

## RESEARCH ARTICLE

## EVALUATION OF SOME HEMATOLOGICAL AND SEROLOGICAL CHANGES IN DENGUE PATIENTS OF LAHJ-YEMEN

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## Abstract

The present study aimed to evaluate the changes in WBC and platelet count and detection of NS1 antigen, IgM and IgG antibodies in dengue patients. There were 103 confirmed cases of dengue including 49(47.6%) females and 54(52.4%) males. The WBC count was less than (2000 / $\mu$ l) in 16 cases and was ranging between (2000-4000 / $\mu$ l) in 44 cases. The platelets count decreased to <50000/ $\mu$ l in 4 (3.9%) of cases, <100,000/ $\mu$ l (50,000- 100,000/ $\mu$ l) in 14 (13.6%) of cases, and were between (100000-150000/ $\mu$ l) in 12 cases. About 83 (80.6%) patients were positive NS1 antigen, and 4 (3.9%) patients had IgM antibodies against dengue. Remaining 16 (15.5%) had both IgM and IgG antibodies against dengue. The identification of NS1 antigen, WBC and platelet count can be used as predictors of dengue infection.

**Keywords:** Dengue Fever, serology, WBC count, PLT count.

## 1. Introduction

Dengue fever (DF) is caused by mosquito-borne single-stranded (RNA) positive-strand Dengue virus (DENV), which has four serotypes of the dengue virus (DEN-1, DEN-2, DEN-3, and DEN-4) also referred to as an arbovirus (arthropod-borne viruses). It belongs to the family Flaviviridae, genus Flavivirus [1-3] and manifests as an acute febrile illness [4,5] in tropical and subtropical areas more than 100 countries and districts displayed dengue endemic [6-8], including Yemen. [9-12]

Transmission to humans occurs by the female bite of the *Aedes aegypti* mosquito, which infected by four serotypes of the virus. The incubation period of the virus in humans ranges from 3 to 15 days with an average of 5 days following the transmission. [13, 14]

Dengue fever disease characterized by sudden onset of fever of 3-5 days with some symptoms, like intense headache, myalgia, retro-orbital pain, anorexia, gastrointestinal disturbances and rash [15]. Therefore, specific laboratory tests are necessary for an accurate diagnosis.

Thrombocytopenia and leukopenia serve as a predictive marker to promote the early diagnosis of dengue infection. Apart from the dengue-specific parameters, the platelet count is the only accessory laboratory test available in the

peripheral areas that can support the diagnosis of DHF or DSS. [5, 16]

The nonstructural proteins are involved in viral translation, transcription, and replication. Among these proteins, an NS1 is involved in viral RNA replication. Notably, NS1 is expressed on the surface of infected cells without forming part of the virion. Serum levels of secreted NS1 (sNS1) positively correlate with viral titers and have been a useful tool in dengue infection diagnosis [17, 18]. The detection of IgM and IgG antibodies are used for diagnosis of dengue, where the most widely used serological techniques for routine treatment of dengue virus infections are the IgM antibody-capture enzyme-linked immunosorbent assay (MAC-ELISA) [19-21]. In the present study, we evaluated the hematological profile of seropositive (IgM) dengue fever patients.

## 2. Materials and methods

The study carried out with 103 patients diagnosed with dengue, include 54 male (M) and 49 female (F). The case definition was based on the examination of CBC for estimating WBC and platelet count. The detection of (NS1) protein serological test for dengue were done using Dengue Ag Rapid Test and Dengue IgG/IgM Combo Rapid Test. All diagnosis was done at AL-Jamaheer Medical Center, Lahj during the period from July-September 2018.

### 3. Results and discussion

About 103 patients with dengue fever data were used in this study. Patients got admitted to AL-Jamaheer Medical Center from a different area of Tuban district, Lahej. Figure 1. Shows the residence of the studied cases with dengue fever, we observed a higher percentage of patients with dengue fever were from Bir Nasser area (27.18%), followed by AL-Fayush area (14.56%).

**Figure (1):** Residence of the studied patients with dengue fever.

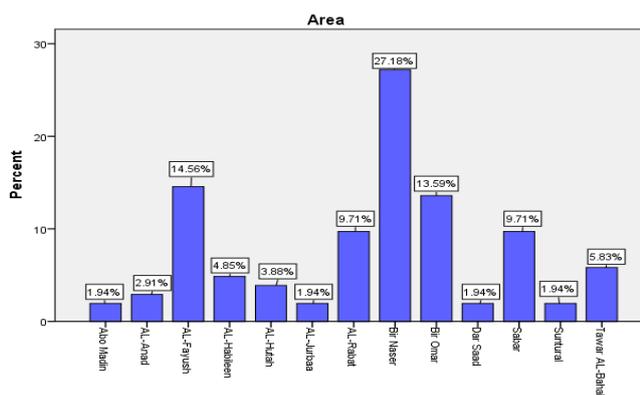


Table (1) indicates the frequency of dengue fever according to age and sex. The age of patients with dengue fever ranged from 1 to 60 years. The female patients from about (47.6%) were slightly lower than male patients (52.4%). The maximum frequency of dengue fever was in the age group of 10. - 20.00 years (33.0%) followed by 21 - 30.00 years (25.2%) and 31 - 40.00 years (15.5%) respectively.

