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Research Article

A Comprehensive Study on Knowledge, Attitude and Preventive measures regarding Dengue Fever in Bangladesh: Quantitative Interview among University Students.

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Abstract

Background: Dengue fever (DF) is the most rapidly spreading mosquito-borne viral disease in the world. In this decade it has expanded to new countries and from urban to rural areas. Limited awareness and nonsystematized health education programmes have contributed adversely to the increase in dengue incidence due to limited attention which has positively contributed to the increase in vector receptivity. The current study was conducted to ascertain the knowledge, attitudes and preventive measures regarding Dengue fever among the students of various universities in Bangladesh.

Study design: A cross-sectional survey was carried out to assess the Knowledge, Awareness and preventive measures (KAP) among the students of various universities in Bangladesh.

Methodology: Between August 2020 & November 2020, an epidemiological survey was conducted among 199 students of various universities throughout Bangladesh. We collected information on the socio-demographic characteristics of the respondents and their knowledge, attitude and preventive measures regarding DF using a structured questionnaire. Majority of the questions were dichotomous (Yes/No type) and some questions were asked using five point Likert scale. We then statistically compared their knowledge, attitude and preventive measures in regard to socio-demographic characteristics of the respondents to identify possible causes of observed differences using SPSS version 23.

Results: Total number of students from Diploma, Undergraduate (Honor's), Postgraduate (Master's) were 199 who had given voluntary consent and participated in this study willingly. The sample comprised more males (56%) than females (44%), and almost 50% of respondents were from allied health science (Pharmacy, Microbiology, Public health, Botany, Zoology, Biotechnology, Biochemistry etc) background. Respondents had relatively good knowledge about aspects of Dengue fever. Out of 199 individuals interviewed, 97% had heard of DF. They had good knowledge score regarding dengue symptoms but comparatively moderate knowledge score regarding dengue transmission and management. The knowledge, attitude and preventive measures level of study respondents was found statistically significant in relation to the academic attainment of the respondents.

Conclusion: We recommend implementing mass educational programmes throughout the country in order to raise the awareness and to translate knowledge into sound practice to control dengue disease epidemics in Bangladesh.

INTRODUCTION:

Dengue is the most conventional and critical arthropod-borne viral (arboviral) disease in humans.[1] Dengue disease is transmitted principally by female mosquitoes primarily of the species *Aedes aegypti* and, to a lesser degree, *Ae. Albopictus* that feed both indoors and outdoors during the daytime.[2] Dengue Virus is a positive-stranded encapsulated RNA virus that is composed of three structural protein genes, which encode the nucleocapsid or core (C) protein, a membrane-associated (M) protein, an enveloped (E) glycoprotein, and seven nonstructural (NS) proteins.[3]

Dengue is widespread throughout the tropics, with local variations in risk influenced by rainfall, temperature, relative humidity and unplanned rapid urbanization.[2] This disease affects infants, young children, and adults, with symptoms ranging from mild fever to incapacitating high fever, with severe headache, pain behind the eyes, muscle and joint pain, and rash. The illness can advance to intense/serious dengue, characterized by shock, respiratory distress, severe bleeding, and/or damage of severe organ. The disease has a seasonal pattern: most cases in the southern hemisphere occur in the first half of the year, and most cases in the northern hemisphere in the second half. This pattern corresponds to the warmer, rainy months.[4] Dengue has been listed as one of the ten bigger threats on global health for 2019 (WHO, 2019).[5]

It is estimated that more than 3 billion humans live in dengue endemic regions of the world, and currently, more than 50 million infections occur annually with at least 500,000 individuals requiring hospitalization.[6] Of these, tens of thousands have a high risk of developing hemorrhagic disease, potentially with fatal consequences depending to a large extent on the quality of the available medical services.[7]

The dengue viruses are positive stranded RNA viruses in the genus *Flavivirus*, family *Flaviviridae.*[8] There are four distinct dengue virus (DENV) serotypes that share antigenic relationships (DENV-1, DENV-2, DENV-3, and DENV-4), and although infection with one serotype confers lifelong protection against that serotype, it does not necessarily protect against a secondary infection with a heterologous serotype. Indeed, nonprotective but cross-reactive antibodies may enhance disease severity.[9] Currently, there are no effective vaccines or antiviral drugs against these viruses. This problem is being addressed as a matter of urgency as failure to develop effective DENV control strategies will inevitably result in a further increase in the number of infected humans, as predicted more than a decade ago.[10] This problem is also exacerbated by the continuing dispersal of these viruses to new geographic regions.

