

## Socio-demographic characteristics and risk factors of functional constipation in children: A case-control study

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*Sri Lanka Journal of Child Health*, 2022; **51**(2): 227-234  
DOI: <http://dx.doi.org/10.4038/sljch.v51i2.10123>

### Abstract

**Background:** Constipation is a worldwide problem among children. Functional constipation (FC) is the most common type of chronic constipation in children comprising 95% of them.

**Objectives:** To study the socio-demographic characteristics and risk factors of FC in children.

**Method:** This was a single centre, case-control study; 165 patients, ages ranging from early infancy to 17 years, who were suffering from FC were recruited for six months and they were age and sex-matched with 165 healthy controls. Using a questionnaire, data were gathered from those individuals and their caregivers regarding socio-demographic characteristics, dietary history, psychological insults, family history and socio-economic status. All patients were examined abdominally and rectally.

**Results:** Mean age of patients under study was 3.7 ± 3.3 years, and males were more affected than females. The male to female ratio was 2.3:1. The mean age at onset of the development of constipation among our cohort was 2.3 years. Male gender, prematurity, low birth weight, formula feeding during infancy, low fibre diet, positive family history of constipation, low socioeconomic status and illiteracy of the mother were all risk factors of FC and the association was highly significant. There was no association between type of residency or bodyweight with risk of FC. Fear of using the toilet was the most common underlying psychological insult. Hard stool was the most frequent presentation of our cohort followed by

infrequent passage of stool. Faecal soiling, colic, anorexia, pain on defaecation, retentive posturing and nocturnal enuresis were also presenting symptoms. Urinary tract infection was seen in 34.5% of FC patients.

**Conclusions:** Male gender, prematurity, low birth weight, formula feeding during infancy, low fibre diet, positive family history of constipation, low socioeconomic status and illiteracy of the mother were all risk factors of FC and the association was highly significant. Fear of using the toilet was the most common underlying psychological insult.

(Key words: Functional constipation, Encopresis, Rome IV criteria, Children, Socio-demographic, Soiling).

### Introduction

Constipation is a worldwide problem among children and a frequent complaint encountered in paediatric medical and surgical practice, affecting up to 30% of children<sup>1</sup>. It is defined as an abnormal stooling process which is referred to as either hard-to-pass stool or infrequent stooling (less than 3 per week). Constipation has an important influence on healthcare costs and can be embarrassing for patients and their families especially when associated with faecal soiling in a chronically constipated child.

Constipation in children is of two types, functional or organic. FC is seen in 95% of cases and is especially common among the preschool-age children<sup>2,3</sup>. FC is diagnosed when there is an infrequent or difficult evacuation of the bowel without underlying biochemical or primary anatomical defects like ano-rectal malformations, Hirschsprung disease or neuromuscular defects<sup>4</sup>. In 2016 Rome IV criteria were released to describe FC in children and require the presence of at least two out of six diagnostic criteria for at least one month with the provision of an absence of underlying organic aetiology<sup>4,5,6</sup>.

The underlying pathophysiology of FC is poorly understood but is likely to be multifactorial. Genetic factors may also play a role since a positive family history is seen on many occasions, but still, there are no confirmed specific mutations<sup>4,7</sup>. Withholding behaviour (which follows passing a painful hard

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(Received on 29 August 2021; Accepted after revision on 22 October 2021)

The authors declare that there are no conflicts of interest

Personal funding was used for the project.

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stool) is the most common mechanism for initiation of FC, especially at the age of toilet training and this evolves into a vicious cycle of hardening of stool and withholding. Children who are more prone to the risk of FC are infants at the age of introduction of complementary feeding, children around the period of toilet training and children at the start of school<sup>8</sup>.

### Objectives

The objectives of this study were to assess the socio-demographic characteristics and the risk factors for the development of FC in children.

### Method

This was a single centre, case-control study conducted from July 2020 to January 2021. The *cases* group involved patients who were visiting the paediatric gastroenterology clinic complaining of chronic constipation and the patients' age range was from early infancy to late adolescence. The *control* group included healthy infants and children who were visiting a primary care centre for vaccination and / or routine care. They were age and sex-matched with each subject in the *cases* group.

**Inclusion criteria:** All infants and children from early infancy to late adolescence with a diagnosis of FC according to Rome IV criteria.

**Exclusion criteria:** Any case with a medical or surgical cause of constipation (organic constipation) e.g., drugs, congenital hypothyroidism, Hirschsprung disease, recto-anal malformations, spinal cord lesions etc.

Each patient was fully examined by a well-trained paediatrician and paediatric surgeon to tackle the cause of constipation. Over six months the total number of patients collected with chronic constipation was 256 patients. Only 165 patients were included in the study because they met the inclusion criteria and they were matched with 165 healthy controls.

