Asian Pacific Journal of Tropical Disease

journal homepage: http://www.apjtcm.com

Original article https://doi.org/10.12980/apjtd.7.2017D7-149

Knowledge on fever and its associated factors among the parents of the children who were treated as cases of dengue fever or dengue hemorrhagic fever in a tertiary care setting of a lower middle income country

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ARTICLE INFO

Article history:
Received 22 Jun 2017
Received in revised form 14 Jul, 2nd revised form 10 Aug 2017
Accepted 28 Aug 2017
Available online 25 Sep 2017

Keywords:
Dengue fever
Dengue hemorrhagic fever
Parents' knowledge on fever
Associated factors

ABSTRACT

Objective: To develop a tool for assessing knowledge on fever and to describe the knowledge and its associated factors of the parents of the children treated as dengue fever/dengue hemorrhagic fever (DF/DHF) at a tertiary care setting in Sri Lanka.

Methods: A descriptive cross sectional study was done in Lady Ridgeway Hospital for Children from July 2012 to January 2013. The calculated sample size was 425. Systematic sampling was done. Knowledge on fever was assessed using a tool judgmentally validated with expert guidance which consisted of equally-weighed 10 questions. The construct validity of the tool was assessed using two *a priori* hypothesis. Bivariate analysis was followed by multivariate analysis for the associations of knowledge. Analysis was stratified for DF and DHF groups.

Results: The response rate of the study was 99.5% (n = 423). The developed tool to assess the knowledge on fever fulfilled the assumptions of two *a priori* hypotheses. The median knowledge scores of total sample, DF and DHF groups were respectively 40 (30.0–60.0), 40.0 (30.0–60.0) and 50.0 (30.0–60.0). Child's age, income, main caregiver's and spouse's highest education level and the presence of a thermometer at home were significantly associated with the knowledge on fever in bivariate analysis ($P < 0.05$). Main caregiver's education level and having a thermometer at home had a significant association with the knowledge ($P < 0.001$) following multivariate analysis.

Conclusions: The developed tool is with apparent construct validity. Main caregiver's education level and presence of a thermometer are associated with a higher knowledge on fever irrespective of the dengue category.

1. Introduction

Dengue virus (DEN) is a small single-stranded RNA virus comprising four distinct serotypes (DEN-1 to 4)[1]. The first documentation of a dengue-like syndrome has been found in a Chinese medical encyclopedia during AD 265–420[2]. Dengue fever (DF) is the most significant mosquito-borne viral disease globally[3]. In recent years the annual average numbers of dengue fever/dengue hemorrhagic fever (DHF) cases reported to the World Health Organization (WHO) have been markedly increased[4]. Dengue became a public health burden in the South East Asia after the 2nd World War[5]. Sri Lanka has been mentioned as one of the countries in which epidemic dengue is a major reason of fever burden among children[6]. In Sri Lanka, clinical dengue-like-illness had been reported from the beginning of the 20th century and was first confirmed serologically in 1962[7].

The critical phase (leaking phase) of dengue is associated with fluid accumulation due to increased permeability of capillaries and leakage[8,9]. Timely identification of the onset and the end of this phase is important in reducing the morbidity and mortality among

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Ethical approval was obtained from the Ethics Review Committee of the Faculty of Medicine, University of Colombo as well as from the Ethics Review Committee of the Lady Ridgeway Hospital for Children. Data collection was done with informed written consent and without causing disturbances to the in-ward management of the patients.

The journal implements double-blind peer review practiced by specially invited international editorial board members.

patients with DHF[10]. In other words, timely detection of fever and general understanding of the essentials on fever are important modifiable factors influencing the outcome of dengue. The favorable association between awareness-related factors with prevention of dengue has been highlighted in global literature[11,12]. The WHO has stated "public education and community action" as important components in preventing dengue[13].

In many scientific studies, fever has been defined as body temperature being more than 38 °C[14]. In a study done in Turkey, it was revealed that only 27.5% of parents knew the correct temperature for fever[15]. In a study done in India on urban parents understanding on children's fever, it was revealed that a total of 58% considered fever as a disease, 91% felt that fever could go on rising if being unchecked and 60% believed that if it is brought down the child would be cured[16]. Misconceptions on fever have been highlighted in many other studies as well[17-19].

Globally it has been found that parents' beliefs and practices regarding childhood fever vary with socio-demographic characteristics[20]. In a study on DHF in Thailand, it was revealed that these factors include educational, residential and economic factors of the caregiver as well[21].

