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Functional constipation among apparently healthy adolescents in Sokoto, North– western Nigeria

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Abstract: *Background / Aims:* Functional constipation (FC) is an emerging global health problem that could be associated with psychological maladjustments in childhood. The objectives were to determine the prevalence, associated factors and predictors of FC among in-school adolescents in Sokoto.

Methods: It was a cross sectional survey of apparently healthy secondary school students in Sokoto metropolis selected via multistage random sampling, using a pretested semi-structured questionnaire. Rome IV criteria for the diagnosis of FC were adopted in determining FC among the subjects. Data was analyzed using IBM-SPSS version 25.

Results: Six hundred and three (603) adolescents were studied, majority 327 (54.2%) were males, their ages ranged between 10 and 19 years with mean (±SD) of 15.2 ± 2.6 years, with majority 246 (40.8%) belonging to age category 10-14 years. Most 383(63.5%) of the respondents attended public schools and 326(54.1%) were in senior secondary class category. Their parents were mainly 483 (80.1%) Hausa by tribe, graduates of tertiary institution 227 (37.6%),civil servants 268 (44.4%), and majority 272(45.1%) belonged to the middle social class. There was family history of constipation among 64(10.6%) of the subjects. Of the 603 adolescents that were studied, 123 of them had FC giving a prevalence of 20.4%. Gender (p=0.001), school type (p<0.001), access to toilet (p<0.001), unstable diet (p<0.001), inadequate physical activity (p<0.001), and poor self-concept (p=0.005) were associated with FC, and they remained independent predictors of FC on logistic regression analysis.

Conclusions: One out of five of the respondents had Functional constipation and it was associated with some socio-demographic and psychological factors.

Keywords: Functional constipation, Adolescents, Secondary schools, Sokoto, Nigeria

Introduction

Childhood constipation is one of the most common chronic disorders of childhood and the most frequent functional gastrointestinal disorders worldwide with an estimated prevalence of 1-30%.[1,2] While constipation occurs in all continents, currently there is a lack of prevalence data in children in rural and non-rural areas, especially in Africa, making it difficult to understand the magnitude of the problem and identify risk factors in these parts of the world.[3,4] Childhood constipation is usually functional (i.e., there is no evidence of an organic condition) however, the pathophysiology of functional constipation in children remains unclear, but is likely multifactorial.[5,6] Poor toilet training, psychological difficulties, child maltreatment and dietary factors may interact with each other in a complex manner, contributing to the development of constipation.[4]

The most common mechanism for functional constipation is withholding behaviour. In young children, it often starts after a painful frightening bowel movement, while in older children it is due to the very active lifestyle and school system, where children do not have enough time for a proper bowel movement. In a subgroup of children, functional constipation can be due to slow transit.[3] Withholding of stool can lead to prolonged fecal stasis in the colon with reabsorption of fluid, causing the stool to become harder, larger, and more painful to pass.[7]Constipation is an increasing public health problem across the world with a significant medical, social and economic impact.[4]Children with constipation have been documented to experience persistent fatigue with significant school absenteeism.[8]Impaired school functioning could lead to a vicious cycle of psychological

stress due to pressures from school, peers and even parents, aggravating the symptoms of constipation. Although it is not linked to mortality directly, constipation leads to poor health-related quality of life and the negative effect on quality of life often persists into adulthood.[4]A study on the family impact of chronic constipation, showed that parents of children with FC have poor health-related quality of life and that constipation had a significant negative impact on parental communication, family functioning, family daily activity and relationships.[9] The recommendations for the management of functional constipation include a normal intake of fibers and fluids, normal physical activity, and an additional pharmacologic treatment for rectal fecal dis-impaction followed by a pharmacologic maintenance therapy.[5]
Previous study on FC in adolescents was conducted in the southern part of Nigeria.[10]From our literature search; no study has been conducted on functional constipation among adolescents in Northern Nigeria, including Sokoto, north-western Nigeria. The socio-economic background of children and adolescents in this study area is such that access to basic amenities such as toilet facilities and adequate portable drinking water are lacking.[11] The situation is worse in the school environment where such facilities are grossly inadequate, overstretched, and poorly maintained, making it possible for risk factors of functional constipation such as inadequate fluid intake and stool withholding to thrive.[12]

