

**The Prevalence of Dengue Fever in Al-Leith Province, Saudi Arabia 2023**

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Abstract: Cross-sectional descriptive study was conducted to; measure the prevalence of dengue fever, assessment the socio-economic, demographics factors, diseases associated with dengue and identify mosquito's species in Al Leith province. About 420 people was participated in this study. The questionnaire was used to collect information included age, gender, average family income, occupation, educational level, infection with dengue fever and other co-infectious such as diabetes, hypertension, heart disease, anemia, malnutrition. In addition, the symptoms of dengue fever. Also, mosquitoes were collected by using a light trap which was placed in four different locations. Data was analyzed by SPSS. The prevalence of dengue fever was found (11%) among the study participants the majority of them were found from age group of 16-30 (N = 35, 8%), followed by the age group of 41-50 (N = 7, 1.6%). The study showed that the rate of infection was higher in females (N= 33, 7.8 %) compared to males (N = 14, 3.3). Also, most infection with dengue fever was found in family members who had a low level of monthly income less than 5000 RS (N = 21, 5%), followed by from 5000 to 10000 RS (N = 11, 2.6%). The majority of the participants were found students (44.3%) and those who did not have a job (26.2%), from education sectors (14%) and from private sectors (6 %). Three mosquito species were reported *Culex pipiens* (N= 102, 90%) was the common abundant species, *Anopheles arabiensis* (N= 5, 4%) and *Aedes aegypti* (N= 6, 5%).

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1. Introduction

The World Health Organization (WHO) estimates that more than 2.5 billion individuals are at risk of contracting dengue. The majority will have asymptomatic infections. Dengue fever and dengue haemorrhagic fever/dengue shock syndrome are caused by four virus serotypes that are spread from viraemic to susceptible humans mostly through bites from the *Aedes aegypti* and *Aedes albopictus* mosquito species. According to WHO figures, approximately 5% of the estimated 500,000 dengue haemorrhagic fever/dengue shock syndrome cases that require hospitalization each year die (Guha-Sapir and Schimmer, 2005).

Dengue fever (DF) is currently endemic in all continents except Europe, with epidemics occurring in Asia and America. Asia has significantly higher rates of dengue haemorrhagic fever compared to the Americas. Epidemic dengue haemorrhagic fever first appeared in the Americas in 1981, about 30 years after its introduction in Asia, and its prevalence is increasing (Monath, 1994). Dengue Haemorrhagic Fever (DHF) is a fatal consequence that includes hemorrhagic tendencies, thrombocytopenia, and plasma leakage. Dengue Shock Syndrome (DSS) combines all of the above criteria, as well as circulatory failure, age-related

hypotension, and low pulse pressure. DHF and DSS are potentially fatal, but with early detection and effective treatment, individuals can recover with little complications (WHO, 1999). The rise in dengue mortality is thought to be due to an increase in the proportion of DF patients developing DHF or DSS (Guzman *et al.*, 1997). Epidemiological changes: Demographic, economic, behavioural, and social aspects are frequently critical for effective communicable disease control and support successful public health programs (Guha-Sapir and Schimmer, 2005).

In Saudi Arabia, DF first appeared in the 1990s, the most common serotype is DENV-2. Also, in circulation since 1994 and 1997, respectively, are DENV-1 and DENV-3. DENV-4 was discovered in a recent seroprevalence investigation that used samples from Makkah in 2015 (Altassan *et al.*, 2019). In the 1990s, DHF was more prevalent in Southeast Asia, specifically Vietnam and Thailand. These two countries account for more than two-thirds of the DHF cases recorded in Asia (Pinheiro and Corber, 1997). The *Aedes aegypti* and *Aedes albopictus* mosquitoes are the carriers of the virus. Small pools of still water are ideal for the vectors to breed, especially in the water

storage containers that surround houses. Although the two species can coexist in the same habitat, *Ae. aegypti* is typically more abundant indoors and in densely populated regions, whilst *Ae. albopictus* is more common outdoors and in suburban or rural areas (Altassan *et al.*, 2019). The virus replicates in the mosquito's midgut after it enters during a blood meal from an infected host and moves to the salivary glands, where it can infect a new host during a subsequent bite. This procedure takes one to three weeks, and it moves more quickly in warm weather (Nedjadi *et al.*, 2015). Although both species bite mostly during the day, *Ae. aegypti* can bite at night if artificial lighting is powerful enough (Altassan *et al.*, 2019).

