.2
All of theabove		44	0.49
Howoften do you do theactivitiestoOccasionally		65	0.73
prevent malaria? 4 to 6 days a week		20	0.22
Everyday		4	0.04

Table 4. Plants used for the treatment of malaria

PartEmployed	ScientificName	Family	Percentage
Stem&Leaf	*Sambucus L.*	Adoxaceae	0.08
Stem&Leaf	*Portulaca oleracea*	Portulacaceae	0.09
Stem&Leaf	*Dysphaniaambrosioides*	Amarana	0.09
Leaf	*Plantagomajor L.*	Plantaginaceae	0.09
Stem&Leaf	*Peristeria elata*	Orchidaceae	0.11
Stem&Leaf	*Solan and NudumDunall*	Solanaceae	0.11
Stem&Leaf	*Ocimumtenuiflorum*	Lamiaceae	0.33
Leaf	*Mentha Piperita L*	Lamiaceae	0.45
Stem&Leaf	*Gliricidiasepium*	Fabaceae	0.82
Leaf	*Acmellaoppositifolia*	Asteraceae	0.82

The plants most reported to treat malaria were Gliricidia sepium and Acmella opposit if olia which were used together by 82% of respondents (table 4), of which they stated that they used the stem and leaf.

In 84% of the homes there has been at least one case of malaria, with an average of 1.7 cases per home, with 7 being the maximum number of cases found. It is estimated that 24% of the inhabitants have had malaria. Table 5 shows the statistically significant bivariate associations with the Chi^2 test (p value <0.05) between having presented at least one case in the home (dependent variable) and each of the other variables.

Table 5. Bivariate analysis with the variable having malaria at home as a dependent variable

Dependent variable	OR	CI 95%	p-value *
Whatisthe mosquito called?	3.72	0.97 to 14.63	0.0233
How Malaria IsAcquired	5	1.25 to 23.68	0.0076
Consultyourtraditional doctor	7.35	0.98 to 324.01	0.0326
Gliricidisepium (Matarratón)	3.44	0.74 to 14.37	0.0489
Fisherman	6.5	0.86 to 287.5	0.0483
5 or more peoplelive in thehouse	6.96	1.48 to 31.00	0.0015
There are onaverage 2 or more people per room	8.9	2.02 to 53.17	0.0005

Table 6. Defined logistic regression models

		OR	CI 95%	p-Value of the Variables	p-Value of theModel	R^2
Model 1	Howyouacquire malaria.				0.0006	0.193
	CorrectAnswer	6.8	1.8 to 25.6	0.004		
	Consultyourtraditional doctor	10.9	1.3 to 94.1	0.029		
	constant	1.3	0.5 to 3.0	0.55		
	Howyouacquire malaria.					
Model 2	Correctanswer.	8.55	2.04 to 35.88	0.003	0.0002	0.252
	Consultyourtraditional doctor	14	1.48 to 131.53	0.021		
	Havelived in Corozal for 15 yearsor					
	more years	4.25	1.06 to 17.00	0.041		
	Constant	0.5	0.14 to 1.81	0.294		
Model 3	Howyouacquire malaria.				0.0003	0.247
	CorrectAnswer	5.11	1.29 to 20.21	0.02		
	Consultyourtraditional doctor	8.88	1.01 to 77.88	0.049		
	5 or more peoplelive in thehouse	4.78	1.06 to 21.44	0.041		
	Constant	0.46	0.12 to 1.78	0.259		
Model 4	HowYouGet Malaria. CorrectAnswer				0.0005	0.264
		4.55	1.13 to 18.22	0.032		
	Conchera Activity	0.17	0.03 to 0.96	0.045		
	Occasionalprevention	7.5	1.17 to 48.13	0.034		
	House with 5 or more people	6.1	1.35 to 27.63	0.019		
	Constant	0.37	0.06 to 2.13	0.263		
*Chi 2 Test						

To generate the logistic regression models, the step-by-step elimination technique was carried out, initially including all the variables that presented a statistical significance of the chi ^{2} test, with a value of $p<0.25$, thus identifying initially 14 variables. To select the final models, those whose variables are each significant and the final model with a value of $p<0.05$ were taken into account for the Chi^2 test. In this way, 4 models were generated (table 6).

