El Niño Phenomenon: Characterization of the Level of Knowledge About Dengue Prevention in Residents of Peripheral Areas of Lima, 2023

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Abstract

Introduction: climate variability and dengue transmission are related; Peru is on the brink of an El Niño Phenomenon; the increase in environmental temperature has an impact on the extrinsic incubation period of the virus and on the population dynamics of the vector. Objective: characterize the level of knowledge about dengue prevention in residents residing in the peripheral areas of Lima, 2023. Material and methods: observational, prospective, cross-sectional and analytical study. Residents of North Lima and East Lima participated, ages between 18 and 60 years, head of household, residents in the area for at least 3 years. The variables level of knowledge, marital status, occupation, level of education, whether or not it has a drain, source of water for consumption, water storage, material and ventilation of the dwelling were included. Descriptive statistics, Pearson's chi-square test, and ANOVA were used for statistical analysis. Results: the variables associated (p<0.05) to the level of knowledge about preventive measures against dengue were level of education, home drainage, source of drinking water, water storage and housing material. Low level of knowledge in 60.8% of residents of North Lima versus 28.9% in East Lima. Conclusions: it is urgent to implement education programs that address preventive measures against dengue.

Keywords: Dengue, Disease Prevention, Poverty

Introduction

Dengue is an infectious and endemic disease that has become one of the main public health problems worldwide, with high morbidity and mortality rates. Dengue spreads widely in tropical/subtropical areas, the spread is conditioned by the level of temperature (25°C and 29°C), altitude (< 1200 meters above sea level) and population density [1-4]. Transmission of the virus is through the bite of the female mosquito, previously infected with human blood in the viremic stage (symptomatic or asymptomatic), *Aedes aegypti* [5,6]. The incubation period ranges from 4 to 10 days; The vector can infect people of different ages, with the youth population (15-24 years old) being the most vulnerable [7].

In recent years, the incidence rate of dengue has been increasing worldwide [8]. A report estimates that more than 2,500 million people are located in risk areas and more than a hundred countries have reported cases of this virus [2], annually the prevalence of infections is around 400 million,

not counting the cases that are not reported [6]. Several studies show that factors associated with the level of knowledge about preventive behaviors to counteract dengue are of great importance as a variable that allows us to know the health education of citizens who are in risk areas [9,10]. Worldwide, the level of knowledge of preventive behaviors about dengue is low, which translates into the alarming morbidity and mortality figures shown by the World Health Organization (WHO) [1]. Currently, dengue is widespread in almost the entire American continent, however, most of the cases registered are distributed in Latin America and the Caribbean [2].

Previous studies show that the population of Latin America knows the vector and the disease it produces; despite this, the level of knowledge about anti-vector practices is moderate-low [10-12]. This shows the difficulties that people in this region have in preventing the spread of the vector. In recent years, epidemic outbreaks have been reported in new geographical areas of Latin America, areas where the level of knowledge about dengue prevention practices is not optimal due to its low incidence in these new places [9].

In Peru, dengue is an infectious disease that poses a serious public health problem with a high prevalence of morbidity and mortality. The regions with the highest number of annual cases are Piura, Loreto, Ica, Ucayali and increasingly more cases in Lima; The disease is most prevalent during the summer season [13]. Although the national studies present interesting results on the level of knowledge about dengue prevention, these studies have focused on tropical or subtropical places in Peru, where the vector is frequently found [9,14]. In the city of Lima, dengue outbreaks have been reported since 2005 in districts such as Comas, Carabayllo, Puente Piedra – North Lima -, La Molina, Ate Vitarte, San Juan de Lurigancho – East Lima – and Villa María del Triunfo – South Lima. [15:16].

Peru is on the verge of a new El Niño phenomenon. The influence of meteorological events on dengue transmission dynamics has been the subject of research for years; Variability in disease incidence and occurrence of outbreaks have been observed in several countries/regions, with changes in temperature and precipitation being key factors. Scientific evidence shows that climate variability plays an important role in dengue's potential for transmission. El Niño events can lead to an increase in mosquito populations, which in turn increases the potential for transmission [17,18]. Climate change has further affected transmission rates, particularly affected by relative humidity in rainfall [19]. The objective of this study is to characterize, within the framework of the El Niño phenomenon, the level of knowledge about dengue prevention among residents of the peripheral areas of Lima, 2023.