In Sri Lankan context, in a study done at a semi-government tertiary care hospital, it was revealed that more than half of the parents had not measured fever with a thermometer[22]. Unlike in other illnesses with symptoms of different systems in the body, in dengue, "fever" is the initial perception of ill-health and is one of the main diagnostic factors. Hence the responses are mainly influenced by the time the parents determine the child's fever. It has been shown that a better knowledge on fever is associated with usage of a thermometer. Furthermore the usage of a thermometer is associated with earlier treatment seeking and lesser duration of hospital stay[23].

The parents' knowledge on fever and associated factors have not been scientifically studied in the Sri Lankan context specifically in relation to dengue. This study was done to develop a tool for assessing knowledge on fever and to describe the knowledge and its associated factors on fever among the parents of the children treated as DF/DHF in the main pediatric tertiary care setting, Sri Lanka.

2. Materials and methods

The study was carried out as a hospital-based descriptive cross sectional study in six general pediatric medical wards of the Lady Ridgeway Hospital (LRH) for Children. The study was carried out from July 2012 to January 2013. Study population included the caregivers (bystanders) of the children treated as DF/DHF who were admitted to the LRH. A suspected case of dengue by the ward staff was verified by the investigators with the surveillance case definitions for notifiable diseases in Sri Lanka[24]. The case definition for DF was: "an acute febrile illness of 2–7 days with two or more of the following: headache, retro-orbital pain, myalgia, arthralgia, flushed extremities, tender hepatomegaly, rash, leucopenia and hemorrhagic manifestations. DHF definition was "a probable or confirmed case of DF and hemorrhagic tendencies (*i.e.* one or more of positive tourniquet test, petechial, ecchymosis, purpura, bleeding, hematemesis or melena) and thrombocytopenia and evidence of plasma leakage (*i.e.* > 20% rise in average hematocrit for age, > 20% drop in hematocrit following volume replacement treatment compared to baseline, signs of plasma leakage such as pleural effusion, ascites and hypo-proteinemia). Parents of the children those transferred from other hospitals and died within the Intensive Care Units (ICUs) were excluded.

Sample size was calculated using the formula:

$n = Z^2 p(1 - p)/d^2$

where Z was taken as standard normal distribution value for at 95% level, d (margin of error) was taken as 5% on either side and to get the maximum sample size p (estimation of proportion of the parents with satisfactory knowledge) was taken as 50% since local literature not available for the study setting[25]. With an expected response rate of 90%, the required sample size was 425 at the data collection stage. Systematic sampling technique was used getting the admissions that met the eligibility criteria in each ward as the sampling frame. Data collection was carried out in all six medical wards in consecutive days until the required sample size was achieved.

Interviewer administered questionnaire with two parts, one to gather socio-demographic data and the other to assess the knowledge was used. The authors with vigorous literature review defined the domains and sub-domains of a questionnaire which are suitable to assess the knowledge on fever (Table 1). There were 10 questions on the essential core knowledge on fever thus developed. Five of these questions were not "close-ended" and were semi-structured (Table 2). Each question was initially proposed to carry a maximum of 5 marks adding up to a knowledge score out of 50 which was subsequently presented as a percentage.

Table 1
Domain structure of the questionnaire.

Domain	Marks	Subdomains	Questions
Basic knowledge on fever	20%	Pathophysiology of fever	1
		Defining the presence of fever	1
Determination of fever	60%	Variations of temperature in different sites of the body	1
		Practices of determining fever	5
Knowledge on resolving fever	20%	Fever resolves when underlying condition resolves	1
		Awareness on anti-pyretics	1

Table 2
Content of the questionnaire.

Question No.	Question	Maximum marks
1	Can you explain why someone get fever: Probe: what does the body expect from raising temperature	5
2	How do you classify someone as having fever: Probe: body temperature	5
3	What can you say of the temperature of different sites of the body Probe: mouth, axilla, rectum	5
4–8	Which of the followings are reliable methods in determining a child as having fever: 4. Using a thermometer 5. Touching the forehead 6. Touching the heel 7. Observing a child as "inactive" 8. Feeling a warmth when been near the child	5 × 5
9	How will the fever be resolved Probe: underlying condition	5
10	Why do we use anti-pyretics Probe: overdosing, febrile-convulsions	5

The formulated questions and the proposed marking scheme were circulated using the Delphi technique among an expert panel which consisted of two pediatricians, two consultant community physicians and a medical officer of health. The panel was asked to mention a

score for each question based on the appropriateness. The marks for each question were amalgamated and analyzed for any outlier. There were no outliers and the 10 questions were retained in the questionnaire.