For the selection of the final model, the highest value of McFadden's pseudo R2, the adjusted Count R2, the AIC and the lowest value of the BIC were used. As a final discriminant aspect, the difference in the BIC between the models was established, using the Raftery criterion in which the level of evidence is established to choose one model over another. In this sense, model 2 was chosen, according to which it was established that the presence of at least one case of malaria in the home is associated with knowing how malaria is acquired, consulting the traditional doctor about its management and who have lived in Ongole for more than 15 years.

Discussion

Malaria can generate immunity in people over several years of exposure, which reduces the risk of it causing serious illness[3]. According to this, contrary to what would be expected, this study determined that those who have been living in Ongole for more than 15 years, they are more likely to have malaria at home, which presumes that in this area there is no immunity effect and that the longer time living in this endemic area increases the risk due to the longer exposure time. In the third logistic regression model, which is also an acceptable model, the presence of malaria was found to be associated with the fact that more than 5 people lived in the house, which agrees with a study carried out in Tumaco[8]. In this way, the high number of people at home can be considered a factor of overcrowding, which increases the probability of the disease occurring.

A work in which information related to the use of medicinal plants for antimalarial purposes in 9 African countries was collected, identified that plants from the families Fabaceae (to which the mousetrap belongs) and Solanaceae, are among the most used to treat the disease[9]. None of the plants reported in the list of medicinal plants accepted for therapeutic purposes by Health department, that have antimalarial activity. as traditional use or that this is its indication. A systematic review of medicinal plants from the Andhra Pradesh region identified 7 species with potential antimalarial activity[10], none of which include the plants reported in this study. On the other hand, an investigation in which the in vitro activity of four species of medicinal plants used and evaluated, found that Solanum nudum had moderate antispasmodic activity and that Plantago major and Gliricidia sepium did not even have activity[11].

When contrasting the plants identified here with what is reported in bibliographical references, there is no evidence that they have antimalarial activity, even so, the population uses it for these purposes, probably recommended by traditional doctors. This can be risky because a significant percentage only uses these medicinal plants, ignoring the use of medications. Gliricidia sepium (Madri), which is one of the most used, does not have antimalarial activity, but it does have antipyretic activity, the latter perhaps being the reason for its use, however fever is only one of the symptoms, in this case the ideal It would be that it is used for this, as can happen with other plants and not to treat the disease[12]. The limitation of the study is stated as not determining the impact of medicinal plants in the community, through the cultural importance index, which is an indicator that would have allowed identifying the hierarchy in importance. that they give to each plant. It is possible that medicinal plants are used preventively due to their repellent effect on mosquitoes, however none of those reported in this study show this activity.

The respondents identified the traditional doctor as one of the main people consulted for the management of the patient, however it is vital that he is suitable for this responsibility, given that inadequate primary care is a factor that can influence the death of the patient. It is important then that the health professional, when he or she appears in this locality, identifies the traditional doctors as a figure of influence in the population, to provide them with truthful information, in order to carry out joint work in favor of the best advice to community.

It is vital that malaria control programs function optimally, given that deficiencies such as errors in diagnosis, registration and monitoring of cases and the provision of treatment are factors that negatively affect treatment adherence.

A low socioeconomic level can influence the occurrence of the disease in the population. In this sense, housing conditions such as clay or zinc roofs, wooden walls and floors, and humidity can contribute to the reproduction of the mosquito and the spread of the disease. However, in this study no statistically significant association was found between these conditions and the presence of malaria, perhaps because most of the homes had the same characteristics. It is proposed for future studies to make comparisons of the presence of the disease between communities with different housing characteristics. In this study, the presence of the disease was found to be associated with knowledge of it and knowing that it is acquired through the mosquito bite. This is important given that knowledge is a factor that determines positive adherence to treatment and therefore its effectiveness, furthermore this may be indicative that malaria is known, but that this knowledge is not put into practice or that those who are at risk for having had the disease are those who know it best. Some practices such as the use of mosquito nets and repellents are protective factors for the disease; in this study it was found that the majority of respondents report that they use all of these prevention measures[13].

