IJBPAS, September, 2022, 11(9): 4229-4236

ISSN: 2277–4998

International Journal of Biology, Pharmacy and Allied Sciences (IJBPAS)

'A Bridge Between Laboratory and Reader'

www.ijbpas.com

AN EPIDEMIOLOGICAL STUDY ON SUSCEPTIBILITY OF HUMANS TO DENGUE FEVER IN RELATION TO BLOOD GROUPS, AGE AND SEX

NAGABHUSHAN REDDY M*, GNANESWARI CH AND RAJAMMA M

School of Life Sciences, Rayalaseema University, Kurnool-518007 (A.P.), India

***Corresponding Author: Dr. M. Nagabhushan Reddy: E Mail: mnabhushr@gmail.com**

Received 16th Oct. 2021; Revised 20th Nov. 2021; Accepted 20th Jan. 2022; Available online 1st Sept. 2022

https://doi.org/10.31032/IJBPAS/2022/11.9.6375

ABSTRACT

Dengue fever is the fastest spreading mosquito-borne viral disease in the world, affecting millions of humans annually. Studies on association of blood groups with dengue fever are less informative and further age and sex with dengue fever is very limited. Hence to study the susceptibility of human population to dengue fever concerning their blood groups, age and sex. Human individuals both admitted and outpatients were divided into '7' groups according to their age (between 1 to 70 years) & sex. Alongside the serum samples were collected. Hospital based case control study has been done to determine the susceptibility of human individuals to dengue fever in relation to their blood groups, age and sex. DMR test, where Values are means (n=6) which do not share common superscript differ significantly at $p<0.05$. This study finds that the occurrence of dengue fever is more in human individuals with blood group B^+, followed by O, A, AB and age groups between 1 & 20 years and 41 & 60 years of males and females where males are more susceptible to dengue fever than females. Blood group B^+, aged between 1 & 20 years and 41 & 60 years and males are more prone to the occurrence of dengue fever.

Keywords: Age, Blood groups, Dengue, Epidemiology, Sex

INTRODUCTION

Factors such as urbanization, global travel and human population in growth have increased the potential for mosquitoes to proliferate and hence cause diseases on wider scale. Although the pathogeneses of arthropod-borne diseases differ, their clinical and biological presentations are unspecific **[1]**. Dengue is a viral infection

transmitted by mosquitoes mainly the *Aedes aegypti*. There are four strains or serotypes of dengue virus "DENV", meaning that it is possible to be infected four times **[2]**. Around 1 million confirmed cases are reported annually by the national vector borne disease control programme (NVBDCP) in India **[3]**. Although *A. aegypti* is associated with most infections, *A. albopictus* range is expanding and may be associated with increasing numbers. These species of mosquitoes tend to live indoors and are active during the day. Transmissions perinatally, via blood transfusions, breast milk and by organ transplantation have been reported **[4]**.

The dengue viral serotype causing disease outbreaks has varied with time as has the occurrence of severe dengue fever. Rapid laboratory identification of dengue fever includes NS1 antigen detection and serological tests. Serological tests are only useful after several days of infection and may be associated with false positives due to other *flavivirus* infections such as yellow fever or Zika virus **[5]**. Serology will reveal a marked increase in immunoglobulins **[6]**.

The blood groups are determined by antigens on the surface of red cells; The ABO and Rh systems are the two major blood groups, but incompatibilities involving many other blood groups may cause haemolytic transfusion reactions and/or haemolytic disease of the newborn (HDN) **[7]**. A relationship between blood groups and disease was first hypothesized by Kaipainen and Vuorinen **[8]** during 1960 and the gene involved in different blood groups was discovered in 1990 **[7]**.

Ageing is accompanied by decline in immune system function and immune alteration which increases susceptibility to infections **[9]**. However, the studies to show the relationship between dengue fever, its severity and A, B, AB & O blood groups, especially in relation to age and sex is very limited. Hence we thought that there could be a significant relationship between A, B, AB, O, Rh blood groups, age and sex and dengue fever, its severity and studied them in both the admitted & out patients.