Severe dengue was first recognized in the 1950s during dengue epidemics in the Philippines and Thailand. Today, severe dengue affects most Asian and Latin American countries and has become a leading cause of hospitalization and death among children and adults in these regions.[11] During the 1980s and 1990s, rapidly expanding populations of St. aegypti in Brazil resulted in successive epidemics due to DENV-1, DENV-2, and DENV-3. In Brazil, these infections presented mostly as DF, with surprisingly few cases of DHF. This contrasts with Asia where the proportion of DHF cases was significantly higher during DF epidemics. These differences have been partly attributed to the widespread presence of dengue virus resistance genes in Latin Americans with African ancestry.[12, 13, 14]

Today, all four DENV serotypes circulate in Africa, South and Southeast Asia, the Western Pacific region, the Caribbean basin, and Central and South America.[15-18] Frequent introductions into the Southern states of North America are also regularly recorded although to date they have not resulted in epidemic outbreaks in the USA; DF has the potential to become reestablished as an endemic disease in this country. Conditions exist that could facilitate sustained dengue transmission, including environmental factors, competent mosquito vectors, limited vector and dengue surveillance, increased domestic outdoor daytime activities in warmer months, and low public awareness of the disease.[19] Indeed, dengue continues to spread more widely as demonstrated in 2010 by the first recorded cases of autochthonous dengue fever in southern France and Croatia.[20,21]

Many countries in the tropics and subtropical regions show cocirculation of at least two DENV serotypes and increasingly, cocirculation of all 4 serotypes is being recorded in individual countries.[22] Taken together with the ecological and demographic changes, this partly explains why the pattern of epidemics is gradually increasing from a frequency of outbreaks every 3–5 years to approximately every 2 years.[23] Additional explanations for this increased incidence include the possibility that more highly pathogenic strains of DENV are also emerging.[24-27]

Bangladesh had sporadic transmission of dengue virus from 1964 to 1999, but the first outbreak due to dengue virus type 3 occurred in 2000, with dengue outbreaks occurring at increasing frequency and magnitude since then, peaking with 10,148 cases in 2018. [28,29] In 2019, dengue outbreaks surpassed all previous records, mostly in the capital city of Dhaka. By August, 2019, a total of 70,188 dengue cases had been officially recorded, with 67 dengue-related deaths. The numbers increased to 81 832 cases with 67 deaths as of the last count on Sept 16, 2019. This high frequency of dengue cases is due to dengue virus type 3, but all other serotypes are co-circulating.[30] Although in recent years Bangladesh has achieved a remarkable progress in controlling communicable diseases, the country has still been facing a tremendous pressure in respect of public health problems especially controlling the emerging or re-emerging diseases. The upsurge in dengue cases and the recent outbreak of chikungunya and zika introduce major threats to the health of the community people. This emerging situation warrants an increased level of interventions and allocation of both human and financial resources in the health sector of Bangladesh. Considering the lack of studies related to epidemics and how to facilitate outbreak management of Dengue in Bangladesh, and hence there is an urgent need to understand the public's perception and awareness of Dengue Fever, this study aimed to investigate the knowledge, Attitude and preventive measures regarding Dengue disease among university students in Bangladesh.

MATERIALS AND METHODS

Study design & Setting:

A cross sectional study considering quantitative approach on knowledge, attitude and practice of dengue fever in various universities in Bangladesh. The sample size was calculated using the following formula: $n = Z^2pq/d^2$, here n is the sample size, Z is the statistic that corresponds to the level of confidence, P is a measure of expected prevalence, q=(1-p), When p is in decimal value and d is precision (analogous to effect size).[31] With response rate of 50% and a confidence interval 95% then the sample size was calculated as 384 subjects from which 199 respondents completed the full questionnaire.

Measurements and Instruments

For data input, SPSS (Statistical Package for the Social Sciences) and Microsoft Excel software were used carefully. And for data analysis, SPSS version 23 was used as principal software. The collected demographic data included age, religion, academic level, academic attainment, family size and monthly income, living area. We investigated respondents' knowledge about DF by asking if respondents' could identify clinical symptoms; the means of transmission; the means of management. Each correct answer counted as 1 point. The knowledge score ranged from 0–24 points. We asked the respondent's feeling about the severe levels of DF

disease. Each question used a Likert scale with five levels or dichotomous scale. The scores for each item in Likert scale ranged from 1 (lowest) to 5 (highest). The attitude toward dengue fever score ranged from 0–32 points. We gathered information about how they controlled mosquitoes and larvae in their house to prevent mosquito-man contact (Dichotomous scaling) and eliminating mosquito breeding sites (4-point scaling: Always>Often>Sometimes>Never). The DF prevention practices score ranged from 0–19 points. Responses were presented using descriptive analysis, with chi-square tests to identify factors associated with Knowledge, Attitude and preventive measures concerning Dengue Fever.

RESULTS:

A total of 199 respondents were interviewed and the data so obtained was used for primary analysis. comparatively more number of males (56%) had participated than females (44%) (Table-1).

Table 1: Distribution of study respondents age by sex

Sex	Number of respondents	% Number of respondents
Male	111	56%
Female	88	44%

From table # 2, Demographic information of study respondents can be obtained.