Material And Methods

Scope and design of the study

Research with a quantitative, observational, prospective, cross-sectional and analytical approach. This research was tested by the ethics committee of the Universidad Continental, Lima-Peru. The criteria of justice, beneficence, autonomy and non-maleficence were met.   Information was provided through informed consent to all study participants.

Study Population

The population consisted of inhabitants of the districts of Comas/localities of San Agustín and La Libertad (Lima Norte, outbreak 2005) and San Juan de Lurigancho/localities of Mangomarca and Huáscar XV (Lima Este, outbreak 2022).

For the sampling calculation, a p-value of 0.3 was used, taking as a reference previous studies in the country [8,9,14], confidence level 95%; the initial sample was 462 inhabitants, a loss of 10% was considered, the research is based on the results with the participation of 420 people. The units of analysis were distributed as follows: 181 people from North Lima and 239 from East Lima; Simple random sampling was applied. Persons over 18 years of age, head of household, both sexes and who agreed to participate voluntarily were included; People with a limiting physical/mental condition, over 60 years of age and residing in the area for less than 3 years prior to the application of the research instrument were excluded.

Data collection

Information was collected on the level of knowledge and the variables age, sex, marital status, occupation, level of education, has or does not have a drainage, source of water for consumption, water storage, material and ventilation of the house. The application of the instrument was carried out by four previously trained interviewers. The interview time per inhabitant was approximately 15 minutes. The surveys were conducted on a house-to-house basis over the weekend.

The information was collected using a previously validated questionnaire [20], Cronbach's alpha 0.817. The instrument consists of 12 multiple-choice questions on dengue prevention knowledge, a value of 1 point is assigned for each correct answer in the various items. The score for measuring the level of knowledge about dengue prevention was low (0-6 points), medium (7-9 points) and high (10-12 points). Once the instrument was applied, the survey responses were scored.

Statistical analysis

Data were analyzed using Microsoft Excel version 2019 and SPSS version 27 software. The association of variables was determined through the use of descriptive statistics (frequency *distribution, summary measures*), Pearson's chi-square test and ANOVA ($p < 0.05$).

Results and Discussion

The mean age of the inhabitants surveyed in the North and East Zones of Lima was 39.33 +/- 8.2 and 40.47 +/- 9.7 years respectively; male sex predominated in both areas of research (56.9% and 55.6%); single/separated/divorced people in North Lima represent 38.7% and East Lima 46.8%; likewise, the heads of household who dedicate themselves exclusively to the household are 24.3% in the North versus 13.8% in the East. The population without higher education – *technical or university* – was 33.7% and 47.7% respectively. Lack of drainage in homes in North Lima was 41.4% and 47.7% in East Lima; only 33.1% of households have an indoor water network in North Lima compared to 23.0% in East Lima. 76.8% store water in North Lima and 74% in East Lima; adequate housing in 49.7% versus 34.7% (Table 1).

Table 1. 36.4%

Características	Lima Norte		Lima Este	
	n=181	%	n=239	%
Edad				
Media +/- DE	39.33 +/- 8.2 años		40.47 +/- 9.7 años	
Sexo				
Masculino	103	56.9%	133	55.6%
Femenino	78	43.1%	106	44.4%
Estado civil				
Soltero	48	26.5%	55	23.0%
Casado	77	42.5%	62	25.9%
Viudo	34	18.8%	65	27.2%
Separado/Divorciado	22	12.2%	57	23.8%
Ocupación				
Hogar	44	24.3%	33	13.8%
Comercio	56	30.9%	46	19.2%
Temporal	35	19.3%	40	16.7%
Empleo técnico/profesional	18	9.9%	38	15.9%
Estudiante	22	12.2%	44	18.4%
Ninguno/otros	6	3.3%	38	15.9%
Characteristics				
%	n=239	%	Age	15.1%
Primaria	38	21.0%	Average +/- OD	39.33 +/- 8.2 years

