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Density of Dengue Vector in Hodeidah, Yemen 2017

Safwan AlDobaie [1,2*], Amjad AlKrny [1], Ziad Ali [1], Nabil Hudish [1], Faisal Almahi [1], Abeer Alburai [1], Husam Badr[1], Hasib AlHakimi [1], Tyseer AlQubaty [1], Fadl Alaskari [1], Mohammed Amood Al Kamarany [1,2 *]

1. *Center of Tropical Medicine and Epidemiology Studies, Hodeidah University (CTMES-HU), Hodeidah, Yemen*
2. *Center of Tropical and Infectious Diseases (CTMES), Authority of Public AL Thawarah Hospital , Hodeidah, Yemen*

***Corresponding author: E-mail**: safwanaldobaie@hoduniv.net.ye ; alkamarany@gmail.com

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Abstract

Background: Dengue fever is a significant vector-borne disease in tropical and subtropical regions, with *Aedes aegypti* and *Aedes albopictus* being the primary vectors. Hodeidah, Yemen, has witnessed increasing dengue cases, necessitated an in-depth analysis of vector density. **Objective:** This report aimed to investigate the density of dengue vector (*Aedes aegypti*) in Hodeidah in 2017. **Methods:** The entomological survey was conducted in Hodeidah Governorate, Yemen in 2017. Data were collected across four seasons—winter, spring, summer, and autumn—through field inspections of mosquito breeding sites. Standard indices, including the House Index (HI), Container Index (CI), and Breteau Index (BI), were calculated based on larval and pupal presence. Environmental parameters such as temperature, humidity, and rainfall were also recorded to assess their correlation with vector density. **Results:** The entomological survey revealed notable differences in the density of *Aedes aegypti* between urban and rural districts in Hodeidah Governorate. In urban districts, including Al Hali, Al Hawak, and Al Mina, the mean House Index (HI) was 33.3%, the Container Index (CI) was 17.2%, and the Breteau Index (BI) was 57.23. These levels, while concerning, were significantly lower than those observed in rural districts. In contrast, rural areas showed a higher risk of dengue transmission, with a mean HI of 52.3%, CI of 23.4%, and an alarming BI of 139.9. Several districts such as As Salif, Az Zaydiyah, and Al Qanawis reported BI values exceeding the World Health Organization (WHO) epidemic threshold of 50, reaching up to 330.0 in As Salif. **Conclusion :** The study revealed a seasonally dynamic trend, with peak infestation observed particularly in autumn and spring. These high values suggest intense but uneven breeding activity across rural settings. The variation in vector indices across districts indicates that while urban areas face persistent risk due to population density and poor sanitation, rural districts may act as hotspots for outbreak initiation due to weak surveillance and inadequate vector control. Coordinated public health action, tailored to local epidemiological and environmental conditions, remains essential to curbing dengue transmission.

Keywords: *Dengue Fever, Density Vector , Hodeidah, Yemen*

1. INTRODUCTION

Dengue fever remains one of the most significant mosquito-borne viral diseases worldwide, affecting millions of individuals annually. The disease is primarily transmitted by *Aedes aegypti* and *Aedes albopictus* mosquitoes, with *Aedes aegypti* being the predominant vector in tropical and subtropical regions, including Yemen [1,2]. In recent years, Hodeidah, a coastal governorate in Yemen, has experienced an increase in dengue fever cases, underscoring the importance of understanding vector density as a key factor in disease transmission [3]. The Yemen has witnessed recurrent outbreaks of dengue fever, exacerbated by environmental conditions and socio-political instability [4], the presence of both malaria and dengue fever in Hodeidah contributes to diagnostic challenges, leading to increased morbidity and mortality. Additionally, the surveillance and reporting of dengue cases in Yemen have been suboptimal, further complicating vector control efforts [5,6]. The density of *Aedes* mosquitoes is a crucial determinant of dengue virus transmission. Entomological indicators such as the House Index (HI), Container Index (CI), and Breteau Index (BI) are commonly used to assess mosquito abundance. A recent study in Yemen found that dengue vector density is alarmingly high, with HI values exceeding 70% in some districts. These findings suggest a high risk of sustained dengue transmission, particularly in areas with

*Corresponding author: E-mail: safwanaldobaie@hoduniv.net.ye ; alkamarany@gmail.com

poor water storage practices and limited vector control interventions. Environmental factors such as temperature, humidity, and rainfall play a significant role in *Aedes* mosquito population dynamics. Furthermore, improper water storage and urban waste accumulation contribute to increased mosquito breeding, as demonstrated in a study on vector density in Saudi Arabia [8,9]. The Hodeidah's vulnerability to dengue outbreaks is further compounded by ongoing conflict and economic instability, which hinder public health interventions. Limited access to healthcare, poor sanitation, and displaced populations contribute to the proliferation of Aedes mosquitoes. A study evaluating the dengue surveillance system in Yemen highlighted significant gaps in data quality, flexibility, and representativeness, suggesting that improvements in vector monitoring are needed Al-eryani et al., (2022) [5]. Efforts to control the dengue vector in Hodeidah have included insecticide spraying, larval source reduction, and community engagement. However, recent studies emphasize the need for an integrated vector management (IVM) approach, which combines chemical, biological, and environmental control strategies [10,11]. Additionally, predictive modeling of dengue vector density could aid in early intervention and targeted vector control measures [12,13]. Comparisons with other dengue-endemic regions reveal similar trends in vector density and control challenges. For instance, studies in Malaysia and China have shown that proactive vector control measures, including environmental sanitation and public awareness campaigns, can significantly reduce mosquito populations and disease incidence [14 - 16]. These lessons can be applied in Hodeidah to enhance dengue control efforts. This report aimed to investigate the density of Aedes mosquitoes in Hodeidah in 2017