Age of the respondents: In this study, majority of the respondents (71.9%, n=143) were in age range 18-23 years and lowest number of respondents (4%, n=8) were in 30-35 years range. The mean age was 1.32±0.548. The positive value of skewness (1.491) indicates data are highly skewed/peaked right.

Religion of the respondents: In this study, majority of respondents were Muslim's (86.9%, n=173) and some of the respondents were non-muslim (13.1%, n=26) by religion. The mean religion was 1.33±0.338. The positive value of skewness (2.209) indicates data are highly skewed/peaked right.

Family Size of the respondents: In this study, majority of the respondents (44.7%, n=89) family size was 4 persons, followed by 5 persons (22.6%, n=45) and less respondents (12.6%, 25) family size was 3 persons. The mean family size was 2.5±0.953. As the value of skewness (0.258) is between -0.5 to 0.5, that means data are fairly symmetrical.

Family Monthly Income: In this study, 34.7% of the respondents (n=69) had family monthly income between 21000 to 40000 taka and the less number of respondents (5,2.5%) family monthly income more than 100000 takas. The mean family monthly income was 2.25±1.162. The positive value of skewness (1.116) indicates data are highly skewed /peaked right.

Area of Residence (Division): In this study, the precedence respondents (42.2%, n=44) were lived around Dhaka city, followed by Chittagong (17.1%, n=34) and Mymensingh (14.6%, n=29). The lower number of respondents (2.5%, n=5) were lived in Rangpur city. The mean area of residence was 3.43±2.664. The positive value of skewness (.670) indicates that data are moderately skewed.

Level of Education: In this study, the highest level of education was mainly Undergraduate (Honor's) (79.9%, n=159), followed by Postgraduate (Master's) (10.6%, n = 21), and diploma (9.5%, n = 19). The mean level of education was 2.01±0.449. In this case, data are fairly symmetrical as the value of skewness (0.450) is between -0.5 to 0.5.

Academic Attainment: Regarding academic attainment, most of the respondent's respondents (50.3%, n=100) were studying in Allied Health science (Pharmacy, Microbiology, Public health, Botany, Zoology, Biotechnology, Biochemistry) and the minor respondents (11,5.5%) were studying in Humanities (English, Bangla, Economics, History, Geography, Development studies etc. The mean Academic Attainment was 2.2±1.47. The positive value of skewness (.837) indicates that data are moderately skewed.

Table 2: Demographic information of study respondents.

Sl	Variables	Total	Male	Female	Mean	Std. Deviation	Skewness
Socio-demographic variables of respondents							
1	**Age of Respondents**						
	18-23	143 (71.9%)	79 (55.2%)	64(44.7%)	1.32	0.548	1.491
	24-29	48 (24.1%)	27 (56.2%)	21(43.7%)			
	30-35	8 (4%)	05 (62.5%)	03(37.5%)			
2	**Religion of Respondents**						
	Muslim	173 (86.9%)	93 (53.7%)	80(46.2%)	1.13	0.338	2.209
	Non-muslim	26 (13.1%)	18 (69.2%)	8(30.7%)			
3	**Family Size**						
	3 persons	25(12.6%	10 (40.0%)	15(60.0%)	2.50	0.953	0.258
	4 persons	89(44.7%)	54 (60.6%)	35(39.3%)			
	5 persons	45(22.6%)	18 (40.0%)	27(60.0%)			
	> 5 persons	40(20.1%)	29 (72.5%)	11(27.5%)			
4.	**Family Monthly Income**						
	0 to 20000 tk	58(29.1%)	38 (58.5%)	20(34.4%)	2.25	1.162	1.116
	21000 to 40000 tk	69(34.7%)	39 (65.5%)	30(43.4%)			
	41000 to 60000 tk	52(26.1%)	25 (48.1%)	27(51.9%)			
	61000 to 80000 tk	9(4.5%)	4(44.4%)	5(55.5%)			
	81000 to 100000 tk	6(3.0%)	3(50.0%)	3(50.0%)			
	100000tk +	5(2.5%)	2(40.0%)	3(60.0%)			
5	**Area of Residence (Division)**						
	Dhaka	84(42.2%)	43 (51.1%)	41 (48.8%)	3.43	2.664	0.670
	Barishal	10(5.0%)	6(60.0%)	4(40.0%)			
	Mymensingh	29(14.6%)	17 (58.6%)	12(41.3%)			
	Sylhet	11(5.5%)	8(72.7%)	3(27.2%)			
	Khulna	16(8.0%)	11 (68.7%)	5(31.2%)			
	Rajshahi	10(5.0%)	5(50.0%)	5(50.0%)			
	Rangpur	5(2.5%)	5(100%)	0(0%)			
	Chittagong	34(17.1%)	16 (47.1%)	18 (52.9%)			
6	**Level of Education**						
	Diploma	19(9.5%)	9(47.3%)	10(52.6%)	2.01	0.449	0.450
	Undergraduate (Honor's)	159(79.9%)	89 (55.9%)	70(44.0%)			
	Postgraduate (Master's)	21(10.6%)	13 (61.9%)	8(38.1%)			
7	**Academic Attainment**						
	Allied Health science	100 (50.3%)	59(59.0%)	41(41.0%)	2.2	1.47	0.837
	Engineering	25 (12.6%)	16(64.0%)	9(36.0%)			
	Commerce (BBA)	34 (17.1%)	15(44.1%)	19(55.9%)			
	Humanities	11 (5.5%)	6(54.5%)	5(45.5%)			
	Science	29 (14.6%)	15(51.7%)	14(48.3%)			