Using a questionnaire, data were gathered from those patients and their caregivers including socio-demographic characteristics, onset and duration of constipation, type of feeding during early infancy, current dietary fibre content, any new psychological trauma or fear (e.g., familial quarrels, the start of school or direct physical or verbal or sexual abuse of the child, etc.), any family history of chronic constipation and common symptoms associated with constipation. A low fibre diet was considered when the usual diet of the patients during the day was lacking fruits, vegetables, and whole grains or if it was mainly sweets and junk food. Also, each patient

was examined for abdominal and rectal findings. All findings during the physical examination were recorded. A midstream clean catch urine sample from each patient was sent for general urine examination.

**Ethical issues:** Ethical approval was obtained from the Medical Research Ethics Committee, University of Mosul College of Medicine, Mosul, Iraq (Ref. No. UOM/COM/MREC/21-22 (3) dated 12/9/2021). Written informed consent was obtained from parents of all subjects involved in the study.

**Statistical analysis:** Data were processed using SPSS 23.0 software. A Chi-square test was used to study the association between the categorical variables & FC. A *p*-value <0.05 was considered statistically significant.

### Results

Out of 291 patients complaining of chronic constipation who were visiting the paediatric gastroenterology clinic for 6 months, only 165 patients had a clear diagnosis of FC and they were included in the study. Patients' ages ranged from 2 months to 17 years. The mean age of the patients was 3.7 years and the standard deviation (SD) was 3.3 years. There were 115 (69.7%) male patients and 50 (30.3%) female patients with a male to female ratio of 2.3:1. The mean age at onset of the development of constipation among our cohort was 2.3 years (SD 2.9 years) as shown in Figure 1, while the mean duration of chronic constipation among them was 17 months (SD 23.3 months).

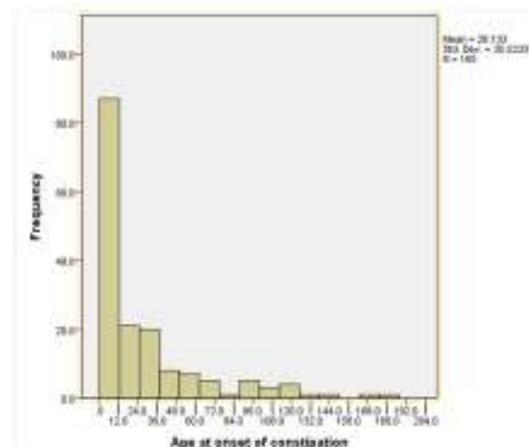


Figure 1: Age at onset of constipation

The patients' socio-demographic characteristics in comparison to controls are illustrated in Table 1.

**Table1: Socio-demographic characteristics of cases and controls**

Characteristic	Patients n (%)	Controls n (%)	Odds ratio (OR)	95% CI of OR	p-value
<i>Weight</i>					
Low	42 (25.5)	36 (21.8)	1.18	0.71-1.96	0.5*
Normal	123 (74.5)	129 (78.2)			
<i>Residence</i>					
Urban	119 (72.1)	105 (63.6)	1.48	0.93-2.35	0.06*
Rural	46 (27.9)	60 (36.4)			
<i>Gestational age at birth</i>					
Pre-term	14 (08.5)	01 (0.6)	15.20	1.97-117.02	<0.0001***
Term	151 (91.5)	164 (99.4)			
<i>Birth weight</i>					
<2.5Kg	31 (18.8)	01 (0.6)	37.90	5.11-281.57	<0.0001***
≥2.5 Kg	134 (81.2)	164(99.4)			
<i>Feeding during infancy</i>					
Formula	100	18	15.24	8.27-28.09	<0.0001***
Breast	43	118			
<i>Current diet (fibre content)</i>					
Low	136 (87.7)	32 (20.6)	27.50	14.88-50.87	<0.0001***
Well balanced	19 (12.3)	123 (79.4)			
<i>Psychological insult</i>					
Yes	30 (18.2)	01 (0.6)	36.44	4.90-270.73	<0.0001***
No	135 (81.8)	164 (99.4)			
<i>Family history</i>					
Yes	35 (21.2)	12 (07.3)	3.43	1.71-6.88	<0.0001***
No	130 (78.8)	153 (92.7)			
<i>Socio-economic status</i>					
Low	79	51	7.23	3.24-16.11	<0.0001***
High	09	42			
<i>Educational level of child's mother</i>					
Illiterate	79	56	2.82	1.43-5.54	0.002**
High education	17	34			

\*Non-significant p-value, \*\*Significant p-value, \*\*\*Highly significant p-value

During the first six months of life, formula feeding was documented in 100 (60.6%), breastfeeding in 43 (26.1%) and mixed feeding in 22 (13.3%). Association between formula feeding and FC was highly significant (Table 1). In children older than 6 months (155 cases and 155 controls) we studied the usual daily diet and the fibre content in it like fruits, vegetables and whole grain. A low fibre diet (mainly junk food, sweets and snacks) was usual in 87.7% children, the association with FC being highly significant.