2. METHDOLOGY

Entomological surveys were conducted across four seasons: winter, spring, summer, and autumn in Hodeidah ,Yemen , 2017 . Data collection involved mosquito breeding site identification, larval counts, and calculation of standard indices. House Index (HI): Percentage of houses infested with *Aedes larvae* or *pupae*. Container Index (CI): Percentage of water-holding containers infested with *Aedes larvae* or *pupae*. Breteau Index (BI): Number of positive containers per 100 houses inspected. The samples were selected randomly and included the temperature and humidity [17,18].

3. RESULTS

3.1. Urban Areas: The HI ranged from 21.7% to 45%, averaging 33.3% ; The CI ranged from 13.8% to 20.9%, averaging 17.2%. The BI ranged from 46.7 to 70, averaging 57.23 ;The highest infestation was seen in Al-Hali (HI 45%, CI 20.9%, BI 70) (Table 1).

Table 1. Entomological indices of *Aedes aegypti* in urban districts of Hodeidah, Yemen , 2017

	HI			CI			BI
District	**House (n)**	**Positive**	**%**	**Containers**	**Positive**	**%**	
Al-Hali	60	27	45	200	42	20.9	70
Al-Hawak	60	20	33.3	211	33	17	55
Al-Mina	60	13	21.7	206	28	13.8	46.7
Total	**180**	**60**	**33.3**	**617**	**103**	**17.2**	**57.23**

3.2. Rural Areas : The House Index (HI) ranged much wider, from 6.7% (Al Mighlaf) to 85.0% (Kamaran), averaging 52.3%—significantly higher than in urban areas. The Container Index (CI) ranged from 2.0% to *43.7*%, with a rural average of 23.4%—again higher than urban. The Breteau Index (BI) was markedly elevated in many districts, with values over 200 in several locations, and an average of 139.9, nearly three times the urban average (Table 2).

3.3. Seasonal trends in urban area

3.3.1. Winter recorded the highest overall vector indices, particularly in Al-Hali and Al-Hawak districts. Al-Hali had the highest HI (66.67%) and BI (113.33), indicating substantial domestic breeding. The winter peak is likely influenced by environmental factors such as increased household water storage due to irregular water supply, which creates favorable larval habitats (Table 3).

3.3.2. Spring also showed elevated indices, particularly in Al-Mina (HI = 46.67%, BI = 106.67), suggesting sustained breeding even after winter. The high CI in Al-Hali (26.09%) and Al-Mina (26.67%) further reflects the persistence of immature mosquitoes in domestic containers (Table 3).

3.3.3. In summer, infestation levels declined across all districts. Al-Hawak and Al-Mina showed low HI (13.33% and 26.67%, respectively) and BI (13.33 and 33.33), possibly due to higher temperatures reducing larval survival or increased community awareness and vector control efforts (Table 3)..

3.3.4. Autumn showed mixed trends. Al-Hawak again had a high HI (66.67%) and CI (35.9%), indicating a localized resurgence. In contrast, Al-Mina and Al-Hali had relatively lower values, suggesting district-level variability in vector density (Table 3). Al-Hali consistently recorded high infestation levels across seasons, with the highest HI and BI in winter and spring. This suggests that this district is a persistent hotspot requiring targeted interventions. Al-Hawak showed a fluctuating pattern, with a notable peak in autumn. This could be due to temporary lapses in vector control or localized breeding site proliferation. Al-Mina generally had lower HI and CI values but peaked in spring, which could reflect specific environmental or behavioral factors influencing vector breeding during that period. The overall House Index (HI) was 33.3%, the Container Index (CI) was 17.2%, and the Breteau Index (BI) was 57.23. These values exceed WHO thresholds for epidemic risk (HI > 5%, CI > 3%, BI > 20), indicating a high potential for arbovirus transmission, particularly dengue, in urban Hodeidah throughout the year (Table 3).