The construct validity of the questionnaire was assessed with two *a priori* hypotheses: 1. Those who have better knowledge on fever would administer the paracetomol correctly (getting the correct dose as 10–15 mg/kg/dose with a maximum 4 doses per day); 2. Those who have better knowledge would have suspected this feverish episode to be DF or DHF prior to hospital admission.

The data collection was done by two data collectors who were pre-intern medical graduates. The investigators were involved in getting the consent of the patients and in recruiting them for the study. Measures were taken to ensure the quality of data at designing, data collection and data analysis stages. The knowledge scores were initially planned to be categorized as satisfactory and unsatisfactory as decided by the median value. Subsequently it was decided to express them as numerical variables in order to minimize any data loss. The associations between the knowledge score and categorical variables were tested using the Mann-Whitney *U* test. The associations between the knowledge score and numerical variables were assessed using Spearman correlation co-efficient. The significant level was considered as 5%. The associations were further stratified according to the classification of dengue types – as DF or DHF.

Ethical approval was obtained from the Ethics Review Committee of the Faculty of Medicine, University of Colombo as well as from the Ethics Review Committee of the Lady Ridgeway Hospital for Children. Data collection was done with informed written consent and without causing disturbances to the in-ward management of the patients.

3. Results

The study was carried out among 425 participants with a response rate of 99.5%. A majority (n = 270, 63.8%) of the admitted children were in the school starting age (above 5 years). Another 80 (18.9%) were between 3 and 5 years of age, 65 (15.4%) were between 1 and 2 years of age, and the rest (n = 8, 1.9%) were infants.

Out of the study population, 326 children were treated as DF and 97 as with DHF. Out of the children with DHF, 63 (64.9%) were treated as stage I, 18 (18.6%) as stage II, 13 (13.4%) as stage III and 3 (3.1%) as stage IV. According to the WHO 2009 classification of dengue, there were approximately 272 (64.3%) with dengue without warning signs, 137 (32.4%) with warning signs and 14 (3.3%) with severe dengue.

It was found that over 97% (n = 413) of the by-standers were mothers while 10 (2.3%) were fathers. The mean age of mothers was (35.6 ± 6.9) years and their spouses were (38.8 ± 6.5) years. The mean age of the fathers who were staying with the child was (42.9 ± 6.6) years and their spouses was (38.2 ± 8.4) years. The number of children in the families were: 1 in 99 (23.4%), 2 in 196 (46.3%), 3 in 106 (25.1%) and more than 3 in 22 (5.2%).

In a majority (n = 222, 52.5%) of the families, the income was between Rs. 20 001 to Rs 39 000 (approximately USD 133–266) and in another 58 (13.7%) families, it was below Rs 20 000 (approximately USD 133). Table 3 shows the amalgamated summary of the education level of the parents, prepared by combining the education levels of the interviewee and the spouse. Majority in the mothers' as well as in the fathers' groups, had secondary level of education. Of the parents, 415 (98.8%) fathers and 97 (22.9%) mothers were employed. Both parents were employed in 90 (21.3%) families.

Table 3
Education level of the interviewee and the spouse [n (%)].

Level	Mother	Father*	Total
No school education	7 (1.7)	3 (0.7)	10 (1.2)
Primary education	24 (5.7)	13 (3.1)	37 (4.3)
Secondary education	251 (59.3)	262 (62.4)	513 (60.9)
Collegiate level	125 (29.6)	126 (30.0)	251 (29.8)
Tertiary education	16 (3.7)	16 (3.8)	32 (3.8)
Total	423 (100.0)	420 (100.0)	843 (100.0)

*: Three deceased and separated partners were excluded.

The knowledge of the parents was assessed with 10 questions. Only 24.1% knew the normal body temperature and fever was recognized as a symptom by 45.2%. The fact that the underlying disease has to be cured to resolve the fever completely was acknowledged by 36.6%. Majority of respondents (95.7%) knew that thermometer is a reliable method and 67.6% thought touching the forehead is also reliable. A majority of parents (61.2%) were not aware of ill-effects of over-dose of anti-pyretics. The average marks respondents obtained per each domain have been summarized in Table 4. The mean knowledge score was 23.04 out of 50 which was expressed as 46.08%.

Table 4
Distribution of marks obtained for the knowledge component.