For the history of any significant psychological insult or problem, 18.2 % of children had a positive history before the onset of chronic constipation and Table 2 illustrates the types of psychological insults and their order of frequency among those children, A history of fear of using of a toilet the most common type in 36.7% of cases. The association also was highly significant. Furthermore, a positive family history of chronic constipation among first-degree relatives was seen in 21.2% of children with a statistically significant p-value (<0.0001).

**Table 2: Types of psychological insults**

Type of psychological insult	n (%)
Fear of using toilet	11 (36.7)
Start of school	07 (23.3)
New family member	03 (10.0)
Verbal or physical abuse	03 (10.0)
Separation of parents	03 (10.0)
Death of family member	2 (06.7)
Family quarrels	01 (03.3)
Sexual abuse or others	0 (0)
Total number of patients	30 (100.0)

We had 3 levels of socioeconomic status (low, medium, and high) among our cohort divided according to monthly income and social level of the family. Low socioeconomic status was characteristic in 47.9% of patients also with a highly significant association. Similarly, we studied the association between the educational level of the mother and FC in their children. We found that 47.9% of FC children had illiterate mothers. Again, the association was highly significant (Table 1).

Table 3 shows the common symptoms on presentation among our cohort. In retentive posturing, the child is trying to withhold his stool voluntarily by standing or sitting with stiff straight

or crossed legs. Sometimes they may have a red face on straining or they may hide in a corner in an attempt to postpone defaecation.

**Table 3: Presenting symptoms among children with functional constipation**

Symptoms on presentation	n (%)
<i>Passage of hard stool mainly</i>	148 (89.7)
<i>Infrequent passage of stool (two or fewer per week)</i>	17 (10.3)
<i>Abdominal distension</i>	
Yes	54 (32.7)
No	111 (67.3)
<i>Faecal soiling once / week at least for children ≥ 4 years (Total no. 63 children)</i>	
Yes	35 (55.6)
No	28 (44.4)
<i>Colic</i>	
Yes	147 (89.1)
No	18 (10.9)
<i>Anorexia</i>	
Yes	108 (65.5)
No	57 (34.5)
<i>Pain on defaecation</i>	
Yes	103 (65.5)
No	62 (37.6)
<i>Retentive posturing in patients ≥ 1 year (Total no.131 children)</i>	
Yes	37 (28.2)
No	94 (71.8)
<i>Urinary tract infection (confirmed by elevated pus cells and presence of viable bacteria)</i>	
Yes	57 (34.5)
No	108 (65.5)
<i>Nocturnal enuresis preceding onset of constipation)for children ≥ 5years (Total no.46)</i>	
Yes	10 (21.7)
No	36 (78.3)
Total	165 (100.0)

Findings on clinical examination and their frequencies in FC patients are shown in Table 4.

**Table 4**  
**Findings on clinical examination in children with functional constipation**

Clinical finding	n (%)
<i>Palpable faecal abdominal mass</i>	
Yes	35 (21.1)
No	130 (78.8)
<i>Presence of anal fissure</i>	
Yes	82 (49.7)
No	83 (50.3)
<i>Presence of anal skin tags</i>	
Yes	20 (12.1)
No	145 (87.9)
<i>Palpable large rectal faecal mass</i>	
Yes	98 (59.4)
No	67 (40.6)
Total	165 (100.0)

**Discussion**

FC is a common problem among children all over the world. Our study revealed that the mean age at onset of FC was 2.3 years. This was consistent with other studies<sup>9,10,11</sup>. We also found that males were more affected by FC than females. This was consistent with studies from Romania and Sri Lanka<sup>10,12</sup>. In other studies, there was no gender association with FC<sup>13,14,15</sup>. In our study, there was no significant effect of body weight or living place whether urban or rural on the incidence of constipation<sup>13</sup>. Different studies on this subject showed different results. A study by Rajindrajith S, *et al*<sup>16</sup> revealed that children living in urban areas were at higher risk of constipation, while Chu H, *et al* concluded that residing in rural areas increases the risk of constipation among Chinese children<sup>16,17</sup>. The conflict between different papers needs to be studied further to reach an appropriate conclusion. On the other hand, patients with a history of prematurity and low birth weight are at increased risk of FC which may be due to some neurodevelopmental impairment and poor muscle tone. This was also reported by Cunningham C, *et al*<sup>18</sup>.