Table 2. Entomological indices of *Aedes aegypti* in rural Districts of Hodeidah, Yemen , 2017

District	HI			CI			BI
	House (n)	Positive	%	Containers	Positive	%	
Ad Dahi	60	35	58.3	371	90	25.9	150.0
Ad Durayhimi	60	18	30.0	677	61	7.5	101.7
Al Hujaylah	60	50	83.3	673	156	23.1	260.0
Al Jarrahi	60	28	46.7	271	36	16.5	60.0
Al Khukhah	60	16	26.7	306	36	11.9	60.0
Al Mansuriyah	60	25	41.7	272	54	21.0	90.0
Al Marawi'ah	75	25	33.3	453	53	12.9	70.7
Al Mighlaf	60	4	6.7	261	5	2.0	8.3
Al Munirah	90	39	43.3	423	65	17.1	72.2
Al Qanawis	90	72	80.0	474	190	40.9	211.1
Alluhayah	75	62	82.7	384	134	34.2	178.7
As Salif	60	50	83.3	453	198	42.9	330.0
At Tuhayta	60	37	61.7	228	70	31.3	116.7
Az Zaydiyah	75	59	78.7	470	202	43.0	269.3
Az Zuhrah	90	60	66.7	561	238	36.3	264.4
Bajil	165	41	24.8	770	35	4.9	20.0
Bayt Al Faqih	60	38	63.3	533	132	26.9	220.0
Hays	90	39	43.3	702	102	12.4	113.3
Kamaran	60	51	85.0	264	114	43.7	190.0
Zabid	60	19	31.7	307	33	11.9	55.0
Total	1470	768	52.3	8853	2004	23.4	139.9

Table 3. Entomological indices of *Aedes aegypti* in seasons urban of Hodeidah, Yemen – 2017

		HI			CI			BI
Seasons	**District**	**House (n)**	**Positive**	**%**	**Containers (n)**	**Positive**	**%**	
Winter	Al-Hali	15	10	66.67	54	17	31.48	113.33
	Al=Hawak	15	6	40	61	15	24.59	100
	Al-Mina	15	1	6.67	62	4	6.45	26.67
Spring	Al-Hali	15	8	53.33	46	12	26.09	80
	Al=Hawak	15	2	13.33	64	2	3.13	13.33
	Al-Mina	15	7	46.67	60	16	26.67	106.67
Autumn	Al-Hali	15	4	26.67	52	6	11.54	40
	Al=Hawak	15	10	66.67	39	14	35.9	93.33
	Al-Mina	15	1	6.67	54	3	5.65	20
Summer	Al-Hali	15	5	33.33	48	7	14.58	46.67
	Al=Hawak	15	2	13.33	47	2	4.26	13.33
	Al-Mina	15	4	26.67	30	5	16.67	33.33
	Total	**180**	**60**	**33.3**	**617**	**103**	**17.2**	**57.23**

3.4. Seasonal trends in rural area

3.4.1. Dengue density vector and seasonal variation in rural area

The data presented in Tables 4–7 highlight seasonal and geographic variations in the entomological indices — House Index (HI), Container Index (CI), and Breteau Index (BI) — of *Aedes aegypti* across rural districts of Hodeidah in 2017. These indices are critical indicators of dengue vector infestation levels. Across all districts, the spring and autumn seasons exhibited higher infestation levels compared to winter. For instance:

- **Alluhayah** had a **100% HI** in both spring and autumn, compared to **56.67% in winter**.
- **Az Zuhrah** recorded a **BI of 543.34 in autumn**, the **highest observed**, showing an alarming level of infestation.
- In **spring**, multiple districts such as **As Salif, Alluhayah, and Bayt Al Faqih** showed extremely high indices (HI and BI ≥ 100), suggesting peak breeding activity in this season.
- **Winter** showed the lowest overall indices; several districts like **Ad Durayhimi, Al Mighlaf, and Hays** recorded **0% positivity**, suggesting limited breeding activity in colder months.

3.4.2. Dengue density vector and geographical variation

There was significant variation between districts: Al Hujaylah, Az Zaydiyah, and Az Zuhrah consistently reported high indices across all seasons, indicating persistent vector presence and likely hotspots for dengue transmission. Conversely, Hays, Al Mighlaf, and Ad Durayhimi showed low to moderate indices, potentially due to environmental or socio-behavioral factors limiting mosquito breeding.

3.4.3. Most Affected Districts

Az Zaydiyah showed consistently high HI and BI**:** HI ranged from 80% in winter and spring to 83.33% in autumn, with BI as high as 546.67 in winter. Az Zuhrah had a notably high BI (543.34) in autumn, and high HI values in both spring and autumn.

Table 4. Entomological indices of *Aedes aegypti* in winter , rural districts of Hodeidah, Yemen , 2017

		HI			CI			BI
Season	District	House (n)	Positive	%	Containers (n)	Positive	%	
Winter	Ad Dahi	15	5	33.3	85	11	12.94	73.33
	Ad Durayhimi	15	0	0	80	0	0	0
	Al Hujaylah	15	15	100	200	55	27.5	366.67
	Al Jarrahi	15	5	33.3	100	5	5	33.33
	Al Khukhah	15	4	26.67	84	6	7.15	40
	Al Mansuriyah	15	6	40	95	11	11.58	73.33
	Al Marawi'ah	15	1	6.67	81	1	1.23	6.67
	Al Mighlaf	15	0	0	76	0	0	0
	Al Munirah	15	4	26.67	142	4	2.82	26.67
	Al Qanawis	30	25	83.34	236	93	40.44	310
	Alluhayah	30	17	56.67	73	17	23.05	56.67
	As Salif	15	11	73.33	108	37	34.26	246.67
	At Tuhayta	15	7	46.67	52	28	53.85	186.67
	Az Zaydiyah	15	12	80	254	82	32.28	546.67
	Az Zuhrah	30	22	73.34	138	42	31.05	140
	Bajil	45	16	35.6	457	22	6.14	48.9
	Bayt Al Faqih	15	7	46.67	179	18	10.06	120
	Hays	15	0	0	0	0	0	0
	Kamaran	15	11	73.33	71	24	33.8	160
	Zabid	15	7	46.67	134	15	11.19	100