Studies on the fauna and distribution of mosquitoes in the Kingdom Saudi Arabia (KSA) revealed about 49 species, that include 18 anophelines and 31 culicines. Among these species, *Anopheles arabiensis*, *An. sergentii* and *An. stephensi* are currently considered as the potential vectors of malaria parasites, *Culex pipiens*, and *Cx. quinquefasciatus*, probable vectors of human filariasis and West Nile virus, *Cx. tritaeniorhynchus* and *Aedes vexans arabiensis* are proposed to be vectors of RVF in KSA, *Aedes aegypti* the main vector of dengue fever in the country. Most of these mosquito species are recorded in almost all surveyed regions in the Eastern, Western, and Southern areas of Kingdom Saudi Arabia, including the Riyadh Region. However, *Aedes aegypti* was recorded only in the western and southern regions of the country (Alzahrani *et al.*, 2021).

The country harbors both vector *Ae. aegypti* and *Ae. albopictus*, especially during the rainy season. *Ae. aegypti* is becoming more widely distributed; it is now found in Aseer, Jizan, Makkah, and Jeddah. Recently, *Ae. aegypti* has also been found in Al-Madinah. The mosquito is thought to have entered the country through traffic between Jeddah and Al-Madinah, maybe via the transportation of tires (Altassan *et al.*, 2019).

2. Material and Methods

Cross-sectional descriptive study was conducted to measure the prevalence of dengue fever in Al Leith province of the Kingdom of Saudi Arabia, to determine the most affected age groups and genders, to assess the socio-economic, demographics factors associated with disease and to identify common mosquito's species. The sample size was taken randomly by distributing an electronic questionnaire: <https://n9.cl/lz80v>, about 420 participants were participated in this study.

The collected data included; demographic and health characteristic information such as age, gender, marital status, average family income, place of residence, occupation, educational level, and co-

infection with other diseases such as diabetes, hypertension, heart disease, anemia and malnutrition. Also, information on infection with dengue fever, the symptoms, person's knowledge about dengue fever, control measures to limit mosquito bites by using mosquito nets and repellents was collected.

To identify the common mosquito's species in the study area light trap was used in mosquitoes' collection it's was placed in four different locations where mosquitoes are abundant in Al-Laith locality. Mosquitoes were collected during periods they were active at night and in the early morning. Data was statistically analyzed by Statistical Package for Social Sciences (SPSS).

Plat 1: Sitemap I



Plat 2: Sitemap II



Plat 3: Sitemap III



Plat 4: Sitemap IV



3. Results

Table 1: The distribution of dengue fever cases among age groups of the participants

		Dengue Fever Infection		Total
		Infected	Non-infected	
Age groups	3-9	0	2	2
	10-15	2	6	8
	16-30	35	251	286
	31-40	3	78	81
	41-50	7	30	37
	over 50	0	6	6
Total		47	373	420

Out of 420 participants in this study, 47 participants (11%) were found infected with dengue fever, the majority of infections were found from age group of 16-30 (N = 35, 8%), followed by the age group of 41-50 (N = 7, 1.6%).

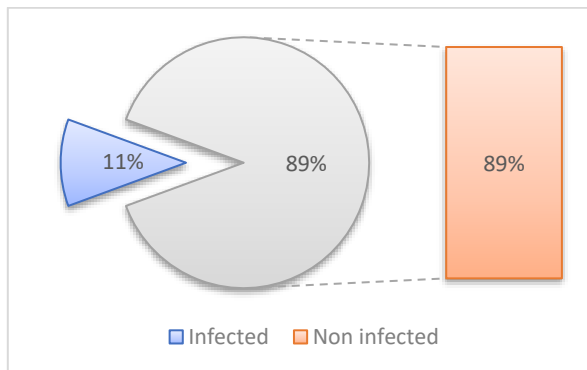


Figure 1: Prevalence of dengue cases among the study population

Table 2: The occurrence of Dengue fever among genders of the study population

		Dengue cases		Total
		Infected	Non-infected	
Sex	Male	14	69	83
	Female	33	304	337
Total		47	373	420

The study showed that the rate of infection with dengue fever is higher in females (N= 33, 7.8 %) compared to males (N = 14, 3.3).