This study sought to determine the prevalence, associated factors and predictors of FC among in-school adolescents in Sokoto. Findings from this study were intended to be used in creating awareness and providing insight into the occurrence of FC and the impact it could have on adolescents in the study area, as well as to provide evidence-based information for stakeholders to employ in addressing factors identified to be associated with FC. Tackling FC is imperative because it may have a prolonged course of intermittent relapse causing anxiety to children and their caregivers.[13]

Methods

Study area

The study was conducted in Sokoto metropolis, the capital of Sokoto state, Nigeria. The town has within it, three local government areas (LGAs) which include Sokoto-North, Sokoto-South and Wamakko LGAs. There were 47 (28 public and 19 private) secondary schools in the metropolis and 27 of them were co-educational. Sokoto-North LGA had 15(seven public and eight private) secondary schools, Sokoto- South LGA had 19(14 public and five private) secondary schools and Wamakko LGA had 13(seven public and six private) secondary schools. Major occupations of the inhabitants include trading, farming and civil service. The main agricultural produce in the study location are carbohydrate-based sources. Sokoto is one of the hottest cities in Nigeria with the warmest months being February to April, where daytime temperatures can exceed 40 °C.[14]The total population of adolescents aged 10-19 years in the metropolis was 136,900with a projected population of 195,186.67 in 2018.[15]

Study design and subjects

The study was a cross sectional survey that was conducted between January and April 2018 in secondary schools in Sokoto metropolis, Sokoto State, Nigeria. Multi-stage random sampling technique was employed in selecting the participating schools. The schools were stratified based on LGA's intoco-educational (27) schools and non-coeducational (20) schools. Further stratification per LGA was done by line listing the schools into public and private schools. Simple random sampling method (balloting technique) was used to select six secondary schools from the coeducational schools (one public and one private school from each of the three LGA's) following 20% proportional allocation. The desired sample size was allocated proportionally to the randomly selected schools based on the student population. Six class levels were identified per selected school, and an arm from each class level was randomly selected by balloting. Students from each arm were selected by systematic random sampling technique, with investigators ensuring proportional allocation of gender. The study comprised of assenting randomly selected apparently healthy secondary school adolescents aged between 10 years and 19 years whose parents or guardians consented to the study, who resided in the study area for at least one year, and who satisfactorily completed the questionnaire. Excluded from the study were critically ill students, those with features of diseases such as hypothyroidism, sickle cell disease, known behavioural problems, those with warning signs such ashaematochezia, weight loss and those already on treatment for constipation.[5,16]

Sample size determination

The sample size was determined using the formula for cross-sectional studies.[17]
$n = Z^2 \times pq / d^2$
Where n = minimum sample size needed for meaningful statistical analysis
Z = standard normal deviation, usually standard value set at 1.96, which corresponds to the 95% confidence interval.
p = the proportion in the target population estimated to have a particular characteristic. The prevalence from a previous study 27% (0.27) was used.[10]
q = 1-p
d = the degree of accuracy desired, usually set at 0.05.
Therefore, $n= (1.96)^2 (0.27) (0.73)/ (0.05)^2 = 303$
However, because of the non-invasive nature of the study, the researchers enhanced the calculated sample size to 606 (100% of the minimum sample size).