Response about knowledge regarding dengue fever:

Table 3: Source of information of Dengue Fever

Frequencies (Source of information of dengue fever)

		Responses		
		N	**Percent**	**Percent of Cases**
Information on dengue fever[a]	TV/Radio	173	18.2%	86.9%
	Mass meetings	40	4.2%	20.1%
	Brochures	75	7.9%	37.7%
	Newspapers	165	17.4%	82.9%
	Workmates	80	8.4%	40.2%
	Friends	131	13.8%	65.8%
	Family	116	12.2%	58.3%
	Social media	170	17.9%	85.4%
Total		950	100.0%	477.4%

a. Dichotomy group tabulated at value 1.

In the above output, Percent of responses and percent of cases are displayed. Percent of response is the percentage of each response out of total responses from the given data-set. Thus, the sum total of percent of response is 100. Here 199 respondents gave 950 opinions on source of information. Of 199 respondents, 18.2% obtained information from TV/radio (86.9% of the respondents), 17.9% from Social network (85.4% of the respondents), 17.4% from newspapers (82.9% of the respondents), 13.8% from friends (65.8% of the respondents), 12.2% from family (58.3% of the respondents), 8.4% from workmates (40.2% of the respondents), 7.9% from brochures (37.7% of the respondents) and 4.2% from mass meetings (20.1% of the respondents).

Respondent's knowledge and perception regarding dengue fever was discussed in Table-4.

Most of the respondents were able to correctly identify typical symptoms of dengue such as headache (78.9%), joint pains (92.5%,), muscle pain (82.4%) and pain behind the eyes (70%).

With respect to transmission of dengue, about half of the respondents were aware that flies and ticks do not transmit dengue fever (51.8% and 55.3% respectively). 87.4% respondents answered correctly that Aedes mosquito transmits Dengue Fever. Regarding transmission by a blood transfusion and by a needle stick, respondents were able to correctly (77.9% and 56.3% respectively). On the other hand, majority of the respondents informed correctly that all types of mosquitoes don't transmit Dengue fever and person to person contact doesn't transmit Dengue fever (73.9% and 65.3% respectively). About 60.3% respondents answered accurately that Dengue fever cannot be transmitted by sexual intercourse.

With regard to management of dengue, 60.3% respondents wrongly said that aspirin can be administered for dengue treatment while only 21.1% correctly said aspirin cannot be administered for dengue treatment. About three-quarters (71.9% and 76.4% respectively) of the respondents correctly said that plenty of rest and drinking plenty of water is essential to get remedy from dengue fever; (13.1% and 11.1% respectively) would not while (15% and 12.5% respectively) were unsure. Lower percentage of respondents knew that 'there is no treatment for dengue fever' (19.6%) as well as 'no vaccine is available for dengue fever' (33.2%). Most of the respondents (81.9%) believed that 'It is necessary to consult a physician for dengue fever'.