Domain	No. of questions	Mean (SD)	Maximum allocated marks
Pathophysiology of fever	1	2.26 (2.49)	5
Defining the presence of fever	1	1.21 (2.14)	5
Variation of temperature of the body	1	2.39 (2.50)	5
Determination of fever	5	14.44 (6.92)	25
Rationale of resolving fever	1	1.83 (2.41)	5
Rationale of antipyretics	1	0.91 (1.93)	5
Total	10	23.04 (10.9)	50

The Table 5 summarizes the results of *a priori* hypotheses. As expected, the group that gave the correct dosage of paracetomol was with a higher knowledge score (P = 0.017). Similarly the group who suspected the illness episode could be DF or DHF was with a higher knowledge score (P = 0.029).

Table 5
Associations between the knowledge score and the two a-priori hypothesis.

Hypothesis	Knowledge score median (IQR)	Association
Paracetomol dose		
Correct	50.0 (30.0–60.0)	P = 0.017*
Incorrect	40.0 (30.0–60.0)	
Suspecting the episode as DF or DHF		
Suspected	50.0 (40.0–60.0)	P = 0.029*
Not suspected	40.0 (30.0–60.0)	

*: Significant at 0.05 level. IQR: Interquartile range.

The mean (±SD) knowledge score of the total sample was 46.08 ± 21.80. When stratified under DF and DHF, the respective data were 46.26 ± 21.90 and 45.46 ± 21.60. The median (IQR) scores of the total sample, DF, DHF groups were respectively 40.0 (30.0–60.0), 40.0 (30.0–60.0) and 50.0 (30.0–60.0).

Table 6 summarizes the non-parametric correlation of the knowledge score with five quantitative variables, *viz.* child's age,

interviewee's age, spouse's age, number of children in the family and the total income of family. The associations between knowledge *vs.* the income of the family and the child's age were significant in the total sample as well as in the DHF category. In the DF category, only the income was significantly associated with the knowledge score.

Table 6

Spearman's correlation between knowledge score and selected numerical variables.

Parameters	Total sample	DF	DHF
Interviewee's age	0.027 (P = 0.579)	0.060 (P = 0.277)	–0.097 (P = 0.344)
Spouse's age	0.008 (P = 0.869)	0.048 (P = 0.390)	–0.142 (P = 0.168)
Child's age	–0.106 (P = 0.030)*	–0.072 (P = 0.198)	–0.211 (P = 0.038)*
Number of children	–0.072 (P = 0.141)	–0.036 (P = 0.521)	–0.195 (P = 0.056)
Income	0.276 (P < 0.001)*	0.277 (P < 0.001)*	0.322 (P = 0.002)*

*: Significant at 0.05 level.

The associations between the knowledge and four selected categorical variables have been presented in Table 7. These variables are sex of the interviewee, educational level of the interviewee, the education level of the spouse and the presence of a thermometer at home. The associations were statistically significant for the latter three variables. When the results were stratified on the category of dengue, same parameters were statistically significant.

Table 7

Association between knowledge score and selected categorical variables

Parameter	Total sample	DF	DHF
Gender			
Male median (IQR)	45.0 (37.5–70.0)	45.0 (40.0–65.0)	50.0 (30.0–70.0)
Female median (IQR)	40.0 (30.0–60.0)	40.0 (30.0–60.0)	50.0 (30.0–60.0)
Significance	P = 0.710	P = 0.790	P = 0.758
Respondent's education			
Post-secondary (median IQR)	60.0 (40.0–70.0)	60.0 (40.0–70.0)	60.0 (50.0–70.0)
Less (median IQR)	40.0 (30.0–60.0)	40.0 (30.0–60.0)	30.0 (30.0–50.0)
Significance	P < 0.001*	P < 0.001*	P < 0.001*
Spouse's education			
Post-secondary (median IQR)	60.0 (40.0–70.0)	50.0 (30.0–70.0)	60.0 (50.0– 77.5)
Less (median IQR)	40.0 (30.0–60.0)	40.0 (30.0–60.0)	30.0 (20.0–50.0)
Significance	P < 0.001*	P = 0.001*	P < 0.001*
Thermometer at home			
Available median (IQR)	60.0 (40.0–70.0)	50.0 (40.0–70.0)	60.0 (50.0–70.0)
Not-available median (IQR)	40.0 (20.0–50.0)	40.0 (30.0–60.0)	30.0 (20.0–40.0)
Significance	P < 0.001*	P < 0.001*	P < 0.001*

*: Significant at 0.05 level.

Table 8 shows the results of the significant variables having adjusted for the confounders by the multivariate analysis. Having a higher education level of the main caregiver and the presence of a thermometer at home were independently associated with a higher knowledge score on fever. These two factors alone, explained 20.9%, 16.4% and 36.0% percent of the total variability in the knowledge score in total sample, DF and DHF groups respectively.

