Constipation During and After the Civil War in Sri Lanka: a Paediatric Study

by Shaman Rajindrajith,1 Sachith Mettananda,1 and Niranga Manjuri Devanarayana2
1Department of Paediatrics, Faculty of Medicine, University of Kelaniya, Thalagolla Road, Ragama, Sri Lanka 11010
2Department of Physiology, Faculty of Medicine, University of Kelaniya, Thalagolla Road, Ragama, Sri Lanka 11010

Correspondence: Niranga Manjuri Devanarayana, Department of Physiology, Faculty of Medicine, University of Kelaniya, Thalagolla Road, Ragama, Sri Lanka 11010. Tel: +94 11 2961128, Fax: +94 11 2958337, E-mail: <niranga1230@lycos.com>

Summary
Constipation is a common childhood disease. It is associated with exposure to stressful events. Sri Lanka was involved in three decades of civil war causing significant emotional stress. This study assessed the prevalence of childhood constipation during and after war. Data were collected from 10- to 16-year olds in five randomly selected schools, in three provinces (two schools from Eastern province), using a validated, self-administered questionnaire. Constipation was diagnosed using Rome III criteria. Phase I was conducted during the war to liberate Eastern province from separatist groups. Phase II was conducted 2 years after the war in same schools. During Phase I, prevalence of constipation was significantly higher in Eastern province (18.1%) compared with Western (14.2%) and Southern (12.6%) provinces \( (p = 0.009) \). Constipation was significantly lower in Eastern province in Phase II (10%) compared with Phase I \( (p < 0.0001) \). This study highlights the possible link between devastating emotional effects of civil war and childhood constipation.

Key words: constipation, war, stress, child, adolescent, bowel habit.

Introduction
Constipation is a worldwide problem among children. Its prevalence in children ranges from 0.7% to 29.3% [1]. In over 90% of them, the aetiology is obscured and thought to be of functional in origin [2].

Psychological factors, such as emotional stress, affect gastrointestinal motility and sensation including lower bowel functions. Several studies have reported an association between emotional stress and constipation in children [3, 4], but its association with war has not been studied previously. According to an adult study, irritable bowel syndrome (IBS) was commoner in those exposed to civil war in Nicaragua [5]. Another study found a higher prevalence of IBS in adults who were exposed to the Second World War as early as 6–18 months of age [6]. Emotional stress associated with the war may lead to dysregulation of the function of the brain gut-axis and would have contributed to these observations [7].

Sri Lanka was involved in three decades of civil war with disruption of human life and social infrastructure. Northern and Eastern provinces were the main areas affected by the war. Suicidal attacks, bombing and other acts of violence were common in these areas. Furthermore, deliberate attacks on the border villages and public transport were also reported in these provinces. These would have resulted in a significant emotional stress for the school children living in these areas. Therefore, we hypothesized that abnormal bowel habits and constipation were more common in children living in war-affected Eastern province.

Eastern province was liberated from terrorist groups in July 2007. Restoration of public facilities, resettlement of internally displaced people and normalization of the civil life after the end of war are likely to reduce the emotional stress in the school children living in this area. Therefore, in this study, we also investigated the hypothesis that reduction in exteroceptive stress after the end of civil war normalizes the bowel habits and hence reduces the prevalence of constipation of the children.

Methods
This study was conducted in two phases.

Phase I
This phase was conducted from January to June 2007. Children aged 10–16 years, in five randomly selected schools, in three randomly selected provinces of Sri Lanka were recruited. Two schools were from Eastern province affected by war. Terrorist activities
(e.g. bomb blast, abductions) and the war to liberate Eastern province from terrorists were going on during this phase of this study.