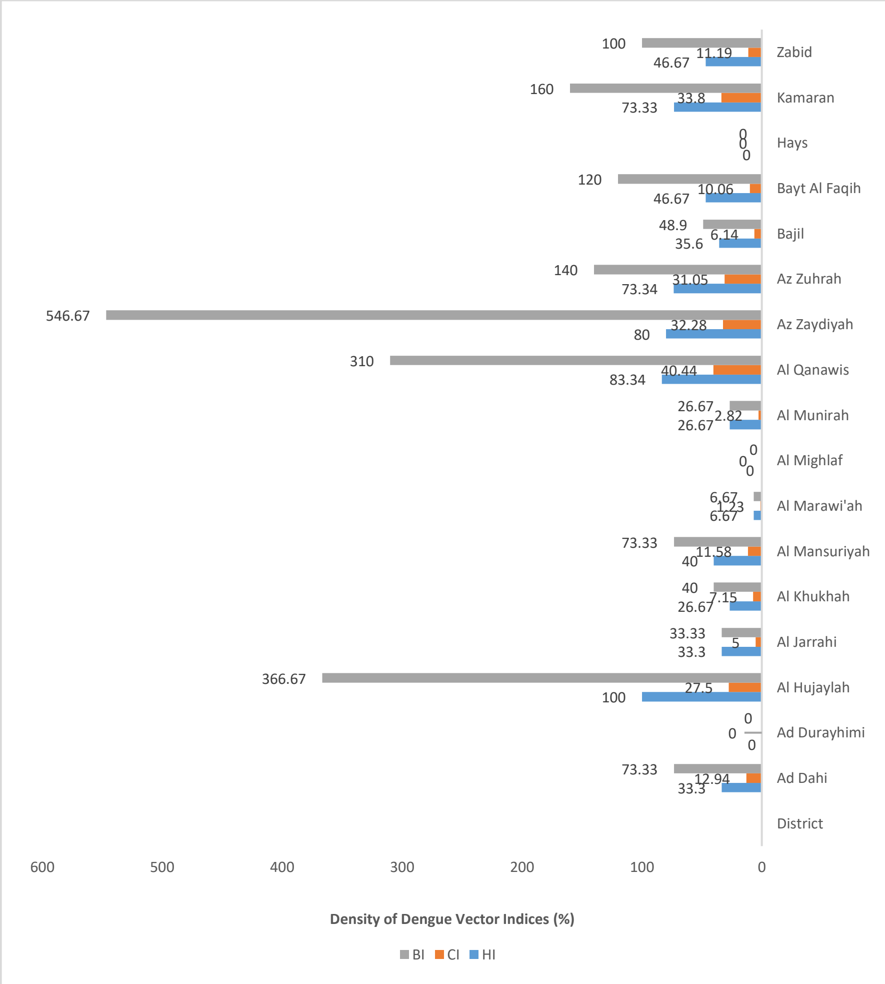

Figure 1. Density of dengue vector indices in winter , rural districts of Hodeidah, Yemen , 2017

Table 5. Entomological indices of *Aedes aegypti* in season spring, rural districts of Hodeidah, Yemen , 2017

		HI			CI			BI
Season	**District**	**Houses (n)**	**Positive**	**%**	**Containers (n)**	**Positive**	**%**	
Spring	Ad Dahi	15	11	73.33	99	35	35.35	233.33
	Ad Durayhimi	15	2	13.33	141	6	4.26	40
	Al Hujaylah	15	12	80	138	34	24.64	226.67
	Al Jarrahi	15	10	66.67	51	14	27.45	93.33
	Al Khukhah	15	6	40	61	20	32.79	133.33
	Al Mansuriyah	15	5	33.33	54	13	24.07	86.67
	Al Marawi'ah	15	10	66.67	39	14	35.9	93.33
	Al Mighlaf	15	2	13.33	65	3	4.62	20
	Al Munirah	15	10	66.67	55	12	21.82	80
	Al Qanawis	15	13	86.67	60	25	41.67	166.67
	Alluhayah	15	15	100	77	37	48.05	246.67
	As Salif	15	15	100	169	78	46.15	520
	At Tuhayta	15	10	66.67	52	10	19.23	66.67
	Az Zaydiyah	15	12	80	67	40	59.7	266.67
	Az Zuhrah	15	2	13.33	43	5	11.63	33.33
	Bajil	15	2	13.33	50	2	4	13.33
	Bayt Al Faqih	15	15	100	123	39	31.7	260
	Hays	15	9	60	97	21	21.65	140
	Kamaran	15	14	93.33	72	28	38.89	186.67
	Zabid	15	0	0	75	0	0	0