**Table (1):** Frequency of dengue fever according to Age and Sex.

Age	Sex				Total	
	F	%	M	%	N	%
≤ 10.00	7	53.8%	6	46.2%	13	12.6%
10. - 20.00	16	47.1%	18	52.9%	34	33.0%
21. - 30.00	13	50%	13	50%	26	25.2%
31 - 40.00	8	50%	8	50%	16	15.5%
41 - 50.00	4	40.0%	6	60.0%	10	9.7%
> 50	1	25.0%	3	75.0%	4	3.9%
Total	49	47.6%	54	52.4%	103	100.0%
Mean age±SD	24.19±13.68		26.35±14.53		25.32± 14.10	

The collected specimens were diagnosed by serological tests to detect NS1 antigen and IgM and IgG antibodies against the dengue virus. The serological diagnosis of studied cases result in detecting about 83 (80.6%) patients, who were NS1 antigen positive and 4 (3.9%) patients had IgM antibodies against dengue. Remaining 16 (15.5%) had both IgM and IgG antibodies against dengue (Table 2).

**Table (2):** Frequency of dengue fever according to a Serological prevalence and Sex.

Serological	Sex				Total	
	F	%	m	%	N	%
NS1+	43	51.8%	40	48.2%	83	80.6%
IgM+	2	50.0%	2	50.0%	4	3.9%
IgM+IgG+	4	25.0%	12	75.0%	16	15.5%
Total	49	47.6%	54	52.4%	103	100.0%

Dengue NS1 antigen testing is a direct method of dengue virus detection. It used to achieve an early, conclusive, and serotype-specific diagnosis if it has been less than five days since the onset of fever rapidly, and at a lower cost than other methods such as PCR. [22]

Dengue IgM and/or IgG are the tests of choice after the first five days of illness, IgM is detected 5 or more days after the onset of illness in the majority of infected individuals and immunoglobulin IgG is detected from 10–15 days. In secondary infections, IgM appears earlier or in the same time frame but are usually at lower titers than in primary infection. IgG is present from the previous infection and the titer increases rapidly. [20, 23]

The CBC test is one of detecting method used for in dengue patients, we observed the decreasing of WBC (leukopenia) followed by platelets (thrombocytopenia) by the day of the fever, specifically on days 3 to 7 of fever.

As shown in Table (3), among studied 103 cases, 16 cases had a lower total WBC count, were less than (2000 /µl) and the total WBC count of 44 cases was ranging (2000-4000 /µl). The remaining cases had more than (4000/µl). Leukopenia was found from day 3 of fever and the incidence increased on successive days of the fever until day 5 and then there was a gradual recovery.

The platelet count were of <50000/µl in 4 (3.9%) of cases, <100,000/µl (50,000- 100,000/µl) in 14 (13.6%) of cases, and were between (100000-150000/µl) in 12 cases. (Table 4).

The WBCs and platelet count alter each day of the fever in patients infected with dengue. The platelet and WBC counts were found to be predictive as well as recovery parameters of dengue fever [21, 24]. Leucopenia is usually observed in the course of dengue fever. Both DF and DHF patients showed mean values less than 5000/µl [25]. A total leucocyte count of less than  $2.6 \times 10^9/L$  and platelet count less than  $100 \times 10^9/L$  at day 2.5 was highly suggestive of a child progressing into DHF [26]. These findings were similar to our study. According to WHO guidelines, the thrombocytopenia are one of the criteria, that is used as a potential indicator of clinical severity [27, 28]. In the most recent 2009 WHO guidelines, the definitions generally describe a rapid decline in platelet count or a platelet count less than 150,000 per microliter of blood. [29]

**Table (3):** Frequency of dengue fever according to a White blood cell and Age

Age	WBC Count/ $\mu$ l					Total
	<2000	2000-3000	3000-4000	4000-5000	>5000	
	N (%)	N (%)	N (%)	N (%)	N (%)	
< 10	(0)0.0%	(2)15.4%	(3) 23.1%	(4)30.8%	(4) 30.8%	(13)12.6%
10-20	(4)11.8%	(8)23.5%	(8) 23.5%	(5) 14.7%	(9) 26.5%	(34)33.0%
21- 30	(6)23.1%	(6)23.1%	(2) 7.7%	(5)19.2%	(7) 26.9%	(26) 25.2%
31-40	(4)25.0%	(2)12.5%	(3) 18.8%	(2) 12.5%	(5)31.3%	(16)15.5%
41-50	(1)10.0%	(1)10.0%	(5) 50.0%	(0) 0.0%	(3) 30.0%	(10)9.7%
>50	(1)25.0%	(1)25.0%	(1) 25.0%	(0) 0.0%	(1) 25.0%	(4)3.9%
<b>Total</b>	<b>(16)155%</b>	<b>(20)19.4%</b>	<b>(22)21.4%</b>	<b>(16)15.5%</b>	<b>(29)28.2%</b>	<b>(103)100%</b>