Conclusions

To conclude, in this study it was established that knowing how to acquire malaria and consulting a traditional doctor about its management, the first related to knowledge and the second related to attitude, are factors that were associated with the presence of malaria in the home. The fact of living in Ongole for more than 15 years, as a longer period of exposure, contributes to the occurrence of cases in the home. Gliricidia sepium (matarraton) and Acmella oppositifolia are the plants most used to treat the disease, however, there is no evidence that these, or any of the others reported, are effective against malaria. It is vital that there is a more frequent presence of health entities in the territory, so that, together with traditional doctors, effective interventions are carried out in the population. People in Ongole City typically seek treatment for malaria by doing nothing at all. This is because

the community believes that the symptoms are not that severe, do not interfere with daily activities, and can be treated on their own. Getting treatment for malaria is a self-treatment behavior. The course of treatment involves visiting the pharmacy to look for medication. When taking self-medication, such as visiting a pharmacy, residents of Ongole city should first examine themselves to determine their condition and get a prescription from a physician. The residents of Ongole City must be educated about malaria in order to alter the public perception of the illness's self-healing symptoms. When self-medicating, such as by visiting a pharmacy, people should first assess their own conditions and obtain a prescription from a physician.

Conflict of Interest

The authors declare that they have no conflicts of interest.

References

1. Talapko J, Škrlec I, Alebic T, Jukic M, Vcev A. Malaria: The Past and the Present. Microorganisms. 2019; 7(6):179.
2. Espinoza JL. Malaria Resurgence in the Americas: An Underestimated Threat. Pathogens. 2019 Jan 18;8(1):11.
3. WHO. Malaria. Available online:http://www.who.int/mediacentre/factsheets/fs094/en/
4. Ribeiro GdJG, Rei Yan SL, Palmisano G, Wrenger C. Plant Extracts as a Source of Natural Products with Potential Antimalarial Effects: An Update from 2018 to 2022. Pharmaceutics. 2023; 15(6):1638.
5. de Sousa Pinto L, Arroz JAH, Martins MDRO, Hartz Z, Negrao N, Muchanga V, Cossa A, Zulliger R. Malaria prevention knowledge, attitudes, and practices in Zambezia Province, Mozambique. Malar J. 2021 Jun 30;20(1):293
6. https://cdma.ap.gov.in/en/about-us-60
7. Tairou F, Nawaz S, Tahita MC, Herrera S, Faye B, Tine RCK. Malaria prevention knowledge, attitudes, and practices (KAP) among adolescents living in an area of persistent transmission in Senegal: Results from a cross-sectional study. PLoS One. 2022 Dec 1;17(12):e0274656.
8. Chaparro Narváez PE, Jimenez-Serna MM, Gunturiz Albarracin ML, Carrasquilla Gutierrez G. Malaria prevalence in Commune 5 in Tumaco (Nariño, Colombia). F1000Res. 2023 Jul 19;11:448.
9. Titanji VP, Zofou D, Ngemenya MN. The antimalarial potential of medicinal plants used for the treatment of malaria in Cameroonian folk medicine. Afr J Tradit Complement Altern Med. 2008 Apr 10;5(3):302-21.

10. Pasumarthi, Brahmam& Sunita, Kanikaram. (2018). Phytochemical Investigation and In vitro Antimalarial Activity of Acalypha indica (L.) and Cocculus hirsutus (L.) From Prakasam District, Andhra Pradesh, India. Biomedical and Pharmacology Journal. 11. 2123-2134. 10.13005/bpj/1592.
11. Najafian Y, Hamedi SS, Farshchi MK, Feyzabadi Z. Plantago major in Traditional Persian Medicine and modern phytotherapy: a narrative review. Electron Physician. 2018 Feb 25;10(2):6390-6399.
12. Romero N, Areche C, Cubides-Cárdenas J, Escobar N, García-Beltrán O, Simirgiotis MJ, Céspedes Á. In Vitro Anthelmintic Evaluation of Gliricidiasepium, Leucaena leucocephala, and Pithecellobium dulce: Fingerprint Analysis of Extracts by UHPLC-Orbitrap Mass Spectrometry. Molecules. 2020 Jun 30;25(13):3002
13. Jumbam DT, Stevenson JC, Matoba J, Grieco JP, Ahern LN, Hamainza B, Sikaala CH, Chanda-Kapata P, Cardol EI, Munachoonga P, Achee NL. Knowledge, attitudes and practices assessment of malaria interventions in rural Zambia. BMC Public Health. 2020 Feb 12;20(1):216