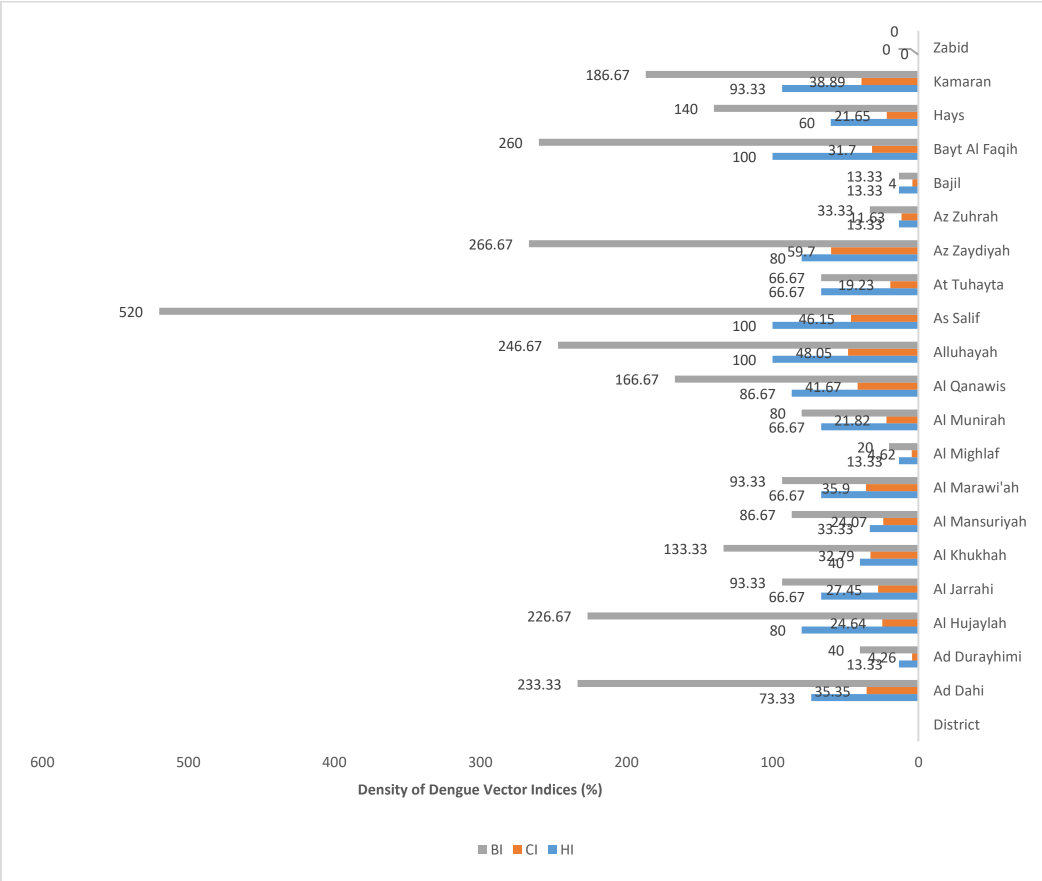

Figure 2. Density of dengue vector indices in spring , rural districts of Hodeidah, Yemen , 2017

Table 6. Entomological indices of *Aedes aegypti* in summer , rural Districts of Hodeidah, Yemen,2017

Season	District	HI			CI			BI
		Houses (n)	Positive	%	Containers (n)	Positive	%	
Summer	Ad Dahi	15	5	33.33	122	17	13.93	113.33
	Ad Durayhimi	15	6	40	262	20	7.63	133.33
	Al Hujaylah	15	9	60	172	31	18.02	206.67
	Al Jarrahi	15	6	40	77	6	7.79	40
	Al Khukhah	15	0	0	30	0	0	0
	Al Mansuriyah	15	8	53.33	51	12	23.53	80
	Al Marawi'ah	15	8	53.33	94	23	24.47	153.33
	Al Mighlaf	15	1	6.67	59	1	1.69	6.67
	Al Munirah	15	0	0	40	0	0	0
	Al Qanawis	15	7	46.67	62	11	17.74	73.33
	Alluhayah	15	15	100	176	53	30.11	353.33
	As Salif	15	13	86.67	110	57	51.81	380
	At Tuhayta	15	11	73.33	64	12	18.75	80
	Az Zaydiyah	15	10	66.67	52	22	42.31	146.67
	Az Zuhrah	15	9	60	92	28	30.43	186.67
	Bajil	15	1	6.67	52	2	3.85	13.33
	Bayt Al Faqih	15	8	53.33	73	25	34.25	166.67
	Hays	15	5	33.33	116	10	8.62	66.67
	Kamaran	15	13	86.67	63	35	55.56	233.33
	Zabid	15	6	40	50	11	22	73.33