Data collection

The selected schools were visited before the commencement of the study to interact with the heads of the schools in terms of requirements for the study, and to identify free periods for the collection of data. Designed pretested semi-structured questionnaires were distributed to the parents and guardians of the randomly selected students that satisfied the inclusion criteria, through the school teachers. Information sought included; age, gender, address, ethnicity, family history of constipation, and socio-economic status of parents and guardians was determined using Oyedeji's classification.[18]Other information sought included histories suggestive of behavioural disorder, hypothyroidism, sickle cell disease in the subject, and subject's drug history. Information on dietary intake of fiber, stability of dietary pattern, fluid intake, access to toilet, timing of defecation, and physical activity were obtained from the subjects. General physical and systemic examinations were performed on the subjects.

For the purpose of this study, functional constipation was defined according to the Rome IV criteria.[19] These criteria are as follows: The presence of at least two of the followings at least once per week for a minimum period of one month: Two or fewer defecations in the toilet per week in a child of a developmental age of at least 4 years; At least one episode of fecal incontinence per week; History of retentive posturing or excessive volitional stool retention; History of painful or hard bowel movements; Presence of a large fecal mass in the rectum; History of large-diameter stools that may obstruct the toilet. The symptoms cannot be fully explained by another medical condition. In addition, the symptoms are insufficient to fulfill the diagnostic criteria of irritable bowel syndrome.[19]Individuals with estimated dietary fibre less than 26 g/day and above 31 g/day were considered to have had low and high fibre diet respectively.[20]Lack of a particular meal pattern per day and skipping of meals was considered unstable diet pattern. Water consumption of 2-3 litres /day was considered adequate fluid intake. Access to clean water cistern or pit latrine with adequate water facility was considered access to functional toilet facility. Stool withholding was referred to as the avoidance of passage of stool despite the urge. Adequate physical activity was defined asone hour or more of moderate-vigorous daily physical activity.[21]

Ethical considerations

Ethical approval for the study was obtained from the Ethics Committee of Usmanu Danfodiyo University Teaching Hospital (UDUTH) Sokoto with approval number UDUTH/HREC/2017/No.561. Approval to conduct the study was also obtained from the Sokoto State ministries of Education/ Science and Technical Education, the school authorities concerned. An Informed written consent and assent were sought and obtained from the parents/ guardians, and the study participants respectively. The data obtained were treated with utmost confidentiality.

Data analysis

Statistical package for social sciences (IBM-SPSS) version 25.0 was used to analyze the data. The prevalence of functional constipation was presented as percentage while the age distribution of the subjects was analyzed and expressed as mean and standard deviation. Frequency distribution tables were used to illustrate results. Chi square test was used to determine the association between socio-demographic variables and functional constipation, and Fisher's exact test was used as applicable. Logistic regression was used to determine the variables that were independently associated with functional constipation. The level of statistical significance was set at 5%, which is p-value < 0.05.

Results

Sociodemographic characteristics of the respondents

Six hundred and three (603) adolescents were studied, giving a participation rate of 99.5%. More than half of them 327 (54.2%) were males, their ages ranged between 10 and 19 years with mean (±SD) of 15.2 ± 2.6 years, while 246(40.8%) belong to age category 10-14 years. Most 383(63.5%) of the respondents attended public schools and 326(54.1%) were in senior secondary class category. Their parents were mainly 483(80.1%) Hausa by tribe, graduates of tertiary institution 227 (37.6%),civil servants 268(44.4%), and almost half 272 (45.1%) belonged to the middle social class. (Table 1)

Prevalence of functional constipation

One hundred and twenty-three (20.4%) of the subjects had FC. The age category 10-14 years had the highest 50(40.6%) age specific prevalence. Males had higher 83 (67.5%) gender specific prevalence than their female counterparts. There was family history of constipation among 64(10.6%) of the subjects.(Table 2).

Participants diet related factors, toilet accessibility, and engagement in exercise.