**Table (4):** Frequency of dengue fever according to a platelet cell and Age.

Age	PLT Count/ $\mu$ l				Total
	<50000	50000-100000	100000-150000	>150000	
	N (%)	N (%)	N (%)	N (%)	
< 10	1(7.7%)	1(7.7%)	3(23.1%)	8(61.5%)	13(12.6%)
10-20	0(0.0%)	3(8.8%)	2(5.9%)	29(85.3%)	34(33.0%)
21- 30	0(0.0%)	6(23.1%)	1(3.8%)	19(73.1%)	26(25.2%)
31-40	1(6.3%)	3(18.8%)	2(12.5%)	10(62.5%)	16(15.5%)
41-50	1(10.0%)	1(10.0%)	2(20.0%)	6(60.0%)	10(9.7%)
>50	1(25.0%)	0(0.0%)	2(50.0%)	1(25.0%)	4(3.9%)
<b>Total</b>	<b>4(3.9%)</b>	<b>14(13.6%)</b>	<b>12(11.7%)</b>	<b>73(70.9%)</b>	<b>103(100%)</b>

According to WHO (2011), Dengue fever (DF) is characterized by leukopenia, WBC < 5000/ $\mu$ l, thrombocytopenia (100000- 150,000/ $\mu$ l) while Dengue Hemorrhagic Fever (DHF) was characterized by thrombocytopenia (<100,000/ $\mu$ l) Add to leukopenia (WBC) < 5000/ $\mu$ l). [29.30]

In our study, we observed leucopenia (White Blood Cells (WBC) < 5000/ $\mu$ l) with thrombocytopenia (100000- 150,000/ $\mu$ l) in 11 (14.9%) and the same of number with leukopenia (WBC) < 5000/ $\mu$ l) with thrombocytopenia (< 100,000 / $\mu$ l).

**Table (5):** Frequency of dengue fever according to WBC and Platelet.

WBC	PLT Count / $\mu$ l						Total	
	<100000		100000-150000		>150000		N	%
	N	%	N	%	N	%		
<5000	11	14.9%	11	14.9%	52	70.3%	74	71.8%
>5000	7	24.1%	2	6.9%	20	69.0%	29	28.2%
<b>Total</b>	<b>18</b>	<b>17.5%</b>	<b>13</b>	<b>12.6%</b>	<b>72</b>	<b>69.9%</b>	<b>103</b>	<b>100.0%</b>

### Conclusion

Among 103 cases of dengue, we observed that (14.9%) had DF and the same number (14.9%) also had DHF cases according to classification WHO. In endemic countries can be useful Peripheral blood parameters as thrombocytopenia and leukopenia with serology confirmation in the prediction of prognosis of dengue and thus assessed can be of value for better care of complicated cases.

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## مقالة بحثية

### تقييم بعض التغيرات الدموية والمصلية في مرضى حمى الضنك في لحج - اليمن

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## المخلص

تهدف الدراسة إلى تقييم التغيرات في كريات الدم البيضاء، وعدد الصفائح الدموية، والكشف عن مولد الضد NS1، والغلوبولين المناعي (IgM & IgG) في مرضى حمى الضنك. شملت الدراسة 103 حالة منها 49 (47.6%) إناث و54 (52.4%) ذكور. أظهرت النتائج انخفاض في عدد كريات الدم البيضاء لأقل من (2000 / ميكرو لتر) في 16 حالة، بينما تراوح كريات الدم البيضاء بين (2000-4000 / ميكرو لتر) 44 حالة. وانخفضت عدد الصفائح الدموية إلى أقل من 50000 / ميكرو لتر في 4 (3.9%) حالات، تلاها 14 (13.6%) حالات بمعدل (50000-100000 / ميكرو لتر)، وتراوح بين (100000-150000 / ميكرو لتر) في 12 حالة. أظهر اختبار الكشف عن مولد الضد (NS1) إيجابية في حوالي 83 (80.6%) من المرضى بينما 4 (3.9%) من المرضى كانوا إيجابيين للغلوبولين المناعي (IgM) لحمى الضنك، البقية حوالي 16 حالة (15.5%) إيجابيين لكلا من الغلوبولين المناعي (IgG و IgM) لحمى الضنك. ويعد استخدام اختبار مواد الضد NS1 والكريات البيضاء، وعدد الصفائح الدموية مؤشرات تنبؤية للإصابة بحمى الضنك.

الكلمات الرئيسية: حمى الضنك، الأمصال، عدد كريات الدم البيضاء، عدد الصفائح الدموية.