Information regarding socio-demographic factors and bowel habits was collected using a validated, self-administered questionnaire. It was developed based on the Questionnaire on Pediatric Gastrointestinal Symptoms [8]. Questionnaire was in native language and questions were simple and easy to understand. It was administered in an examination setting, to ensure confidentiality and privacy. Research assistants were present during administration of the questionnaire to verify doubts and to help children in answering questions. School administration and parents were informed prior to administration of the questionnaire and consent was obtained. Constipation was diagnosed using Rome III criteria [9]. This phase of the study has been published previously [4, 10].

**Phase II**

Phase II was conducted 2 years after (March to July 2009) the end of the war and liberation of the Eastern province from separatist groups. By then, internally displaced personals were resettled and most of the public facilities (e.g. roads, schools, hospitals, etc) were restored. The same questionnaire was distributed in a similar setting, to children aged 10–16 years in the same five schools included in Phase I and in two additional schools randomly selected from Uva province. Uva province was included in Phase II because this province consists of multi-ethnic population as in Eastern province.

Data were analysed using χ²-test using EpiInfo [EpiInfo 6, version 6.04 (1996) Centres of Disease Control and Prevention, Atlanta, GA, USA and World Health Organization, Geneva, Switzerland]. p < 0.05 was taken as significant. Multiple logistic regression analysis was performed on variables that were found to have significant association with constipation in univariable analysis.

This study protocol was approved by the Ethical Review Committee of the Sri Lanka College of Paediatricians.

**Results**

During Phase I of this study, a total of 2770 school children were recruited. Of them, 1368 (50.8%) were males. Age ranged from 10 to 16 years with a mean age of 13.2 years, SD of 1.7 years. During Phase II of this study, 2164 children were recruited and 1173 (55%) were males. During this phase, the age range was same as in Phase I (mean age 13.5 years, SD 1.7 years). Properly filled, 97.3 and 98.7% questionnaire were included in the analysis from Phase I and Phase II of this study, respectively.

Table 1 shows prevalence of constipation during and after the civil war in all provinces. After multiple logistic regression analysis, constipation was significantly higher among those living in war-affected areas during Phase I (adjusted odds ratio (OR) 1.5, 95% confidence interval (CI) 1.1–1.9, p = 0.009). During Phase II, prevalence of constipation has decreased in all three provinces (Eastern, Southern and Western) compared with Phase I of this study. However, there was a statistically significant reduction in prevalence of constipation in previously war-affected Eastern province compared with Phase I (p < 0.0001).

Figures 1 and 2 show the mean predicted probabilities for constipation according to age groups. During the war (Phase I), mean predicted probabilities were significantly higher in all age groups in war-affected Eastern province compared with other two provinces. Two years after the war (Phase II), mean predicted probabilities for constipation were slightly lower in the Eastern province and did not show a significant difference from other two provinces (Fig. 2).

Other factors independently associated with constipation during both phases were having a history of constipation in first-degree relatives (adjusted OR 6.0, 95% CI 3.4–10.8, p < 0.0001 in Phase I and adjusted OR 4.65, 95% CI 2.59–8.34, p < 0.0001 in Phase II) and exposure to family and school-related stressful events other than war (adjusted OR 2.8, 95% CI 1.74–3.0, p < 0.0001 in Phase I and adjusted OR 1.93, 95% CI 1.4–2.66, p < 0.0001 in Phase II). Constipation was significantly higher in children studying in urban schools during Phase I (adjusted OR 1.4, 95% CI 1.1–1.9, p = 0.02), but not during Phase II (adjusted OR 1.16, 95% CI 0.88–1.53, p = 0.302).