Table 4: Knowledge regarding dengue fever among the respondents

Knowledge about Dengue fever among 199 respondents				
Dengue is common in rainy season.	Yes (85.4%, n=170)	No (6.1%, n=12)		Don't Know (8.5%, n=17)
Dengue is characterized by	Fever with Rash (80.9%, n=161)	Fever without Rash (15.6%, n=31)		Rash without Fever (3.5%, n=7)
Dengue mosquito bite time/feeding habit	Morning (38.7%, n=77)	Afternoon (22.1%, n=44)	Evening (25.1%, n=50)	Night (14.1%, n=28)
Which infective organism is responsible for Dengue?	Bacteria (11.6%, n=23)	Virus (65.8%, n=131)	Protozoa (21.1%, n=42)	Fungas (1.5%, n=3)
Knowledge of symptoms	**Yes**	**No**		**Don't Know**
Is headache a symptom of dengue fever?	157 (78.9%)	21 (10.6%)		21 (10.6%)
Is joint pain a symptom of dengue fever?	184 (92.5%)	8 (4.0%)		7 (3.5%)
Is muscle pain a symptom of dengue fever?	164(82.4%)	11(5.5%)		24(12.1%)
Is pain behind the eyes a symptom of dengue fever?	141(70%)	12(6.0%)		46(23.1%)
Knowledge of transmission	**Yes**	**No**		
Do flies transmit Dengue fever?	96 (48.2%)	103 (51.8%)		
Do ticks transmit Dengue fever?	89(44.7%)	110(55.3%)		
Do all types of mosquitoes transmit Dengue fever?	52(26.1%)	147(73.9%)		
Does the Aedes mosquito transmit Dengue Fever?	174(87.4%)	25(12.6%)		
Does person to person contact transmit Dengue fever?	69(34.7%)	130(65.3%)		
Can Dengue fever be transmitted by a blood transfusion?	155(77.9%)	44(22.1%)		
Can Dengue fever be transmitted by a needle stick?	112(56.3%)	87(43.7%)		
Can Dengue fever be transmitted by sexual intercourse?	79(39.7%)	120(60.3%)		
Knowledge on Dengue management	**Yes**	**No**		**Don't Know**
Aspirin can be administered for dengue treatment.	120 (60.3%)	42 (21.1%)		37 (18.6%)
Plenty of rest is essential to get remedy from dengue fever	143(71.9%)	26(13.1%)		38(19.1%)
Drinking plenty of water prevents dengue fever	135(67.8%)	26(13.1%)		38(19.1%)
Is there a treatment for dengue fever	139(69.8%)	39(19.6%)		21(10.6%)
Is there a vaccine for dengue fever	95(47.7%)	66(33.2%)		38(19.1%)
It is necessary to consult a physician for dengue fever	163(81.9%)	18(9.0%)		18(9.0%)

Table 5: Frequency and percentage of knowledge scores among study respondents

Academic level	**No of respondents (Total=199)**	**Frequency and percentage**	**P-value**
Diploma	19	13.94 (58.08%)	F=0.184
Undergraduate (Honor's)	159	14.16 (59%)	P=.832
Postgraduate (Master's)	21	13.86 (57.7%)	

Table #5 shows, knowledge scores were compared with their academic level (Diploma, Undergraduate (Honor's) and Postgraduate (Master's)) by using one-way ANOVA followed by post-hoc analysis with Bonferroni test. P value <0.05 was considered as statistically significant. Values are expressed as frequencies and percentages.

Therefore, no significant results obtained from knowledge of participants (p=) as depicted in Table 5. The order of "good knowledge" about dengue fever according to academic level are graded as Undergraduate (Honor's)> Diploma> Postgraduate (Master's).

Response about attitude regarding dengue fever among the respondents.

As illustrated in Table 6, Out of 199 respondents, 69% of respondents collectively strongly agreed (36.2%) or agreed (32.7%) that 'They are at risk of getting dengue'. About 85% of respondents strongly agreed (45.1%) or agreed (39.2%) that 'Dengue fever can be prevented'. About 70% of respondents strongly agreed (36.2%) or agreed (34.2%) that 'Dengue has a high morbidity'. About 82.9% of respondents effectively appreciated as 'Dengue is considered an alarming diagnosis'. 68.4% respondents thought 'Dengue decreases economic productivity' and only a few of the respondents (43.2%) deliberated that 'Dengue is difficult to detect'

Table 6: **Attitude regarding dengue fever among the respondents.**

Attitude regarding Dengue	Strongly agree	Agree	Neutral	Disagree	Strongly Disagree
You are at risk of getting dengue	72 (36.2%)	65 (32.7%)	52 (26.1%)	7 (3.5%)	3 (1.5%)
Dengue fever can be prevented	91(45.1%)	78(39.2%)	25(12.6%)	4(2.0%)	1(0.5%)
Dengue has a high morbidity	72(36.2%)	68(34.2%)	52(26.1%)	6(3.0%)	1(0.5%)
Dengue is considered an alarming diagnosis	66(33.2%)	99(49.7%)	27(13.6%)	6(0.3%)	1(0.5%)
Dengue decreases economic productivity	73(36.7%)	63(31.7%)	48(24.1%)	14(7.0%)	1(0.5%)
Dengue is difficult to detect	50(25.1%)	36(18.1%)	55(27.6%)	41(20.5%)	17(8.5%)

Table 7: Frequency and percentage of attitude scores among study respondents

Academic level	No of respondents (Total=199)	Frequency and percentage	P-value
Diploma	19	29.16 (91.1%)	F=11.067
Undergraduate (Honor's)	159	24.41 (76.3%)	P=.000
Postgraduate (Master's)	21	24.95 (78%)	

Table #7 shows, attitude scores were compared with their academic level (Diploma, Undergraduate (Honor's) and Postgraduate (Master's)) by using one-way ANOVA followed by post-hoc analysis with Bonferroni test. P value <0.05 was considered as statistically significant.