Larger proportion of the subjects 549(91%) were on high fiber diet, most 575(95.4%) of them had no recent history of change in unstable diet, majority 581(96.4%) were on adequate fluid intake, most 552(91.5%) had access to toilet, 46(7.6%) usually withheld stool, while 425(70.5%) were engaged in regular physical exercise. (Table 3)

Table 1: Sociodemographic characteristics of the respondents

Variables	Frequency (*n* = 603)	Per-cent
Age (years)		
10-14	246	40.8
15 – 17	205	34.0
18 – 19	152	25.2
Mean = 15.2 ±2.6 years		
Gender		
Male	327	54.2
Female	276	45.8
School type		
Public	383	63.5
Private	220	36.5
Class in school		
Junior secondary	277	45.9
Senior secondary	326	54.1
Tribe		
Hausa	483	80.1
Yoruba	33	5.5
Igbo	21	3.5
Others (Igbira, Nupe, Barebari, Fulani)	66	10.9
Parental education		
Tertiary	227	37.6
Secondary	172	28.5
Primary	123	20.5
Arabic school/ Not literate	81	13.4
Parental occupation		
Senior or intermediate level civil servant	268	44.4
Large scale Business/ contractors	102	16.9
Driver or Artisan	44	7.3
Laborer or Petty trader	103	17.1
Unemployed/ Full time Housewife/ Subsistence farmer/Student	86	14.3
Socioeconomic status of Parent		
Upper class	160	26.5
Middle class	272	45.1
Lower class	171	28.4

Table 2: Prevalence of functional constipation among the respondents

Variables	Frequency (n = 603)	Percent
Functional Constipation (FC)		
Yes	123	20.4
No	480	79.6
Family history of FC		
Yes	64	10.6
No	539	89.4
Distribution of FC (n=123)		
Age distribution of FC		
10-14	50	40.6
15 – 17	45	36.6
18 – 19	28	22.8
Gender distribution of FC		
Male	83	67.5
Female	40	32.5

Table 3: Respondents' diet related factors, toilet accessibility, and engagement in exercise

Variables	Frequency (n = 603)	Percent
Consumption of high fibre diet		
Yes	549	91.0
No	54	9.0
Unstable diet intake		
Yes	28	4.6
No	575	95.4
Fluid intake		
Adequate	581	96.4
Inadequate	22	3.6
Access to toilet		
Yes	552	91.5
No	51	8.5
Withholding stool		
Yes	46	7.6
No	557	92.4
Practice of regular physical exercise		
Yes	425	70.5
No	178	29.5

Factors associated with functional constipation.

Gender (p=0.001), school type (p<0.001), access to toilet (p<0.001), withholding of stool (p=0.002), unstable diet (p<0.001), and inadequate physical activity (p<0.001)were associated with functional constipation. Psychological factor such as poor self- concept (p=0.005) was associated with functional constipation. Emotional stress (p=0.182) being bullied at school (p=0.134) were not associated with FC. (Table 4)

Independent Predictors of functional constipation

On logistic regression analysis, Gender (p=0.001), school type (p<0.001), access to toilet (p<0.001), stool withholding (p=0.002), unstable diet (p<0.001), inadequate physical activity (p<0.001), and poor self- concept (p=0.003) remained independent predictors of functional constipation among the subjects.(Table V) Males were 0.2 times more likely to have FC than females. Subjects attending public schools were 0.4 times more likely to have FC than those in private schools. Participants without access to toilet were about four times more likely than those with access to develop FC. Respondents that usually withheld stool were 0.3 times more likely than their counterparts to develop FC. Those with unstable diet were more likely to have FC. Subjects with inadequate physical exercise were thrice more likely to have FC than those that exercised adequately. Subjects with poor self -concept were 0.3 times more likely than their counterparts to have FC.