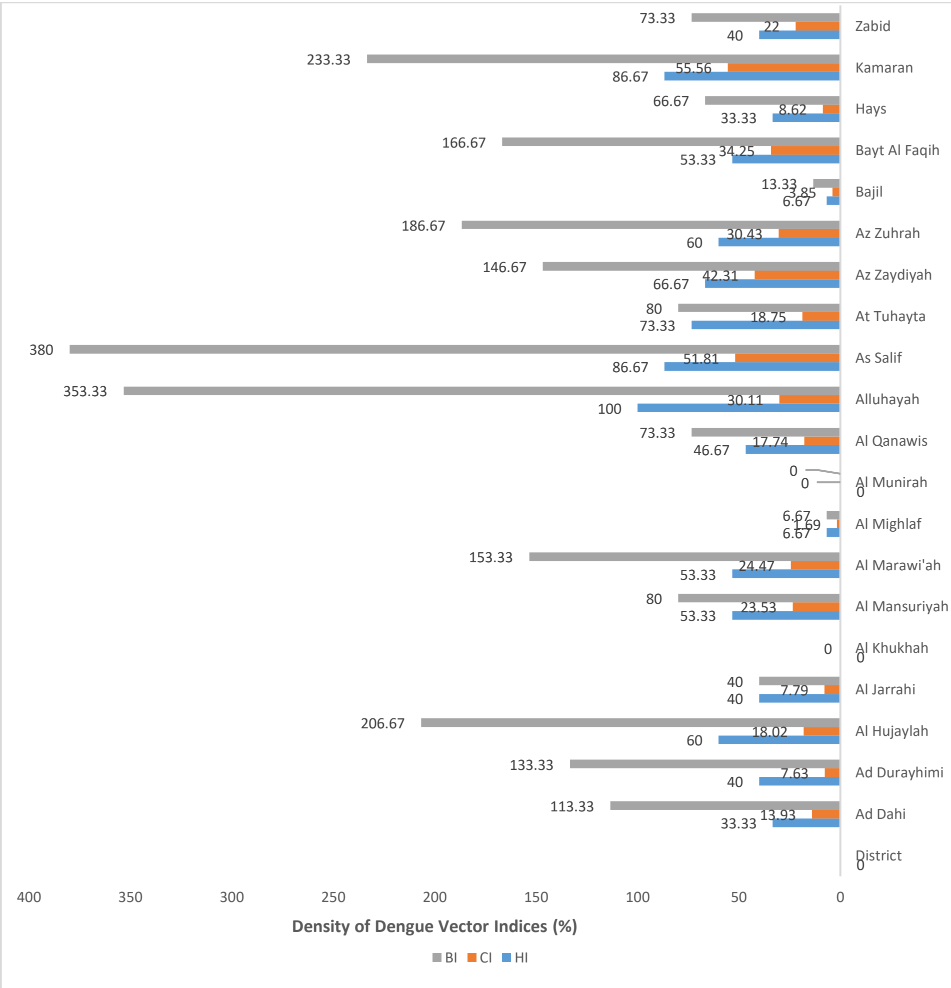

Figure 3. Density of dengue vector indices in summer , rural districts of Hodeidah, Yemen , 2017

Table 7. Entomological indices of *Aede aegypti* in season autumn , rural districts of Hodeidah, Yemen ,2017

Season	District	HI			CI			BI
		Houses (n)	Positive	%	Containers (n)	Positive	%	
Autumn	Ad Dahi	15	14	93.33	65	27	41.54	180
	Ad Durayhimi	15	10	66.67	194	35	18.04	233.33
	Al Hujaylah	15	14	93.33	163	36	22.09	240
	Al Jarrahi	15	7	46.67	43	11	25.58	73.33
	Al Khukhah	15	6	40	131	10	7.63	66.67
	Al Mansuriyah	15	6	40	72	18	25	120
	Al Marawi'ah	30	6	20	239	15	1.37	50
	Al Mighlaf	15	1	6.67	61	1	1.64	6.67
	Al Munirah	30	23	76.67	126	46	36.43	153.33
	Al Qanawis	30	27	90	116	61	52.5	203.34
	Alluhayah	15	15	100	58	27	46.55	180
	As Salif	15	11	73.33	66	26	39.39	173.33
	At Tuhayta	15	9	60	60	20	33.33	173.33
	Az Zaydiyah	30	25	83.33	97	58	58.58	193.33
	Az Zuhrah	30	27	90	288	163	56.7	543.34
	Bajil	45	9	20	211	9	4.21	20
	Bayt Al Faqih	15	8	53.33	158	50	31.65	333.33
	Hays	30	20	66.67	318	60	18.87	200
	Kamaran	15	13	86.67	58	27	46.55	180
	Zabid	15	6	40	48	7	14.58	46.67