Table 8

Independently associated factors with the knowledge on fever

Significant variables	Total sample	DF	DHF
Education level of participant	P < 0.001	P < 0.001	P = 0.011
Presence of a thermometer	P = 0.001	P = 0.024	P = 0.043
R square	20.9%	16.4%	36.0%

4. Discussion

Dengue fever has been a public health problem especially in South East Asian region which includes Sri Lanka. Many interventions are done for the secondary prevention of dengue with emphasis on the hospital management. Dengue is an infection in which fever is the main symptom, varying with the natural history of the disease. It is emphasized that the timeliness of the interventions would influence the morbidity and mortality of dengue. Therefore correct determination of fever becomes a crucial factor in the home based component of secondary prevention. Furthermore, practices on responding to fever are influenced by parents' knowledge and perceptions.

The classification of dengue was done with the surveillance case definitions having considered the other alternatives like WHO 2009 classification system[26,27]. Educational levels of parents did not have a wide variation (Table 3). This may be due to the factors like the equal opportunities for education in Sri Lanka. Another reason may be that females with tertiary education look for a similar educated partner to get married.

Knowledge of the respondents was assessed by the part 2 of the questionnaire which had 10 questions each carrying 5 marks. Its construct validity was tested and verified by the two *a priori* hypotheses which were found to be fulfilled. It is striking that only one fourth knew the normal body temperature. This is the basis on which many decisions are made on fever management and misconceptions on this would lead to many negative consequences. This figure is comparative with 27.5%, which was revealed in the study in Turkey by Erkek *et al*.[15]. Fever was recognized as a symptom by 45.2%. This is again in comparison with the Singhi's study in India which reported a value of 48%[16]. In the same study the fact that disease has to be cured to resolve the fever completely, was acknowledged by 40%. In the present study, the resulted figure was 36.6%. Majority of respondents (67.6%) thought touching the forehead is also as reliable. In the study of Erkek *et al*., those who believe in fever detection at forehead was 56.5%[15].

The child's age was negatively correlated (P = 0.03) with the knowledge in the total sample as well as in the DHF category in bivariate analysis. With child getting older, the parents' worries over the childhood diseases get lesser and their knowledge seeking may get lower. The income of the family has a significant positive correlation with the knowledge (P < 0.001) in total sample as well when stratified for DF and DHF categories. This is comparative to the findings of studies in Thailand[16]. One mechanism for this association may be availability of knowledge gaining factors like television and internet with a higher income level.

Educational levels of both parents have given a significant association with the knowledge in bivariate analysis. These are similar to the findings of the above mentioned studies of Okanurak *et al*.[21]. The better understanding, rationalizing skills people gain with formal education, would be the reason. Another reason is that with the education, the family harmony and negotiation practices get better. Availability of a thermometer was found to be statistically significant with the knowledge.

The higher education level of the main caregiver and the presence of the thermometer at home were independently associated with a better score. The latter association could be due to two reasons. Firstly the group with higher education would keep a thermometer at home. Secondly the practice of using a thermometer would encourage them to be more rational in decision making processes related to fever management.

There were several limitations of the study. The diagnosis of dengue was not done with a gold standard laboratory evaluation but

by the treating consultants' diagnosis verified by the case definitions. Since then the results were interpreted with the emphasis that the study population was "treated as cases of DF and DHF". Secondly the availability of the thermometer and the education level of the respondent were recorded as answered by the participant. There were no means of verifications for those two variables. Monthly income level was considered as an approximation of the participants' financial situation. This was done as there was no reliable way to verify the other relevant aspects like owning a piece of land *etc*. The study was done in a tertiary care setting and the potential bias of recruitment exists. Hence the results were not generalized to primary settings. As LRH is the premier children's hospital is Sri Lanka, it gets admissions throughout the year from all parts of the country. Hence though findings of this study could be generalized to a broader extent, in order to minimize the sampling bias, the findings were applied only for the study setting.

The developed tool is a valid tool for assessing the parental knowledge on essential aspects of fever. Parents' knowledge on fever was apparently not satisfactory. Income of the family, education level of parents, having a thermometer at home had a significant positive association with the knowledge whereas child's age showed a significant negative association in bivariate analysis. The education level of the main caregiver and the presence of a thermometer at home are independently associated with a better knowledge.

Conflict of interest statement

We declare that we have no conflict of interest.

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