40.47 +/- 9.7 years	Sex	30.4%	44	18.4%
Técnico	Male	103	56.9%	133
55.6%	Female	78	43.1%	106
44.4%				
Si	Bachelor	48	26.5%	55
23.0%	Married	77	42.5%	62
25.9%				
27.2%	Separated/Divorced	22	12.2%	57
23.8%	Occupation	43.1%	52	21.8%
Pozo	Home	44	24.3%	33
13.8%	Commerce	56	30.9%	46
19.2%				
16.7%	Technical/Vocational Employment	18	9.9%	38
15.9%	Student	22	12.2%	44
18.4%	None/Others	6	3.3%	38
15.9%	Degree of education	23.2%	62	25.9%
Material de vivienda				
15.1%	Primary	38	21.0%	34
14.2%	High school	55	30.4%	44
18.4%	Technician	49	27.1%	67
28.0%				
24.3%	Drain	30.9%	78	32.6%
Moderada	Yes	106	58.6%	125
52.3%	No	75	41.4%	114

There was a difference in the responses regarding knowledge of preventive measures against dengue; Knowledge about the importance of the use of mosquito nets is higher in North Lima (52.5%), in the other questions the inhabitants of East Lima have greater knowledge, among these questions those related to actions at home to prevent Dengue (79.1%), management of useless (79.1%) and actions against dengue in rainy or very hot seasons (74.5%) stand out with greater frequency of knowledge (Table 2).

Table 2. Knowledge about prevention measures in **45.6**%

47.7%	Water Fountain		Lima Este Intra-home network	60
	n	%		
33.1%	55	23.0%	Tanker	78
43.1%	52	21.8%	Well	32
17.7%	57	23.8%	Water basin	11
6.1%	75	31.4%	Water Storage	79.1%
Uso de espirales	46	25.4%	Tank	57
31.5%	65	27.2%	Drums	47
26.0%	57	23.8%	Buckets/Tubs	35
19.3%	55	23.0%	Does not store	42
23.2%	62	25.9%	Housing material	62.3%
Cuidados en el almacenamiento de agua	103	56.9%	Noble material	90
49.7%	83	34.7%	Wood	70

38.7%			73	30.5%	Mat/Others	21

There were statistically significant differences in the level of knowledge about preventive measures between the areas of North Lima and East Lima (p=0.0001). Low/medium level of knowledge in 91.2% of the inhabitants of North Lima and 60.3% of the inhabitants of East Lima (Table 3).

There was no statistically significant association between the variables age (p=0.951), sex (p=0.711), marital status (p=0.855), occupation (p=0.114) or home ventilation (p=0.054) and level of knowledge. The associated variables were level of education (p=0.036), presence of sewage in the home (p=0.002), source of water for human consumption (p=0.001), water storage (p=0.018) and household material (p=0.006) (Table 4).

	39.7%				
11.6%	**83**		**34.7%**		**Housing ventilation**
	n=181	**%**	**n=239**	**Optimal**	
30.9%	78	32.6%	Moderate	80	
74	31.0%	Lousy	45	24.9%	**44.2%**
36.4%	16	8.8%	95	39.7%	

*Pearson's Chi Square

	29.7%						
	Nivel de Conocimiento						
Características	Bajo	n	%	n	%	Appropriate clothing to prevent dengue mosquito bites	70
38.7%							
		105		43.9%		Recommended mosquito nets	52
		77		32.2%		Actions at home to prevent Dengue	
55.8%							
Use of repellents	107	59.1%	155	64.9%	Waste management	108	
189	79.1%	Actions against dengue in rainy or very hot seasons	109	60.2%	178	74.5%	59.7%
75							
62.3%	The abbot and its community uses	50	27.6%	109	45.6%	Importance of the Abbot	
39.2%	109	45.6%	45	34.6%	31	27.9%	0.855**

Viudo	42	Level of knowledge %	North Lima	East Lima	P Value*	26.1%	
%	n=239	%	23	Low	110	60.8%	
28.9%							
High	16	8.8%	95	39.7%	21	18.9%	
Comercio	46	25.7%	32	24.6%	Characteristics	Level of Knowledge	0.114**
Temporal	36	Low	%	Middle	%	High	
P Value	Age	7.3%	23	17.7%	20	18.0%	
39.22 years	39.31 years old	0.951*	16	[(95% CI) 39.22 - 42.69]	[(95% CI) 37.17 - 41.26]	[(95% CI) 37.15 - 41.46]	
Sex	19	10.6%	15	11.5%	10	9.0%	
Male							
Female	75	41.9%	57	43.8%	52	46.8%	
Marital status	43	24.0%	16	12.3%	13	11.7%	
Bachelor	42	23.5%	34	26.2%	27	24.3%	0.036**
Married	63	35.2%	45	34.6%	31	27.9%	
Widower	42	23.5%	28	21.5%	29	26.1%	
Separated/Divorced							
Occupation	81	45.3%	79	60.8%	71	64.0%	0.002**
Home	37	20.7%	19	14.6%	21	18.9%	
Commerce							
Temporary	36	20.1%	25	19.2%	14	12.6%	
Technical/Vocational Employment	13	7.3%	23	17.7%	20	18.0%	0.001**
Student	28	15.6%	16	12.3%	22	19.8%	
None/Others	19	10.6%	15	11.5%	10	9.0%	
Degree of education							
No studies	18	10.1%	13	10.0%	11	9.9%	
Primary	43	24.0%	16	12.3%	13	11.7%	0.018**
High school	47	26.3%	29	22.3%	23	20.7%	