Table 2 illustrates bowel habits of the study sample during and after the civil war. During the war, painful defecation and stool withholding were significantly more common in war-affected area. When bowel habits during Phases I and II were compared, hard stools, painful defecation, large volume stools and stool withholding posture showed significant

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**Table 1**

<table>
<thead>
<tr>
<th>Province</th>
<th>During war, n (%)</th>
<th>After war, n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eastern provincea</td>
<td>195 (18.1)b</td>
<td>71 (10)c</td>
</tr>
<tr>
<td>Southern province</td>
<td>98 (12.6)</td>
<td>51 (11)</td>
</tr>
<tr>
<td>Western province</td>
<td>123 (14.2)</td>
<td>67 (12.1)</td>
</tr>
<tr>
<td>Uva province</td>
<td>—</td>
<td>45 (11)</td>
</tr>
</tbody>
</table>

*aWar-affected area.

b p = 0.009, Eastern province vs. other two provinces.

c p < 0.0001, Eastern province, during war vs. after war.
reduction after the war in the war-affected Eastern province. In other two areas, there was a significant reduction in painful defecation and stool withholding after the war and rise in low defecation frequency.

Discussion
To the best of our knowledge, this is the first study to assess the prevalence of constipation in school-aged children during and after a civil war. In this study, during the period of war, prevalence of constipation was significantly higher in war-affected Eastern province compared with other areas of the country. There was a significant reduction in prevalence of constipation and related symptoms in this province 2 years after the end of war.

Physical or psychological trauma has been identified as an important risk factor for constipation in children [3]. Furthermore, family and school-related stressful life events are also known to precipitate constipation.
functional gastrointestinal diseases including constipation [4, 11]. Phase I of this study was conducted during the civil war to liberate Eastern province from separatist group in Sri Lanka. During this period, there were events such as random checking of houses, bomb blasts and abduction and recruitment of children by separatist group as child soldiers and for other war-related activities. Many schools were closed from time-to-time and children were forced to leave schools because of bomb threats. There were some civilian casualties also. Public transport system in the war-affected Eastern province was constantly under the threat of landmines and claymore mines. Furthermore, there were deliberate, pre-planned attacks against civilians living in the border villages of the Eastern province. The psychological trauma and stress generated by these events probably have resulted in high prevalence of constipation observed in children living in war-affected area during this period. Catani et al. [12] have shown a linear relationship between the numbers of war-related stressful events and prevalence of post-traumatic stress disorders in Sri Lankan children. Psychological stress is a key factor, which causes significant alterations in functions of the brain-gut axis [7]. In genetically and psychologically vulnerable individuals, this results in alterations of physiological functions of the lower gut, predisposing children to develop constipation.

We have observed a significant reduction in prevalence of constipation 2 years after the end of war and liberation of this province from terrorist groups. Restoration of the day-to-day life after the end of the war would have reduced war-related stressors in these children which would have contributed to the significant reduction observed in prevalence of constipation. Most of the other factors associated with constipation have remained constant during both phases. We have also demonstrated a higher predicted probability of constipation in war-affected areas during Phase I and a significant reduction in it after the war. So far, no other study has demonstrated a reduction in the prevalence of constipation after removal of stressful life events.

In this study, we observed a higher prevalence of abnormal bowel habits (painful defeation and stool withholding) in children living in war-affected area during Phase I, compared with other provinces of the country. Furthermore, clinical features related to stool withholding such as retentive posturing, large diameter stools and pain while passing stools were significantly decreased in the war-affected area after the end of war. The relationship between psychological factors and individual bowel habits has not been reported previously. Some studies have demonstrated abnormalities such as delayed colonic transit among patients with anxiety and depression. Furthermore, emotional distress leads to pelvic floor tension [13], alteration in rectal mucosal blood flow [14] and altered rectal sensitivity [15]. Previous animal studies have reported sustained bowel dysfunction (decreases number of stools and decreased stool weight) and visceral hypersensitivity in rats exposed to prolonged and variable stress [16]. We have previously shown high prevalence of painful defeation, large diameter stools and stool withholding in children exposed to family and school-related stressful life events [4].

In conclusion, this study underscores the significant association between civil war and childhood constipation. The stress and anxiety related to war probably affect brain-gut axis, and alter lower gut functions, leading to constipation. This highlights the possible link between devastating emotional effects of the civil war, gastrointestinal regulatory mechanisms and aetiology of functional constipation.

**References**