Therefore, statistically significant results obtained from attitude of respondents (p=) as depicted in Table 7. The order of "good attitude" about dengue fever according to academic level are graded as Diploma> Postgraduate (Master's)> Undergraduate (Honor's).

Response about practice regarding dengue fever among the respondents.

Table 8 & 9 represents practices toward Dengue fever concerning preventive measures to control mosquito-man contact and eliminating mosquito breeding sites respectively. Most of the respondents undertook preventive activities to avoid contact with mosquitoes. For instance, 88.9% used insecticide sprays; 82.9% employed professional pest control services to reduce mosquitoes, 88.9% used bed nets during the night, 86.9% embarked to eliminate standing water around the house & 81.9% screened their windows to reduce mosquitoes. Around 80% respondents stated that cutting down bushes in the yard is another antidotal measure to reduce mosquitoes. About 74% respondents used mosquito coils to reduce mosquitoes. The proportion of respondents reporting frequently changing water, properly disposing of waste and covering water storage containers were 68.3%, 63.8%, and 58.3%, respectively. Only a few respondents (35.7%, n=71) reported that addition of salt to the water will eliminate mosquito breeding.

Table 8: Practice regarding dengue fever among the respondents (Preventing mosquito-man contact).

Preventing mosquito-man contact	Yes	No
Use insecticide sprays to reduce mosquitoes	177(88.9%)	22(11.1%)
Use professional pest control to reduce mosquitoes	165(82.9%)	34(17.1%)
Use screen windows to reduce mosquitoes	163(81.9%)	36(18.1%)
Use bed nets to reduce mosquitoes	177 (88.9%)	22 (11.1%)
Eliminate standing water around the house to reduce mosquitoes	173(86.9%)	26(13.1%)
Use mosquito coils to reduce mosquitoes	147(73.9%)	52(26.1%)
Cut down bushes in the yard to reduce mosquitoes	160(80.1%)	39(19.6%)

Table 9: Practice regarding dengue fever among the respondents (Eliminating mosquito breeding sites).

Eliminating mosquito breeding sites	Always	Often	Sometimes	Never
Frequently changing water	136 (68.3%)	40 (20.1%)	19 (9.5%)	4 (2%)
Proper disposal of waste	127(63.8%)	51(25.6%)	20(10.1%)	1(0.5%)
Tightly covering water storage containers	116(58.3%)	50(25.1%)	21(10.6%)	12(6.0%)
Adding salt to the water	71(35.7%)	51(25.6%)	52(26.1%)	25(12.6%)

Table 10: Frequency and percentage of practice scores among study respondents

Academic level	No of respondents (Total=199)	Frequency and percentage	P-value
Diploma	19	15.21 (80.06%)	F=0.231
Undergraduate (Honor's)	159	15.21 (79.8%)	P=.794
Postgraduate (Master's)	21	14.71 (77.4%)	

Table #10 shows, practice scores were compared with their academic level (Diploma, Undergraduate (Honor's) and Postgraduate (Master's)) by using one-way ANOVA followed by post-hoc analysis with Bonferroni test. P value <0.05 was considered as statistically significant.

Therefore, statistically no significant results obtained from practice of respondents (p=) as depicted in Table 10. The order of "good practice" about dengue fever according to academic level are graded as Diploma> Undergraduate (Honor's)> Postgraduate (Master's).

Table 11: Knowledge, Attitude and practice scoring of respondents.

	Gender of Respondents	N	Mean	Std. Deviation	Levene's Test for Equality of Variances	Equal variances assumed			Equal variances not assumed		
						t	df	Sig. (2-tailed)	t	df	Sig. (2-tailed)
Score in knowledge section	Male	111	14.40	2.285	F=1.76 P=.186	1.9	197	.058	1.884	175.82	.061
	Female	88	13.74	2.566							
Score in attitude section	Male	111	24.99	4.50	F=.183 P=.669	.259	197	.796	.261	191.65	.795
	Female	88	24.83	4.21							
Score in practice section	Male	111	15.06	3.18	F=1.22 P=.272	-.467	197	.641	-.468	188.67	.64
	Female	88	15.27	3.1							