FC usually has its origin in infancy and in our study, we found that formula feeding during early infancy was linked significantly with the risk of FC. It is known that breast-fed infants tend to have frequent loose stools compared to formula-fed babies who have less frequent bowel movements. This result was likewise obtained by Olaru C, *et al*<sup>10</sup>, Aguirre AN, *et al*<sup>19</sup> and Sangalli CN, *et al*<sup>10,19,20</sup>. Our data found that their usual diet was fibre-poor and a high percentage of them were consuming mainly sweets and junk food with little or no fruits or vegetables in their meals. Olaru C, *et al*<sup>10</sup> and Rezaianzadeh A, *et al*<sup>21</sup> came to the same conclusion. Yang J, *et al*<sup>22</sup> concluded through a meta-analysis study that fibre-rich diet help in increasing defaecation frequency in constipated patients. Moreover, children who are exposed to stressful life events and psychological trauma like punishment, bullying, domestic violence, death of a family member, or any stressful new life events or abuse, are more prone to FC as reported in this study. In our cohort, fear of using the toilet was the most reported event preceding the onset of chronic constipation. Forcing the child to use the toilet before full developmental readiness or any bathroom bad experiences lead to stool withholding and a then vicious cycle of constipation. Psychological stress adversely affects bowel function and increases pelvic floor tension. Some studies reported abnormalities in rectal blood flow and changes in rectal sensitivity in patients with psychological trauma. Rajindrajith S, *et al*<sup>16</sup> concluded that the association between stress and constipation is explained by the disturbance of the brain-gut axis<sup>11,16,23,24,25,26</sup>.

In our sample, a positive family history of constipation was significantly associated with FC in children which was in accordance with studies by Olaru C, *et al*<sup>10</sup>, Chan AO, *et al*<sup>27</sup> and Rezaianzadeh A, *et al*<sup>21</sup>. This may be due to some genetic factors or due to sharing the same dietary habits that influence bowel transit time. In the same way, our study revealed that patients from low socioeconomic status were at more risk of development of FC. This may be due to a bad dietary supply. Poor patients cannot consume an adequate amount of fibre-rich food like vegetables and fruits because of the high cost. In addition, stressful life events affect gut function. A study by Johanson JF<sup>28</sup> in the United States confirmed this relationship. On the other hand, considering the association between the educational level of the mother and FC in children, we found a highly significant association between illiteracy of the mother and FC in her child. This is probably because illiterate or non-educated mothers lack adequate knowledge about healthy dietary practices or how to deal with the constipated child and delays seeking medical advice in this situation. This was also concluded by Rezaianzadeh A, *et al*<sup>21</sup>.

To illustrate the main symptoms of constipation, our data revealed that constipation in infants and children is described as passage of hard stool in most cases and infrequent passage of stool is the second presentation. A high percentage of constipated patients were suffering from encopresis, abdominal distension, colic, pain on defaecation and retentive posturing. These cumbersome symptoms interfere with normal daily activity and schooling. Anorexia is also reported in a high percentage among our case group which was higher than that in a study by Dehghani S, *et al*<sup>29</sup> in a study from Korea on adult patients. Jeong E, *et al*<sup>30</sup> concluded nearly the same result. This can be explained by the fact that constipated patients had slow transit time that leads to anorexia. Conversely, anorexia leads to low food intake that reduces defaecation frequency. So, anorexia and FC both interact in a vicious cycle.

Likewise, chronic constipation affects urinary tract function adversely. We found a significant percentage of our chronically constipated patients were also suffering from urinary tract infection and/or enuresis. This finding is consistent with other studies<sup>22,29,31,32,33</sup>. This is explained by the fact that chronic constipation, stool withholding behaviour, contamination of perineum with faecal material and bad toileting practice, all eventually, lead to urinary stasis and hence increases the risk of urinary tract infection. Therefore, evaluation of symptoms of urinary tract infection and enuresis is mandatory before management of constipation and vice versa. Moreover, drugs with anticholinergic effects (like oxybutynin) should be avoided in the treatment of nocturnal enuresis in a patient with chronic constipation which may eventually exacerbate the enuresis<sup>34</sup>.

Other challenges that should be looked for before management of any chronically constipated child, are looking for anal fissures and anal tags. In our study, nearly half of our patients had anal fissures; this finding was higher than that in studies by Dehghani S, *et al*<sup>29</sup> and Aydoğdu S, *et al*<sup>35</sup>. Early detection and treatment of anal fissures accelerate the recovery of chronic constipation.

This is the first study in our locality. The single-centre study was the main limitation of our study, and we did not study other risk factors like the amount of daily fluid intake and the level of daily activity. A multicentre study and a larger sample size are recommended in the future.

## Conclusions

Male gender, prematurity, low birth weight, formula feeding during infancy, low fibre diet, positive family history of constipation, low socioeconomic status and illiteracy of the mother were all risk factors of FC and the association was highly

significant. Fear of using the toilet was the most common underlying psychological insult.

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