Technician	43	24.0%	38	29.2%	35	31.5%
Superior						
Drain	57	31.8%	66	50.8%	50	45.0%
Yes	81	45.3%	79	60.8%	71	64.0%	0.002**
No	98	54.7%	51	39.2%	40	36.0%
Water Fountain						
Intra-home network	36	20.1%	47	36.2%	32	28.8%
Tanker	75	41.9%	30	23.1%	25	22.5%	0.001**
Well	38	21.2%	28	21.5%	23	20.7%

*One-factor Analysis of Variance, significance level 0.05

**Pearson's Chi-square, significance level 0.05

*Multivariate analysis

Water basin	30		16.8%	
	19.2%	*31*	27.9%	*p valor**
Water Storage	133,061	**,001**	108,987	**,035**
Sexo	8,482	**,014**	Tank	55
30.7%	41	31.5%	26	23.4%
Ocupación	Drums	**52**	29.1%	26
20.0%	26	**23.4%**	0.018**	Buckets/Tubs
43	24.0%	22	16.9%	25
22.5%	6,363	Does not store	29	**16.2%**
41	31.5%	34	30.6%	,194
Housing material	19,267	**,001**	8,599	,072
Ventilación de vivienda	9,228	,056	Noble material	57
31.8%	66		50.8%	
50				

Discussion

The dengue virus affects millions of people globally, with high morbidity and mortality rates every year. It is an endemic disease [21]. One of the characteristics of transmission is seasonality, patterns that are repeated year after year; Climate plays an important role in the host of the virus [22].

The potential role of climate – temperature and rainfall – on dengue transmission is due to the impact it has on vectors; rainfall creates breeding grounds and plays an important role in egg hatching. The host's ability to transmit increases with increasing temperature as its feeding frequency increases [23]. There is no academic doubt about the relationship between climate and transmission potential; An association between dengue epidemics and El Niño has been suggested [24,25].

The present study evaluated factors associated with the level of knowledge about preventive measures against dengue in the population of localities in areas of North Lima and East Lima [26],

areas where dengue outbreaks have occurred in recent years, the population that participated in the research is considered vulnerable to upcoming events of the disease due to the temperature changes typical of the El Niño phenomenon.

The research took information from heads of household, unlike other studies [27,28] most of the people responsible for the household were male, this may be due to the fact that the surveys were carried out on weekends, with a high probability of finding the head of the household.

The average age of the surveyed population is similar to other studies that have evaluated the level of knowledge about preventive measures against the disease, differences are observed in the degree of education, for the particular case of North Lima, the highest level achieved is secondary education with 30.4% of the cases, in East Lima it was higher technical education in 28.0%; this difference in education may explain the level of knowledge about the disease that will be seen later [28, 29]. The average age of the respondents, heads of households, is similar to other surveys – North Lima 39.33 years, East Lima 40.47 years - [30].

The research compares two populations that have had outbreaks of dengue [31] and that to date are hotbeds of risk in the face of a possible El Niño phenomenon, it is worrying that citizens are not clear about the preventive measures against the disease; North Lima has a lower frequency of correct answers to the use of coils (25.4%), community use of the abate (27.6%), mosquito nets (28.7%) and use of appropriate clothing to prevent mosquito bites (38.7%); The inhabitants of East Lima had a lower frequency of correct answers in those related to the use of mosquito nets (32.2%), spirals (41.0%), the importance of the abate (45.6%) and its community use (45.6%). Knowledge about key prevention issues varies in population groups due to different factors, previous research coincides on some of the issues, such as lack of knowledge about abbot, for example, however, the other topics have a different level of response [32-34]. In the particular case of the Abate, the low level of knowledge, with the limitations of its use, continues to be one of the most important preventive measures [35].