In table #11, The results show that the **mean** knowledge score in the **male group** was **14.40** with a **standard deviation** of **2.285**. In the **female group**, mean knowledge score was **13.74** with a standard deviation of **2.566**. Therefore, there was a **mean difference** of **0.66** between the male group and female group in our **two samples**, with knowledge score being 0.66 **higher** in the male group. Levene's test for homogeneity of variance provides an *F*-statistic (1.76) and a significance value (*p*-value=.186). As the Levene's Test for Equality of Variances is not statistically significant, which indicates that the group variances are not unequal in the population, so that test result of scoring in knowledge section between two groups: *t* (175.82) = 1.884, *p* = 0.061. Accordingly, **in attitude section** there was a **mean difference** of **0.16** between the male group and female group in our **two samples**, with attitude score being 0.16 **higher** in the male group. Levene's test for homogeneity of variance provides an *F*-statistic (.183) and a significance value (*p*-value=.669). As the Levene's Test for Equality of Variances is not statistically significant, which indicates that the group variances are not unequal in the population, so that test result of scoring in attitude section between two groups: *t* (191.65) = 0.261, *p* = 0.795. With regard to practice, there was a **mean difference** of **0.08** between the male group and female group in our **two samples**, with practice score being 0.21 **higher** in the female group. Levene's test for homogeneity of variance provides an *F*-statistic (1.22) and a significance value (*p*-value=.272). As the Levene's Test for Equality of Variances is not statistically significant, which indicates that the group variances are not unequal in the population, so that test result of scoring in practice section between two groups: *t* (188.67) = -0.468, *p* = 0.64.

Table 12: Responses to questions related to knowledge, attitudes and practices in relation to dengue fever

Variables	Knowledge level	Symmetric measures	Attitude level	Symmetric level	Practice level	Symmetric level
	X^2 (p- value)	Phi & Cramer's V; (Approximate significance)	X^2 (p- value)	Phi & Cramer's V; (Approximate significance)	X^2 (p- value)	Phi & Cramer's V; (Approximate significance)
Sex of the respondents	X^2 (13) =26.751, P=.013	.367 & .367; (.013)	X^2 (20) =16.47, P=.687	.288 & .288; (.687)	X^2 (12) =16.533, P=.167	.288 & .288; (.167)
Academic level of the respondents	X^2(26) = 14.33, P=.968	.268 & .190; (.968)	X^2 (40) =65.98, P=.006	.507 & .407; (.006)	X^2 (24) =20.048, P=.694	.317 & .224; (.694)
Academic attainment of respondents	X^2 (52) =86.689 P=.002	.66 & .33; (.002)	X^2 (80) =114.08, P=.007	.757 & .379; (.007)	X^2 (48) =73.549, P=.01	.608 & .304; (.01)

As outlined in table 12, knowledge, attitudes and practices level was surveyed with sex of the respondents, academic level of the respondents and academic attainment of the respondents.

In relation to sex of the respondents, we found here that X^2 (13) =26.751, P=.013 for knowledge level, X^2 (20) =16.47, P=.687 for attitude level and X^2 (12) =16.533, P=.005 for practice level. This entailed that there was statistically significant association between sex and knowledge level & strength of association between the variables was very strong but statistically no significant association between sex and attitude level; sex and practice level & strength of association between the variables was very weak.

In relation to academic level of the respondents, we found here that X^2(26) = 14.33, P=.968 for knowledge level, X^2 (40) =65.98, P=.006 for attitude level and X^2 (24) =20.048, P=.694 for practice level. This entailed that there was statistically significant association between (a) academic level and attitude level; strength of association between the variables was very strong but statistically no significant association between (a) academic level and knowledge level; (b) academic level and practice level & strength of association between the variables is very weak.

In relation to academic attainment of the respondents, we found here that X^2 (52) =86.689, P=.002 for knowledge level, X^2 (80) =114.08, P=.007 for attitude level and X^2 (48) =73.549, P=.01 for practice level. This entailed that there was statistically significant association between (a) academic attainment and knowledge level; (b) academic attainment & attitude level; (c) academic attainment and practice level; & strength of association between the variables was very strong.

DISCUSSION

Dengue is an acute febrile disease that is a major public health problem in the tropics and subtropics worldwide. According to the World Health Organization (WHO), dengue is now endemic in over 100 countries. As many as 3.6 billion people, or 40% of the world's population, reside in dengue-endemic areas. Each year, an estimated 400 million people are infected with dengue virus, 100 million become ill with dengue, and 21,000 deaths are attributed to dengue.[32] Our study sought to assess students' knowledge, attitudes and practices concerning dengue fever in Bangladesh.

The knowledge level on dengue fever reported in this study is comparable to findings in similar KAP studies regarding DF conducted in Nepal, India, Jamaica, Taiwan, Srilanka. Most of the respondent's knowledge accuracy regarding symptoms of DF were highly significant such as headache (78.9%), joint pains (92.5%,), muscle pain (82.4%) and pain behind the eyes (70%) compared with other study conducted in Jamaica [headache (41.5%), joint pains (32.5%,), muscle pain (2.1%) and pain behind the eyes (55.9%)].[33] Fever with rash was also the significant recalled symptom in this study (80.9%) that is comparable to a similar study conducted in central Nepal (100%) during the 2010 DF outbreak, India (62.6%) and Jamaica (49.5%).[34,35,33]