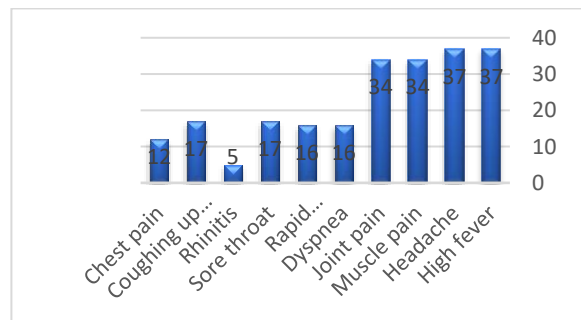


Figure 2: Symptoms of dengue fever among infected participants

The current study, revealed that most symptoms of dengue fever included fever (78.7%), Headache (78.7%), Muscle pain (72%), Joint pain (72%), Sore throat (36%) and coughing up phlegm (36%).

Table 3: Average monthly income of the household members and dengue cases

		Dengue cases		Total
		Infected	Non-infected	
Average monthly income of the household	less than 5000	21	168	189
	from 5000 to 10000	11	121	132
	from 11000 to 15000	6	45	51
	more than 15000	9	39	48
Total		47	373	420

The high infection with dengue fever was found in family members who had a low level of monthly income less than 5000 RS (N = 21, 5%),

followed by from 5000 to 10000 RS (N = 11, 2.6%), more than 15000 (N = 9, 2%) and from 11000 to 15000 (N = 6, 1.4%).

Table 4: Distribution of dengue cases according to the occupation.

		Dengue cases		Total
		Infected	Non-infected	
Occupations	Student	30	156	186
	Education sector	7	51	58
	Health sector	0	18	18
	Private sector	0	25	25
	Military sector	1	9	10
	No job	7	103	110
	Superannuate	2	10	12
	Makeup artist	0	1	1
Total		47	373	420

Table 5: dengue cases associated with other diseases among participants.

		Dengue cases		Total
		Infected	Non-infected	
Allergic	Yes	1 (0.23%)	3 (0.72%)	4 (0.95%)
	No	46 (10.95%)	370 (88.09%)	416 (99.05%)
Diabetes	Yes	4 (0.95%)	13 (3.09%)	17 (4.04%)
	No	43 (10.23%)	360 (85.71%)	403 (95.95%)
Asthma	Yes	1 (0.23%)	5 (1.19%)	6 (1.42%)
	No	46 (10.95%)	368 (87.61%)	414 (98.57%)
Hypertension	Yes	3 (0.71%)	14 (3.33%)	17 (4.04%)
	No	44 (10.47%)	359 (85.47%)	403 (95.95%)
Malnutrition	Yes	2 (0.47%)	33 (7.85%)	35 (8.33%)
	No	45 (10.71%)	340 (80.95%)	385 (91.66%)
Hypothyroidism	Yes	2 (0.47%)	2 (0.47%)	4 (0.95%)
	No	45 (10.71%)	371 (88.33%)	416 (99.04%)
Anemia	Yes	3 (0.71%)	20 (4.76%)	23 (5.47%)
	No	44 (10.47%)	353 (84.04%)	397 (94.52%)
Eczema	Yes	0 (0%)	1 (0.23%)	1 (0.23%)
	No	47 (11.19%)	372 (88.57%)	419 (99.76%)
Sciatica	Yes	1 (0.23%)	0 (0%)	1 (0.23%)
	No	46 (10.95%)	373 (88.81%)	419 (99.76%)
Colon	Yes	2 (0.47%)	0 (0%)	2 (0.47%)
	No	45 (10.71%)	373 (88.81%)	418 (99.52%)
Heart	Yes	0 (0%)	9 (2.14%)	9 (2.14%)
	No	47 (11.19%)	364 (86.66%)	411 (97.85%)

