

AFRICAN JOURNAL OF MEDICINE and medical sciences

VOLUME 24, NUMBER 4, DECEMBER 1995



EDITOR: B.O. ONADEKO

ASSISTANT EDITORS:

B.O. OSOTIMEHIN and A.O. UWAIFO



SPECTRUM BOOKS LIMITED
Ibadan • Owerri • Kaduna • Lagos

ISSN 1116-4077

Defaecation pattern and intestinal transit in Nigerian children

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Summary

The defaecation pattern and intestinal transit time of 410 apparently healthy children aged between 6 months and 5 years were studied by questionnaire and carmine red marker. The majority of the children ate a predominantly high residue diet. Stool frequency varied from once every other day to 5 times a day, with 95% of the children opening their bowels one to three times a day. There was a gradual decline in mean stool frequency with increasing age. The stool produced was usually soft and between 50 and 75ml in size. Mean mouth to anus transit time in 98 randomly selected children from the study group was 18.3 hours. The information obtained from this study should facilitate early identification of diarrhoea and constipation in the Nigerian pre-school child.

Resume

La fa con de defequer et le temps du transit intestinal de 410 enfants apparemment en bonne sante ages entre 6 mois et 5 ans avaient ete studies par questionnaire et coloration au rouge. La majorite des enfants mangeaient des aliments a predominance residuel eleve. La frequence des selles variait dune fois a interval regulier d'un jour, a 5 fois par jour, avec 95% des enfants defequant laz fois par jour. Il avait un graduel declin de la moyenne de frequence de selles au fur et a mesure que l'age augmente. Les selles produites efacent habituellement molles et le volume entre 50 ml et 75 ml. La moyenne du temps du transit entre la bouche et L' anus etait de 18.3h sur un echantillon de 98 enfants selectionnes au hasard sur le groupe etudie. L'information obtenue de cette etude de vrait faciliter l' indentification precore de la

diarrhee et constipation parmi les enfants prescolaire Nigeriens.

Introduction

Although diarrhoea and constipation are commonly referred to in paediatrics, review of the literature reveals that there is a paucity of data on the normal frequency of bowel actions, stool size and transit time in children [1-5]. Most of the data available are from the developed world. The frequency of bowel movements depends on several factors such as diet, infection and probably racial effect[5] which may vary considerably from place to place. The necessity for each region to determine its own normal values is thus obvious, so that deviation from normal may be recognised more readily.

In Nigeria, as in many other developing countries with a high frequency of diarrhoea, data on the normal bowel pattern in children are long overdue. The present study was aimed at providing normal reference values for the bowel habit of Nigerian children.

Subjects and methods

Subjects

Four hundred and ten well children (212 boys and 198 girls) aged between 6 months and 5 years were studied. They were attending the children's clinics of the University College Hospital (UCH) Ibadan and the Institute of Child Health, University of Ibadan, either for routine follow up or for immunization. None had a recent history of gastro-intestinal disease. Of these, 107 were under 1 year of age, 82 aged 1-2 years, 84 aged 2-3 years, 74 aged 3-4 years and 63

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aged 4-5 years. The majority of them (45%) belonged to social class III (manual or non-manual skilled workers), the rest, 9%, 10%, 19% and 17% belonged to social classes I, II, IV and V respectively. Socio-economic class was based on the paternal occupation as previously described [6].

Stool frequency, volume and consistency

After obtaining verbal agreement, a questionnaire was administered to record what each mother regarded, from personal observation, to be her child's normal bowel habit and dietary history. The information requested in each questionnaire included: (i) number of daily bowel actions and time of day bowels were opened; (ii) nature of stool (consistency, presence or absence of blood in stool); (iii) stool volume; (iv) daily food consumption and (v) parents' educational background and occupation. Transparent plastic cups of different volumes (25, 50, 100ml) were presented to mothers to help them estimate the size of their child's stool. In addition, the mothers of 50 children, ten from each group, were given plastic cups with marks indicating different volumes to take home and measure the volume of stool passed on 3 different occasions by their children. The different levels were recorded and returned to the clinic. Dietary fibre consumption was determined using mothers recall of their children's daily food intake and the existing information on fibre content of Nigerian food[7].

Transit time measurement

Twenty children randomly selected from each age group, were asked to report back to the clinic a few days after their first visit. Their mouth to anus transit time was measured using a carmine marker which was administered in the clinic in the morning before they had breakfast. Each child drank a solution of carmine (200mg) dissolved in 50ml of water and the time was recorded. Each mother was given a form on which to record the date and time when her child passed the first red-coloured stool and also daily food intake and time food was eaten. The mothers of 2 of the children did not return their forms.

Statistical analysis

Data was expressed as absolute values with mean and standard deviation (SD) where appropriate. Student's t-test was used to test the significance of the difference between means in the transit studies,

while the Pearson's correlation coefficient was used to determine the degree and significance of the relation between two measurements.