MATERIALS AND METHODS

This study was done for 18 months i.e. from July 2018 to December 2019. Human individuals both admitted and outpatients were divided into '7' groups according to their age (between 1 to 70 years) & sex. Alongside the serum samples were collected. Diagnosis for dengue fever was done by enzyme linked immunosorbent assay (ELISA) for immunoglobulin IgM **[10]**. Blood groups were determined by standard haemagglutination assays **[11]** and these procedures were followed in accordance with ethical standards as per the guidelines laid down by central ethical committee of Indian Council of Medical Research. This

study and the collection of data were carried out with the approval of institutional review board.

Statistical analysis of the data was analyzed by 'DMR test' and observed that the individuals of different age groups from 1 to 70 years distinguishing males and females along with their blood groups suffering from dengue fever, where $p<0.05$ considered as significant. Individuals not being diagnosed with dengue fever are treated as controls in the respective sample size and total sample size too.

RESULTS

The collected data of present study indicates that the occurrence of dengue fever is more in B^+ blood group followed by O^+ both in male and female patients **(Tables 1 & 2)**. The order of occurrence of dengue based on blood group is $B^+ > O^+ > A^+ > AB^+ > AB^- > O^- > B^- > A^-$. With reference to age groups, the four age groups i.e. two between 1 & 20 years and other two between 41 & 60 years in both the males and females are more susceptible to dengue fever than the other age groups indicating $p<0.05$ is significant.

The other interesting aspect is based on the sex of the individuals that we observed males are more prone to dengue fever when compared to females **(Table 3)** and it reflects in the affected %. As B^+ blood group is present in majority of the individuals as is being observed even, it is more prone to dengue fever then by O^+ blood group with the same features. A^- blood group being rare the same phenomenon with respect to the occurrence of dengue fever also. The remaining blood groups A^+ , AB^+, O^- , B^- and AB^- being intermediate with regard to their presence in the individuals the same pattern even in the occurrence of dengue fever was observed in this study.

Table 1: Occurrence of dengue fever – blood groups, age groups, sex

Blood group	Males							Females						
	Age group [in years]							Age group [in years]						
	1-10	11-20	21-30	31-40	41-50	51-60	61-70	1-10	11-20	21-30	31-40	41-50	51-60	61-70
O^+	3	8	2	0	5	4	2	3	6	2	1	5	0	1
O^-	0	0	0	0	2	0	0	0	0	0	0	0	0	0
B^+	6	12	6	9	8	6	3	4	10	5	4	6	5	2
B^-	0	4	0	0	0	0	0	0	0	0	0	0	0	0
A^+	2	4	0	0	2	1	1	1	3	0	1	0	0	1
A^-	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AB^+	1	0	0	0	0	0	0	1	5	0	1	0	0	0
AB^-	0	0	0	0	0	1	0	0	0	0	0	0	3	0
Total	12	28	8	9	17	12	6	9	24	7	7	11	8	4

Sample size 'N' = 50, for each age group of males and females;

Table 2: Dengue fever in different age groups

Sex	Age group [in years]							Total
	1-10	11-20	21-30	31-40	41-50	51-60	61-70	
Males	12^{de}	28^{g}	8^{b}	9^{c}	17^{f}	12^{e}	6^{a}	92 [350]
Affected %	24	56	16	18	34	24	12	26.28
Females	9^{e}	24^{g}	7^{bc}	7^{b}	11^{f}	8^{d}	4^{a}	70 [350]
Affected %	18	48	14	14	22	16	8	20.00

Number in the parentheses is the total no. of individuals tested; Sample size 'N' = 50, for each age group of males and females; Controls are the unaffected individuals from respective sample size; Values are means [n=6] which do not share common superscript differ significantly at $p<0.05$.