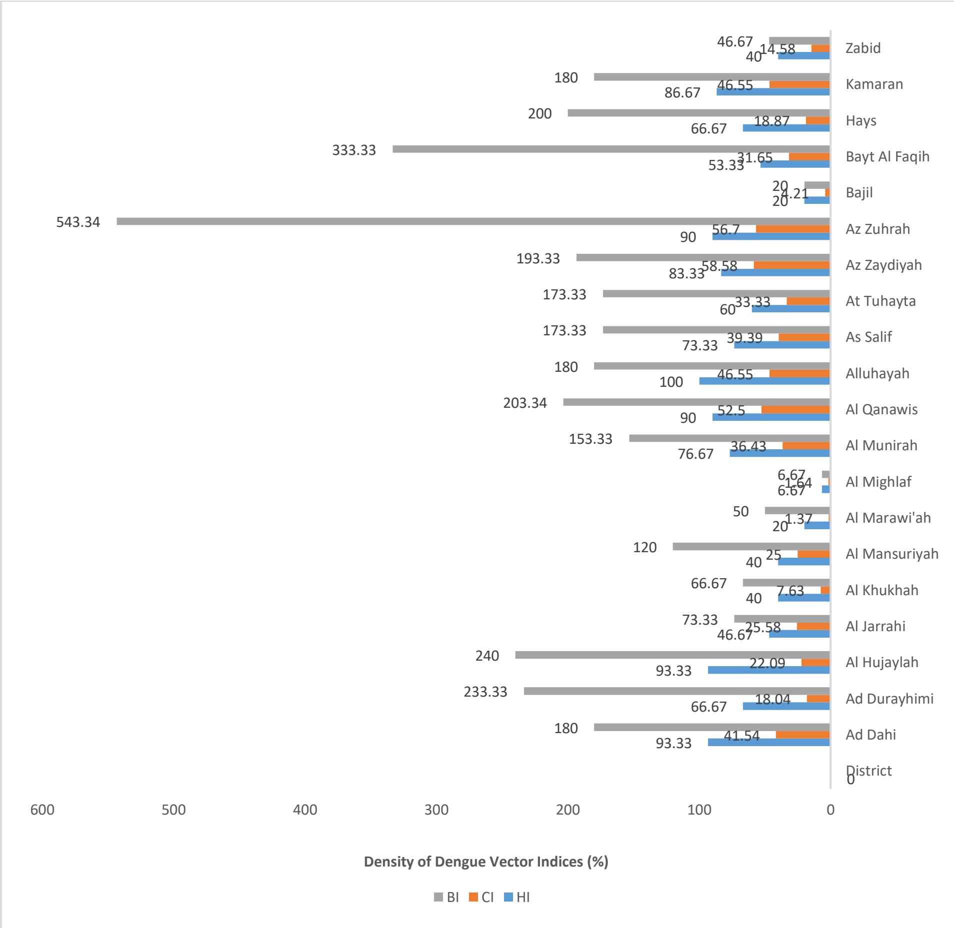

Figure 4. Density of dengue vector indices in autumn , rural districts of Hodeidah, Yemen , 2017

3.5. Overall of density of dengue vector

Finally , the table 8 summarizes HI, CI , and BI for *Aedes aegypti*, the primary vector for dengue, across four seasons.

3.5.1. House Index (HI)

The HI represents the percentage of houses infested with larvae or pupae: Highest in autumn (58.55%), indicating significant household infestation during cooler months. A gradual decline is observed through spring (55.65%) and summer (44.06%). Slight increase in winter (43.28%), possibly due to post-monsoon water stagnation . This suggests that *Aedes aegypti* breeding in households is persistent year-round, but peaks in the winter, possibly due to water storage practices and favorable humidity.

3.5.2. Container Index (CI)

CI indicates the percentage of water-holding containers infested: autumn (27.62%) and Spring (25.63%) show higher infestation in containers, aligning with the high HI values. Winter (17.63%) and summer (19.48%) show relatively lower container infestation. The consistently Q high CI values point toward pervasive breeding in domestic containers, underscoring the need for vector control focused on container hygiene and elimination.

3.5.3. Breteau Index (BI)

The BI measures the number of positive containers per 100 houses inspected: Winter again shows the highest BI (153.19), indicating widespread breeding. The lowest is in summer (113.04), likely due to decreased water availability and higher temperatures which may reduce mosquito survival. Spring and winter exhibit intermediate values (135.07 and 120.68, respectively). A BI above 50 is considered a significant dengue transmission risk. All seasonal BI values exceed this threshold, implying a continuous high risk of dengue transmission throughout the year.

Table 8. Summary Entomological indices of *Aedes aegypti* in Seasons of Hodeidah, Yemen – 2017

Season	HI (%)	CI (%)	BI
Winter	43.28	17.63	120.68
Spring	55.65	25.63	135.07
Summer	44.06	19.48	113.04
Autumn	58.55	27.62	153.19

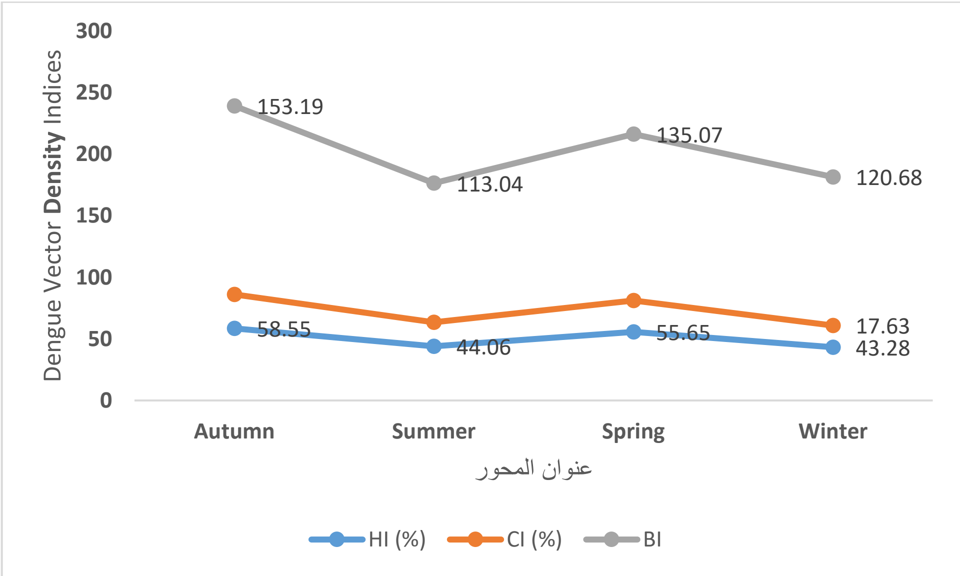

Figure 5. Summary Entomological indices of *Aedes aegypti* in Seasons of Hodeidah, Yemen , 2017