Table 4: Association between socio-demographic factors and functional constipation

Variable	Practice category (n = 603)		Test statistic p value
	FC n (%)	No FC n (%)	
Age (years)			
10-14	50(40.6)	196(40.8)	$\chi^2 = 0.671$
15 – 17	45(36.6)	160(33.3)	p = 0.715
18 – 19	28(22.8)	124(25.9)	
Mean = 15.2 ±2.6 years			
Gender			
Male	83(67.5)	244(50.8)	Fisher's exact
Female	40(32.5)	236(49.2)	p=0.001
School type			
Public	103(83.7)	280(58.3)	Fisher's exact
Private	20(16.3)	200(41.7)	p <0.001
Class in school			
Junior secondary	59(48.0)	218(45.4)	Fishers exact
Senior secondary	64(52.0)	262(54.6)	p = 0.614
Tribe			
Hausa	100(81.3)	383(79.8)	
Yoruba	8(6.5)	25(5.2)	$\chi^2 = 0.918$
Igbo	4(3.3)	17(3.5)	p = 0.821
Others*	11(8.9)	55(11.5)	
Socioeconomic status of Parent			
Upper class	43(34.9)	128(26.7)	$\chi^2 = 3.477$
Middle class	52(42.3)	220(45.8)	p = 0.176
Lower class	28(22.8)	132(27.5)	
Access to toilet			
Yes	100(81.3)	452(94.2)	Fisher's exact
No	23(18.7)	28(5.8)	p <0.001
With holding stool			
Yes	18(14.6)	28(5.8)	Fisher's exact
No	105(85.4)	452(94.2)	p =0.002
Unstable diet			
Yes	199(15.4)	9(1.9)	Fishers exact
No	104(84.6)	471(98.1)	p < 0.001
Practice of regular physical exercise			
Yes	23(18.7)	402(83.8)	Fishers exact
No	100(81.3)	78(16.2)	p < 0.001

FC= Functional constipation, *Others= Igbira, Nupe, Barebari, Fulani

Table 5: Predictors of functional constipation among the respondents

Variables	aOR	95% CI		p-value
		Lower	Upper	
Gender (Male vs Female*)	0.498	0.328	0.756	0.001
School type (Publicvs Private*)	0.272	0.163	0.454	<0.001
Access to toilet (Yes* vs No)	3.713	2.053	6.715	<0.001
Withholding stool (Yes vs No*)	0.361	0.193	0.678	0.002
Unstable diet (Yes vs No*)	0.105	0.046	0.238	<0.001
Inadequate physical exercise (Yes vs No*)	3.402	2.408	6.627	<0.001
Poor self-concept (Yes vs No*)	0.298	0.136	0.655	0.003

aOR = Adjusted Odds Ratio CI = Confidence Interval * = Reference group

Discussion

This study has demonstrated the occurrence of functional constipation among adolescents in Sokoto, Northwestern Nigeria. The prevalence of 20.4% is lower than that of 27% that was reported by Udo *et al*[10] from the southern part of Nigeria. Despite the difference in the prevalence in both regions however, it is evident that FC is common among adolescents and could pose a significant challenge to their physical as well as psycho-social well- being. The prevalence of FC in this study is at variance, (higher) compared with those of studies from United States of America (USA) and Asia.[22-29]The observed variability could be attributed to differences in the ages of the subjects, the study settings, the design and the diagnostic criteria that was applied. Some studies included school aged children or only early adolescents in their study population and majority applied Rome III criteria.[22-29] Socio-cultural and environmental factors, diet and behavioural pattern as well as genetic potentials to develop FC have been suggested as possible reasons for the differences in the occurrence of FC in different parts of the world.[25, 29]

The finding of male gender having a greater risk of developing FC in this series is in consonance with the report from a study in USA,[30]but in contrast with reports from the study in southern Nigeria and other studies where there was no association between gender and FC or that female gender was associated with FC.[10,26,27,29,31] The reason for the gender difference in this study is unclear but has somewhat eliminated the possibility of difference in race as a reason for the observed variance from other studies.[26,27, 29,31] Although Female sex hormones, such as progesterone, are thought to decrease the rate of small bowel and colonic transit times thereby increasing the risk of constipation in them, the predominance of a gender in functional constipation among children is said to be far from conclusive because of the variability and inconsistencies in the report from different studies.[26,29,32]