A total of 113 Adult mosquitoes were collected. The results revealed the occurrence of three mosquito species in Al-Leith province, which were *Culex pipiens* (N= 102, 90%) the most abundant species, *Anopheles arabiensis* (N= 5, 4%) and *Aedes aegypti* (N= 6, 5%).

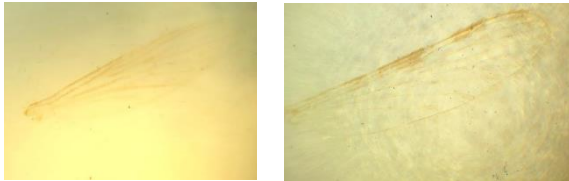
Plate 1: Thorax of adult *Aedes aegypti*

Plate 2: (A) culex wing , (B) Anopheles wing



Plate 3: Male anopheles

4. Discussions

The results of the study revealed that the prevalence of dengue fever was 11% this prevalence is low when compare with statistical result conducted by ministry of health for previous years 2022, 2021, and 2018 in the Mecca, Jeddah, Jazan regions and Asiri. Also, ministry of health, (2021) was stated that there were more laboratory-confirmed cases in 2019 from Makkah, compared to 2017 and 2018. About 204 confirmed cases of dengue were reported in 2017, 163 in 2018, and 748 in 2019. As for the gender most affected by dengue fever the study showed that the rate of infection with dengue fever is higher in females (N= 33, 7.8 %) compared to males (N = 14, 3.3). In contrast to a study conducted by Hegazi *et al.* (2020) from 2010 to 2016, they were found the infection rate was higher in males (3.8 times higher than females). The majority of infections were found from age group of 16-30 (N = 35, 8%), followed by the age group of 41-50 (N = 7, 1.6%) this is consistent with a study conducted by Hegazi, *et al.* (2020) from 2010 to 2016, revealed that 17,646 cases during the course of the study period, dengue was confirmed; the infection rate was higher in

adults (6.5 times higher than in children). Regarding the impact of economic factors, the results of the study showed the high infection with dengue fever was found in family members who had a low level of monthly income Less than 5000 RS (N = 21, 5%), followed by from 5000 to 10000 RS (N = 11, 2.6%).

Results revealed the occurrence of three mosquito species in the study area which were *Culex pipiens* (N= 102, 90%) was the most abundant species, *Anopheles arabiensis* (N= 5, 4%) and *Aedes aegypti* (N= 6, 5%). Compared to a study conducted by Alikhan, Al Ghamdi, and Mahyoub (2014) in Saudi Arabia. The number of mosquitoes collected during their study was 178, three types of mosquitoes have been identified in Al-Laith, the first species, *Aedes aegypti*, numbered 47 This type is consistent with what was measured in our study. The second type, *Aedes vittatus*, numbered 88. The third species, *Aedes vexan arabiensis*, numbered 43. The difference in counting the types of mosquitoes between the studies is due to the time of the study and the climate, as mosquitoes are abundant in the winter and rainy seasons. According to a study conducted by Alzahrani *et al.*, (2021) in Saudi Arabia among these species, *Anopheles arabiensis* are currently considered as the potential vectors of malaria parasites, *Culex pipiens*, and probable vectors of human filariasis and West Nile virus, *Cx. tritaeniorhynchus* and *Aedes vexans arabiensis* are proposed to be vectors of RVF in KSA, *Aedes aegypti* the main vector of dengue fever in the country. Prevention and control measures used by the study population were included use mosquito repellents (N = 305, 73%) and household control measures (N = 200, 48%). This is consistent with Sulehri *et al.* (2012), who reported that dengue mosquitoes bite during the day, therefore to avoid being bitten by mosquitoes, use repellents.

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