On the other hand, there is a strong knowledge about aspects related to actions against dengue in rainy or very hot seasons (60.2%), management of unusable (59.7%) and use of repellents (59.1%) in residents of North Lima; greater strength of knowledge in actions at home to prevent the disease (79.1%), management of unusable (79.1%) and actions against dengue in rainy or very hot seasons (74.5%) in inhabitants of East Lima. As in the previous case, little knowledge about specific prevention issues, high knowledge is defined by multiple variables [36,37], in the case of North and East Lima it may be influenced by being areas of recurrent outbreaks [38].

In general terms, there is evidence of a low level of knowledge in the inhabitants of North Lima (60.8%), and in the case of East Lima the knowledge, between medium and high, was 71.1%. The low level of knowledge brings to the fore, among other reasons, the weakness of the communication or educational programs – *health education* – developed by the Ministry of Health, which are not achieving the desired objectives, making it even more worrying given that they are on the verge of another El Niño phenomenon. If I do not know that water reservoirs are a source for vector reproduction, it is difficult to take action to avoid these breeding sites [39,40].

A good knowledge does not guarantee good preventive practices, in East Lima educational actions must be strengthened to be sure that not only are the prevention measures against dengue known but properly applied. This is a limitation of the study, knowledge was measured but not attitude or practice; However, the results are still important, understanding that we are facing an imminent climatological phenomenon in the coming months. As a cross-sectional study, another limitation is that the relational dynamics of the variables studied are not evaluated; In the development of surveys, the inhabitants assume that they can benefit from public programs or external national/international support and are usually not sincere in some of the data that is required.

The variables evaluated as factors associated with the level of knowledge about preventive measures against dengue in populations affected by dengue transmission include generalized global recommendations for disease prevention and control surveillance programs. Access to knowledge and preventive attitudes are crucial factors in reducing the risk of infection.

Factors associated with the level of knowledge about dengue preventive measures have been explored in numerous studies [8,10,20,34,37]. These studies have used various methods to assess knowledge, including questionnaire scores, self-reported understanding of incidence, disease transmission, and familiarity with preventive practices. The factors that have been found to affect knowledge levels are varied and complex. For example, some studies have found that people who reported contracting the dengue virus had higher knowledge scores than those who had not contracted the disease [36]. This suggests that personal experience may be a factor in improving understanding of prevention. Other studies have analyzed the role of sociodemographic factors as independent variables in predicting knowledge levels [9,11,12]. Factors such as age, education level, income level, and occupation have been shown to be associated with different levels of prevention knowledge.

Community participation, even more so when they have already had outbreaks or are vulnerable areas due to the presence of the vector, is essential to improve knowledge about dengue. Preventive measures, such as mosquito control and improved prevention education, help reduce the incidence of the disease.

The study determined that level of education (p=0.036), absence of drainage (p=0.002), sources of water for consumption (p=0.001), water storage (p=0.018) and housing material (p=0.006) are factors associated with the level of knowledge of preventive measures against dengue.

Strategies to improve knowledge about prevention should take into account individual characteristics, such as history of perceived susceptibility and measures taken to prevent dengue vector breeding sites. In addition, the characteristics of the home, in the case of the study, water storage, and housing characteristics would play a role in determining overall levels of awareness of the problem.

Characterizing the variables around the level of knowledge is crucial to control and prevent the spread of the disease [14,32,36]. Preventive practices, health education initiatives, and targeted intervention strategies could help prevent dengue and other diseases (Zika, Chikungunya).

Health managers should prioritize education and outreach programs that improve prevention practices and increase awareness among all members of the community, especially in areas of risk or vulnerability; Improving knowledge about prevention is critical to controlling outbreaks and reducing the spread of the disease.

FINANCING

CONFLICT OF INTEREST STATEMENT

The authors declare no conflicts of interest

AUTHORS' CONTRIBUTION

Navarrete Mejía Pedro Javier: conceptualized, designed the methodology, conducted the research, analyzed the data, wrote the initial draft, drafted and revised the final version.

Martínez Cabrejos Sergio: conceptualized, designed the methodology, conducted the research, analyzed the data, wrote the initial draft, drafted and revised the final version.

Sullcahuaman Valdiglesias Edith: conceptualized, designed the methodology, conducted the research, analyzed the data, wrote the initial draft, drafted and revised the final version.

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