Results

Eighty (75%) of the 107 infants were on artificial milk with other foods, such as cereal, milk prepared from soya beans and varying amounts of adult diet. Of these, one third were also on breast milk. The remaining infants (27) were completely weaned and were eating the same diet as the older children. All the older children were on a mixed, predominantly unrefined, high-fibre diet. This comprised corn meal ('pap') with beans ('moin-moin'), bread with chocolate drink or yams for breakfast. The lunch and dinner were often similar, and comprised cassava meal ('Eba' and 'foo foo') with vegetable stew, boiled yam, yam flour ('amala') or beans and rice also with vegetable and/or meat stew. Fruits such as oranges, mango, pawpaw and bananas were eaten *ad lib*. Mean daily dietary fibre consumption varied from 12g (2 yr old) to 19.4g (5 yr old).

Stool frequency

No sex difference was observed in bowel habit within different age groups. Bowel opening varied from once every other day to 5 times a day (table 1) with 95% of the children opening their bowels one to three times a day. Only 8 (2%) children opened their bowels every other day. There was a gradual decline in mean-stool frequency with increasing age ($r = -0.8, p < 0.01$) (figs 1 and 2). Seventy-five percent of children below the age of 2 yrs opened their bowels 2 or 3 times/day while after the age of 2 yrs, the trend was for most children (94%) to open their bowels once or twice a day. The time of defaecation in the day varied widely, but occurred after meals in 70% of the children. Seventy-two percent of the children opened their bowels in the morning. Of these, 24% opened their bowels in the morning, 17% both in the morning and after noon, and 31% both in the morning and at night. Of the remaining children (28%), 2% opened their bowels only after noon, 2% only at night and the rest (24%) at anytime of the day.

Stool volume and consistency

The stool volume of the 50 children measured by their mothers at home correlated well with information already given by these mothers in the

questionnaire ($r = 0.69$). Most of the 410 children (78%) produced between 50ml and 75ml soft stool (figs 3 & 4). The percentage of those passing firm stool increased with age ($r = 0.98$, $p < 0.001$) (fig. 4). No mother had noticed blood in her child's stool, either during the study period or at any time previously.

Intestinal transit

The mean mouth to anus transit time in the 98 children studied was 18.3 hours (range 5.25 — 30

hours). Although transit time increased with age (table 2), the change was too small to produce significant differences between consecutive age groups. However, the mean transit time for children of less than 3 years was significantly shorter than for those older than 3 years (15.4 hours and 23.8 hours respectively, $p < 0.05$).

There was no significant difference observed between the social classes for any of the findings described above.

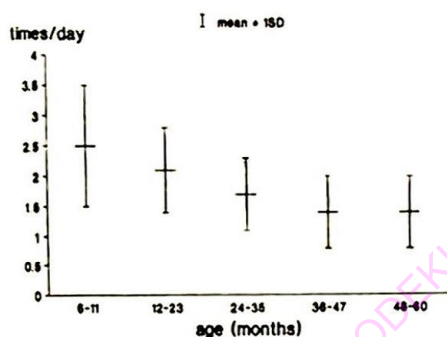


Fig. 1: Mean daily bowel opening of 410 Nigerian children aged 6 months to 5 years.

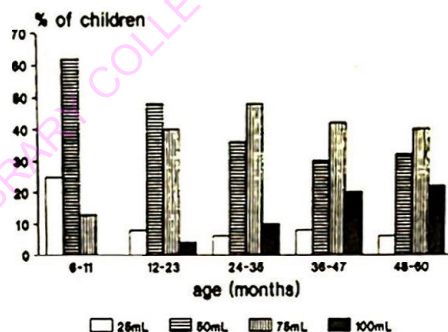


Fig. 3: Volume of stool passed by 410 Nigerian children aged 6 months to 5 years.

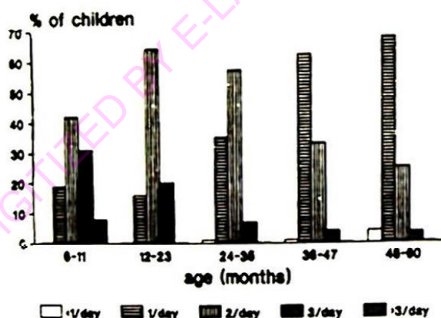


Fig. 2: Daily stool frequency of 410 Nigerian children aged 6 months to 5 years.

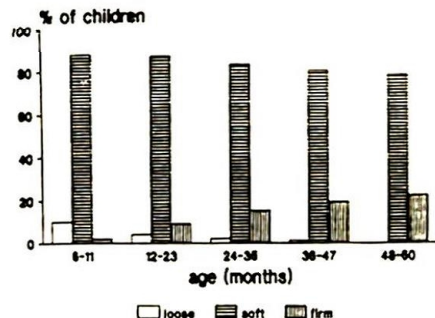


Fig. 4: Consistency of stool passed by 410 Nigerian children aged 6 months to 5 years.