4. DISCUSSION

This study provides detailed entomological data illustrating the widespread infestation of Aedes aegypti across both urban and rural districts of Hodeidah, Yemen. This suggests that *Aedes aegypti* breeding in households is persistent year-round, but peaks in the autumn, possibly due to water storage practices and favorable humidity. The consistently high CI values point toward pervasive breeding in domestic containers, underscoring the need for vector control focused on container hygiene and elimination. The significantly elevated Breteau Index (BI) in rural areas—averaging 139.9 compared to the WHO epidemic threshold of 50—signifies an alarming risk for dengue outbreaks [18]. On the other mean , A BI above 50 is considered a significant dengue transmission risk. All seasonal BI values exceed this threshold, implying a continuous high risk of dengue transmission throughout the year. These results are consistent with epidemiological studies from Brazil and India, which confirm that vector indices rise sharply during wetter seasons, contributing to seasonal outbreaks [19-21]. The high indices observed, particularly in spring and autumn, suggest: Increased risk of dengue transmission during these periods. Need for seasonal vector control interventions, especially in high-index districts. Continuous monitoring and targeted vector management efforts. Several studies in the world namely South America A high presence of *Aedes aegypti* mosquitoes in Urabá, Antioquia, Colombia poses a significant risk for dengue outbreaks. This study assessed dengue transmission risk by measuring mosquito population levels and viral presence in two municipalities—Apartadó and Turbo—between 2021 and 2022. Researchers conducted quarterly entomological surveys across three neighborhoods, calculating mosquito indices (housing, reservoir, and Breteau), mosquito density per dwelling and per person, and conducted virus detection. Mosquito indices: 48.9% (housing), 29.5% (reservoir), 70.2% (Breteau). Average densities: 1.47 females per dwelling and 0.51 per person. Mosquito density correlated with humidity and rainfall in two neighborhoods Dengue virus serotypes DENV-1 and DENV-2 were detected. Indices were lower than those reported in 2014, though similar to other Latin American studies [22]. In Brazil, climatic factors such as temperature, humidity, and rainfall directly influence the presence and distribution of *Aedes aegypti*, regardless of location. These conditions also drive changes in mosquito populations, allowing them to adapt to local environments [23-26]. Contributing factors to high vector density include poor water management, lack of waste disposal, and insufficient public awareness, particularly in rural and marginalized communities [27]. Compounded by Yemen's fragile healthcare infrastructure and protracted conflict, these conditions hinder effective vector surveillance and response [10]. Seasonal peaks in infestation, most pronounced during autumn and spring, align with previous regional findings indicating heightened mosquito activity during periods of lower temperature and higher humidity [28]. The study also reaffirms the need for Integrated Vector Management (IVM), combining environmental, chemical, and biological strategies [29]. IVM approaches—successfully adopted—are critical for long-term reduction of vector habitats and involve multi-sectoral collaboration and community participation [30]. It is also imperative to link entomological surveillance with meteorological data for predictive vector risk modeling [1]. Finally. previous about vector –borne diseases were carried out in Hodeidah, Yemen that infected the peoples such as Dengue (DEN) [31-33], Malaria [34], Chikungunya fever (CHIK) [35] and West Nile virus (WNV) [36] . Therefore , dengue control in Hodeidah faces major difficulties due to a combination of conflict, poor infrastructure, and environmental factors. Ongoing political instability disrupts health services and restricts movement, making it difficult to conduct vector control activities. Poor sanitation and water scarcity lead to widespread mosquito breeding grounds, as people store water in uncovered containers and garbage accumulates. The weak health system lacks the tools and staff for effective surveillance and treatment, while public awareness of dengue prevention is limited. Hodeidah's hot, humid climate supports year-round mosquito breeding, and climate changes worsen outbreaks. Additionally, reduced international funding and aid hinder sustained control efforts.

5. CONCLUSION

The study revealed seasonally dynamic trend , with peak infestation in autumn and spring lowest levels in summer. However, all indices remain well above WHO thresholds for dengue risk year-round, suggesting the need for continuous vector control efforts, especially during winter and autumn. Public health strategies should prioritize community education, regular inspection of containers**,** and sustainable water storage practices to effectively curb vector proliferation.

Data Availability
No data were used to support this study.

Conflicts of Interest
The authors declare that they have no conflicts of interest.

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This work was conducted during our work at CTMID – Al Thawara Public Hospital Authority, Hodeidah,Yemen.

Ethical Approval
The studies involving human participants were reviewed and approved by the Ethics Committee of Tropical Medicine and Epidemiology Studies of Hodeidah University (CTMES-HU), Hodeidah, Yemen **.**

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