Table 3: Dengue fever in different blood groups and sex

Blood group	Males	Affected %	Females	Affected %
O+	24^{f}	26.08	18^{d}	25.71
O-	2^{c}	2.17	0	0.00
B+	50^{g}	54.34	36^{e}	51.42
B-	4^{d}	4.34	0	0.00
A+	10^{e}	10.86	6^{b}	8.57
A-	0	0.00	0	0.00
AB+	1^{ab}	1.08	7^{c}	10.00
AB-	1^{a}	1.08	3^{a}	4.28
Total	92 [350]		70 [350]	

Number in the parentheses is the total no. of individuals tested; Controls are the unaffected individuals from respective sample size; Values are means [n=6] which do not share common superscript differ significantly at $p<0.05$.

DISCUSSION

A complex interaction of host and viral factors then occurs and determines whether the infection will be asymptomatic, typical, or severe. Severe dengue fever with increased micro vascular permeability and shock syndrome is thought to be associated with infection due to a second dengue virus serotype and the patient's immune response **[4]**. The exact course of events following the dermal injection of dengue virus by a mosquito bite is unclear. Skin macrophages and dendritic cells appear to be the first targets. It is thought that the infected cells then move to the lymph nodes and spread through the lymphatic system to other organs. Viremia may be present for 24 to 48 hours before the onset of symptoms **[12]**.

The important role that host genetics plays in determining the susceptibility to infectious pathogens in humans has been less known. Although predisposition to dengue disease determined by human leukocyte antigen haplotype has been proposed by several researchers, no clear specific polymorphisms have been unequivocally described for severe forms of dengue disease **[8]**. The ABO blood group system is part of the innate immune system and it has been shown that individuals with different ABO blood groups differ in their susceptibility or resistance to viral and bacterial infections and diseases **[7]**.

The *A* and *B* genes control specific enzymes responsible for the addition to H substance of *N*-acetylgalactosamine for group A and d-galactose for group B **[13]**. The *O* gene is amorphic and does not transform H substance; therefore O is not antigenic. The A, B and H antigens are present on most body cells **[14]**. These antigens are also found in soluble form in tissue fluids, such as saliva and gastric juice, in the 80% of the population who possess secretor genes **[15]**.

The role of ageing proteins on the occurrence of dengue fever is not known yet as there is significant suffering from dengue fever in the age groups of 50-70 years, where as in the age groups of 1-20 years it has been established that it is of innate immunity **[16]**. In addition to the differences in plasma cytokine levels among age groups from infants through adults and elderly individuals, studies also revealed progressive declines in the percentage of total lymphocytes and absolute numbers of T and B cells **[9]** . Nevertheless the temperature also influences the transmission of dengue fever which has already been studied **[17]** .

A few international studies that have examined male and female dengue incidence have reported a significant association with male gender **[18]**. A

contrasting result of an Indian study suggested that seropositivity and hemorrhagic findings were reported with greater propensity in females **[19]** which may be due to differences in socio-cultural environment where males are more exposed to outdoor activities and their bodies less covered as compared to females **[20]**. Statistically significant association between the presence of NS1 antigens and IgM antibodies and sensitivity of IgM antibody ELISA among males might be the exact reason for more susceptibility to dengue fever than females **[21, 22]**.

The occurrence of these two diseases in the individuals of different blood groups and association with 'particular' blood groups is of more interesting and will be a 'curtain raiser' of deriving more interesting facts in relation to Hematology, Microbiology, Immunology & Epidemiology. Molecular studies in addition definitely are a revolution in these fields. In our view, this work rather needs further investigation to fill any lacunae of the entire facts / results i.e. the factors why only some blood groups, age groups are susceptible to the occurrence of dengue as that of a particular sex of the individuals.

CONCLUSION

Human individuals of blood group B^+, aged between 1 & 20 years and 41 & 60 years and males are more prone to the occurrence of dengue fever.

REFERENCES

[1] WHO Geneva. Dengue. 2004. https://www.who.int/news-room/fact-sheets/detail/dengue-and-severe-dengue/.

[2] Bhatt S. The global distribution and burden of dengue. Nature. 496(7446), 2013, 504–507.