Table 1: Frequency of defaecation in 410 Nigerian pre-school children aged 6 months to 5 years

Frequency of defaecation	Number (%) of children
Less than 1 per day	8 (2)
1 per day	143 (35)
2 per day	185 (45)
3 per day	60 (14.5)
4 per day	8 (2)
5 per day	6 (1.5)
Total	410 (100)

Table 2: Mean bowel transit time of Nigerian children aged 6 months to 5 years

Age (months)	n	Transit time, hours	
		mean (SD)	range
6—11	20	12.4 (4.6)	5.25—16
12—23	20	15.5 (5.5)	7.5—23
24—35	20	18.4 (6.1)	12—27
36—47	20	23.6 (5.2)	17—30
48—60	18	24.0 (4.8)	17—30

Discussion

Our study has shown that healthy Nigerian pre-school children display a wide range of bowel habit, opening their bowels from every other day up to 5 times a day and passing between 50 and 75ml of soft stool. The great majority (95%) however have 1-3 bowel actions per day. The information generated by this study depended solely on the mothers personal observation of their children's normal bowel habit. We believe this source of information is the most reliable available, because the mother is the closest in the family to the child. Moreover, the mothers' observations in this study were consistent with the nursing records and personal observations (FOA), of the bowel habit of children admitted to hospital for elective surgery unrelated to the gastro-intestinal tract.

The frequency of bowel movements in this study, are similar to findings in black South African children[5], but at variance with data on American [2] and British children [4]. Colon and Jacob [2] observed that after the age of eighteen months, over 50% of American children opened their bowels once per day. In our study, 75% of the children below the age of 2 years, opened their bowels 2 or 3 times per

day. While Weaver and Steiner [4] observed that 60% of British pre-school children opened their bowels once daily, only 35% of Nigerian pre-school children opened their bowels once daily. One must bear in mind however that normal stool frequency is very variable and it might be possible for a child to change his bowel frequency significantly within the normal range, and therefore still appear normal, but in fact be abnormal for that child. Thus, in determining what is normal for any child, the stool consistency and size must also be considered.

Many factors have been implicated in the regulation of bowel opening, faecal size and intestinal transit time. Diet, especially the fibre content, has been observed to be the prime factor in the regulation of bowel habit, although the mechanism is not very clear. Cummings[8] observed that the effect of dietary fibre on bowel movements is related to its physico-chemical properties. Fibre, by virtue of its large particles and relatively slow degradation in the colon, provides bulk to gut contents and surface for bacteria to act. Increasing bulk stimulates colonic movement. In addition, fibre promotes microbial growth within the colon, thereby increasing the bacterial content of faeces which accounts for 30-40% of the dry weight of stool. Although, most of the Nigerian staple foods eaten by the children in this study have been more refined in recent years, they still have a relatively high fibre content unlike the highly refined, low residue diet eaten by many British children [4]. This may explain the higher rate of bowel motility and greater frequency of defaecation by the Nigerian child. It is also not very surprising that the Nigerian child passes a larger stool than the British child [4], dietary fibre also influencing the size and consistency of stools.

Transit time, being a reflection of motility of the bowel, would also be influenced by dietary fibre. In this study, transit time increased with age and the mean transit time of 18.3 hours obtained in this study, is much shorter than the transit time of 33 hours reported by Weaver and Steiner [4] for the British child. However, the mean transit time of the Nigerian child is longer than that of his black South African counterparts [5]. The explanation for this is unclear.

The decrease in daily bowel openings in our subjects and the gradual progression of the stool consistency from soft to firm with increasing age, is consistent with the observations of other workers [2-5], and is a part of the gradual decline in stool

frequency and change in consistency of stool from the newborn period to adulthood [9]. Most children in this study, as expected, opened their bowel soon after a meal, the food in the stomach probably initiating the gastrocolic reflex which leads to defaecation.

It is interesting to note that no mother observed blood in her child's stool at any time, in contrast to 2% and 9% of black South African [5] and British [4] children respectively. Although Weaver and Steiner [4] observed a positive correlation between infrequent bowel movements, hard stools and rectal bleeding, we do not think that consistency of stool alone can explain this observation.

The normal bowel habit of children has been documented in other parts of the world [2-5] but not previously in Nigeria. We hope that the data produced by this study will serve as bowel habit reference values for the Nigerian pre-school child and that it will be of use to child health workers in the early recognition of diarrhoea or constipation. We also hope that our observations will serve as a reference for comparison with studies from other developing countries where the diet may also be predominantly high fibre.

Acknowledgement

We thank the health sisters in the Institute of Child Health, University College Hospital, Ibadan, for their invaluable help throughout this study, the dietetics units for assisting in the dietary evaluation and the

mothers of our subjects for their immense cooperation.

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(Accepted 25 March, 1993)