Unlike in the previous reports,[25-27] diet related factors such as inadequate intake of fibre and fluid by respondents in this study were not associated with FC. Although the diet by inhabitants in the study area is mostly carbohydrate based, it's however, mainly from whole grains rich in fibre. Subjects are also exposed to very high temperature pattern making requirement for fluid intake higher.[14]It is therefore, not surprising that even subjects that reported adequate fluid intake experienced FC. The finding in this study of public schools as predictors of FC among the subjects is in contrast with report from the study from Bangladesh where there was no difference in the occurrence of FC between children in government and private schools.[27] The finding in this series could be explained by the deplorable state of physical structures including the lavatories or the need to resort to open defecations because of unhygienic and inadequate availability of toilet facilities more com

commonly reported in public schools in Nigeria.[12,33,34] These factors could result to concerns for hygiene, feeling of embarrassment to use the toilet or open space, and subsequent stool withholding with attendant risk of FC. Unavailability of toilet facilities when the urge to defecate occurs, has been observed to lead to delay in evacuation of stool with subsequent hardening of the stool accompanied by straining during defeacation.[20]
Inadequate physical activity as a factor for FC in this study was in consonance with reports from other studies.[26, 27]Lack of physical activity has been shown to be another risk factor for lower defecation frequency and FC.[4] The mechanism by which physical activity modulates bowel movement is said to be by prolonging colonic transit time.[35] Similar to the study from southern Nigeria, [10] psychological stress was not associated with FC in this study. This finding is however, in contrast with reports from other studies,[26, 29]where stressful events were reported to be significant factors in the occurrence of FC. Low self -esteem was however, a predictor of FC in this study. The role of psychological and emotional components in the aetiology of FC is said to be a matter of debate as its not certain whether emotional problems are the result of FC or that they play an important role in the aetiology of FC.[4] The experience of low self-esteem as demonstrated among subjects with FC in this study could be a pointer towards developing more serious psychologic situations such as depression, if FC is not promptly addressed.

In contrast to the report from the study conducted in southern Nigeria where FC was associated with low socio-economic status, [10]we did not find any association between FC and socio-economic status. Although majority of the respondents' parents were of middle class, most of them were graduates of tertiary institutions and this factor could impact positively on the health and well -being of the subjects. Highly educated parents are likely to be aware or knowledgeable on matters concerning nutrition education, behavioural and life-style modification including other documented risk factors for FC. However, these might not directly translate to improvement in the health status of their wards if child-parent interaction and communication are not maximized. It has been observed that in the current competitive society, parents are forced to work more and spend less time with their children.

Conclusion

Functional constipation is common amongst adolescents in the study area. Socio-demographic and psychological factors such as gender, school type, access to toilet, stool withholding, unstable diet, inadequate physical activity, and poor self- concept were associated with FC and remained independent predictors of FC among the subjects. There is need to design interventions focused on preventive strategies against the development of FC or at least, ameliorating the effect it has on adolescents in the study area and possibly beyond. A nation-wide study is also recommended to bridge the gap in the knowledge of FC in Nigeria and further ascertain the epidemiology of FC.

Study limitation

The limitations included self-reporting and recall bias. To reduce these limitations, the subjects were re-assured and already filled questionnaires were routinely selected, with the questions repeated a second time to ensure consistency in the subjects' responses.

Authors' contribution
Jiya Fatima Bello: Conceptualization, study design, data analysis, writing original draft.
Jiya Nma Muhammed, Ibitoye Paul Kehinde: Writing, reviewing, editing
Jibrin Baba, Adamu Asma'u, Isezuo Khadijat O: Data collection, analysis and interpretation.
All authors approved the submission of the final draft.
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