In this study, TV/Radio was reported as the most common source of information (86.9%, n=173). This is similar to previous studies whereby mass media was cited to have a major role in disseminating information about dengue.[36,37,38] A total of 72 (36.2%) respondents did not correctly identify the correct time of feeding habit of the Aedes mosquito. This finding is higher than a study conducted in Taiwan 14.4%.[39] However, in both cases the result was low and may reflect a knowledge gap of respondents towards the Aedes mosquito. About two-third of respondents (65.8%) knew that dengue is a viral disease that is comparable to similar study conducted in Srilanka (81.28%).[40]

Knowledge regarding modes of dengue transmission was dubious with regard to conceivable transmission through blood transfusion and needle stick injury: approximately 78% and 56.3% respectively of the respondents believed that the disease could be contracted through blood transfusion or needle stick injury which is compared with the study conducted in Jamaica (approximately 45% in both routes).[33] However, it is noteworthy that it is in rare instances (during the acute stage of the disease) that the virus may be passed in blood or organ transplant.[41] The results in the study showed that 87.4% of respondents knew that Aedes mosquitoes are responsible for the transmission of dengue fever while in a study conducted in France stated that 71.2% of respondents knew that Aedes mosquitoes are responsible for the transmission of dengue fever.[42] This result is statistically better than previous similar studies as in Jamaica and Malaysia respectively 62,6% and 64,2% answered that Aedes mosquitoes are responsible for the transmission of dengue fever.[33,43] While 65.3% of participants were aware that person to person contact cannot lead to acquisition of dengue, there still remained 34.7% of respondents who were not aware of correct information that is comparable with study condacted in central Nepal where 56% of the participants were not aware of the fact that ordinary person to person contact does not transmit DF.[34] So in both cases, respondents needed to be

educated appropriately in order to ensure that they have correct information.

Knowledge of management strategies for the disease was significant among respondents with the exception in regard to perception of Aspirin administration for dengue treatment. However, 60.3% reported that Aspirin can be administered for dengue disease which is comparatively similar in a study in Jamaica (67%).[33] Aspirin administration can increase the bleeding tendencies in patients with dengue fever and is therefore highly contraindicated.[44] Aspirin is frequently administered to reduce fevers without prescription. Taking this drug without a prescription from doctors in case of dengue fever could potentiate the patient into bleeding diastases. Though participants agreed they would get plenty of rest if they had dengue (72%) and drink lots of water (76.4%), it is possible that these are the usual remedies they would take if they were ill from any other disease.

In this study, only 10% of respondents claimed that they are not at risk of being infected by dengue virus and 84.3% answered that dengue fever can be prevented while in a study conducted in France 21.2% of respondents replied that they are not at risk of being infected by dengue virus and 67.7% answered that dengue fever can be prevented.[42] However, in Cambodia, a similar study showed that only 6% answered that they are not at risk of being infected by dengue fever.[45]

Although adequate measures to prevent mosquito-man contact at home have been reportedly used among the study respondents, the proportion of respondents taking measures to eliminate mosquito breeding sites was comparatively low. To prevent mosquito-man contact, more than 80% of respondents practiced effective preventive methods such as mosquito screening of homes, insecticide sprays, professional pest control, bed nets, removing standing water around the house and cut down bushes in the yard. This preventive practice is too low in Jamaica study, where malaria was not common, and people do not exercise measures known to protect against mosquito borne diseases.[33] On the other hand, in Malaysia, only 18% are using chemicals to kill larvae and in a similar study in Cambodia 13% of the respondents are spraying chemicals and 15% are cutting bushes.[43,45] The most popular method of eliminating mosquito breeding sites being the frequent changing of water conducted by 68.3% of respondents whereas it was only 17.6% of respondents in a study conducted in Vietnam. [46]

Another major findings of the study revealed that, knowledge, attitude and practice level of study respondents was found statistically significant in relation to academic attainment (Table-12). Moreover, knowledge and attitude level of study respondents was found statistically significant in relation to sex and academic level of the respondents respectively. But there was negative association of knowledge and attitude level with academic level and sex of the respondents respectively(Table-12). There was also negative association of practice level of the respondents found with sex, and academic level of the respondents(Table-12).

A positive finding was better participation of female students in this study and posed better knowledge, attitude and practice in regard to dengue fever. In most developing countries, including Bangladesh, females hold the responsibility of taking care of their children and other family members, thus their better knowledge, attitude and practices should contribute to some extent to the preventive and controlled measure on dengue disease.

CONCLUSION

Dengue is one of the most important viral mosquito-borne disease, with dramatic consequences on global health. There is no treatment for dengue fever as the treatment is symptomatic and vaccination development is still ongoing. To alarm our generation's mass education campaigns are needed to be conducted to emphasize the potential risks of dengue fever and the inappropriateness of using medications. To raise awareness and knowledge concerning dengue fever symptoms, transmission, prevention and treatment, further education to the public is thus primordial to avoid delay to visit to the doctors, improve prevention and treatment.

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