[3] NVBDCP India. Dengue. 2014-15. http://www.nrhmhp.gov.in/content/national-vecor-born-diseases-control-programme / Annual Report/.

[4] Sinhabahu VP, Sathananthan R, Malavige GN. Perinatal transmission of dengue: a case report. BMC Res Notes. 7, 2014, (795).

[5] Waggoner JJ. Viremia and Clinical Presentation in Nicaraguan Patients Infected With Zika Virus, Chikungunya Virus, and Dengue Virus. Clin Infect Dis. 63(12), 2016, 1584-1590.

[6] Shah I, Katira B. Clinical and laboratory profile of dengue, leptospirosis and malaria in children: a study from Mumbai. Arch Dis Child. 92, 2007, 561.

[7] Greenwell P. Blood group antigens: Molecules seeking a function. Glycoconj J. 14, 1997, 159-73.

[8] Skripal IG. ABO system of blood groups in people and their

resistance to certain infectious diseases (prognosis). Microbiol Z. 58, 1996, 102-8.

[9] Valiathan R, Ashman M, Asthana D. Effects of ageing on the immune system: Infants to elderly. Scand J Immunol. 83(4), 2016, 255-66.

[10] Kaipainen WJ, Vuorinen YV. ABO blood groups in pernicious anaemia and pernicious tapeworm anaemia. Ann Med Exp Biol Fenn. 38, 1960, 212-3.

[11] Kalayanarooj S, Vaughn DW, Nimmannitya S, Green S, Suntayakorn S, Kunentrasai N *et al*. Early clinical and laboratory indicators of acute dengue illness. J Infect Dis. 176, 1997, 313-21.

[12] Dussart P, Baril L, Petit L, Beniguel L, Quang LC. Clinical and virological study of dengue cases and the members of their households: the multinational DENFRAME Project. PLoS Negl Trop Dis. 6, e2012, 1482.

[13] Kalayanarooj S, Gibbons RV, Vaughn D, Green S, Nisalak A, Jarman RG *et al*. Blood Group AB is associated with increased risk for severe dengue disease in secondary infections. J Infect Dis. 195, 2007, 1014-7.

[14] Chrispal A, Boorugu H, Gopinath KG, Chandy S, Prakash JA. Acute undifferentiated febrile illness in adult hospitalized patients: the disease spectrum and diagnostic predictors - an experience from a tertiary care hospital in South India. Trop Doct. 40, 2010, 230–234.

[15] Basurko C. Estimating the Risk of Vertical Transmission of Dengue: A Prospective Study. Am J Trop Med Hyg. 98(6), 2018, 1826-1832.

[16] Basurko C. Maternal and foetal consequences of dengue fever during pregnancy. Eur J Obstet Gynecol Reprod Biol. 147(1), 2009, 29-32.

[17] Carrington LB. Fluctuations at low mean temperatures accelerate dengue virus transmission by *Aedes aegypti*. PLoS Negl Trop Dis. 7(4)e, 2013, 2190.

[18] Anker M, Arima Y. Male-female differences in the number of reported incident dengue fever cases in six Asian countries. West Pac Surveill Response J. 2, 2011, 17-23.

[19] Chakravarti A, Arora R, Luxemburger C. Fifty years of dengue in India. Trans R Soc Trop Med Hyg. 106, 2012, 273-82.

[20] Prasith N, Keosavanh O, Phengxay M, Stone S, Lewis HC, Tsuyuoka R *et al.* Assessment of

gender distribution in dengue surveillance data, the Lao people's democratic republic. West Pac Surveill Response J. 4, 2013, 17-24.

[21] Brown MG, Vickers IE, Salas RA, Smikle MF. Seroprevalence of dengue virus antibodies in healthy Jamaicans. Hum Antibodies. 18, 2009, 123-6.

[22] Goswami L, Runumi C, Rasul ES. Seroprevalence of dengue infection in a tertiary care hospital in Assam. Int J Med Dent Sci. 7, 2018, 1582-5.