

Bowel behaviour in young black and white children

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SUMMARY Bowel behaviour was investigated in 81 rural black, 117 urban black, and 77 white children aged 1 to 4 years. The study was undertaken principally because intake of dietary fibre by urban blacks is now lower than that of whites: moreover, that of rural blacks has also fallen. Average daily defecation frequencies in rural and urban black children and white children were 1.9, 1.8, and 1.5, respectively. Black children voided smaller stools and more frequently than white children. In both ethnic groups most stools were soft. Median transit times, determined in 55 rural black, 80 urban black, and 45 white children, were approximately 6.5, 7, and 27 hours, respectively. Median transit times increased little with age in black compared with white children. The higher defecation frequency and the much shorter transit time in black children are not explicable in terms of the levels of fibre intake.

Numerous workers have noted an association between bowel behaviour variables and frequency of non-infective bowel diseases.¹ Relatively low frequency of defecation; small amount of faeces voided each day; high frequency of formed, often hard stools; and a long transit time are characteristics associated with high prevalences of non-infective bowel diseases, including appendicitis, diverticular disease, and colorectal cancer. This association, usual to Western populations, is not observed in most Third World populations, for among the latter, frequencies of these diseases are rare or low—defecation is more frequent, stool weights are larger, most stools are unformed or semi-formed, and transit time is much shorter. The reason for this difference has been attributed largely, but not wholly, to the habitually low and high intakes of dietary fibre in Western and Third World populations, respectively.

Dietary fibre intake, formerly high in black South Africans,^{2,3} has been falling progressively in recent years, especially among urban dwellers. The decrease is due to: (1) the refined nature of the staple maize meal (about 70% extraction rate) which is still by far their main source of energy; (2) the decrease in the consumption of legumes (intake has halved or more within the last few years); and (3) the greatly increased cost of vegetables and fruit. In recent investigations made in Johannesburg,⁴ and at Potchefstroom, the mean daily intake of dietary fibre in black adults was about 10 to 15 g—that is, lower than that in the local white population (about 20 g).

Formerly the daily intake of urban blacks was 20 to 30 g or more.³ The occurrence, however, of bowel diseases, seen at Baragwanath Hospital, Soweto (2300 beds) has scarcely risen, and indeed has remained steady for several years.

Because of the absence of systematic studies of normal bowel behaviour (frequency of defecation, size and consistency of stools, and transit time) in preschool children, Weaver and Steiner⁵ investigated a series of 350 English children. Briefly, they found that 85% of 1 to 4 year olds eating a predominantly low fibre diet opened their bowels once or twice a day. At all ages most children produced soft stools of about 25 ml volume. The mean transit time in 35 randomly selected children was 33 hours.

In view of the findings described and of the changing dietary habits of South African blacks, it was thought desirable to investigate the current pattern of bowel behaviour in black rural and urban preschool children and in a series of white preschool children for comparison.

Subjects

Rural black children. Eighty one (two groups of 51 and 30) children were studied in two village regions situated 40 and 320 miles from Johannesburg. A senior black nursing sister and two senior black teachers made the requisite observations. The children came mainly from poor homes.

Urban black children. Altogether 117 (three groups of 53, 35, and 29) children were studied in Soweto and in Kagiso, Krugersdorp. A senior black nursing sister and a senior black social worker carried out the observations. The children studied attended creches and came from middle class homes.

Full cooperation was received from the mothers who participated. In the rural and urban series, 25% and 16% respectively of the mothers initially approached refused for reasons of suspicion, lack of understanding, or being too busy.

White children. A total of 77 (two groups of 48 and 29), children were studied by two workers, a senior medical technologist and a senior dietitian. The subjects were drawn from the workers' neighbouring families, were predominantly middle class, and were resident in Johannesburg and Potchefstroom. There were nine refusals—because mother was out working (5), going on holiday (2), and the child was unwell (2).

Methods

Rural black children. Studies were carried out in the children's homes and in all cases very extensive supervision was essential.

Urban black children. It was originally intended that children should be studied in their own homes, but this was found impracticable because mothers who were literate were mainly working, and the semi-literate or illiterate grandmothers looking after the children had insufficient understanding to take responsibility for the observations. Accordingly, in Soweto and Kagiso, children who attended creches were studied there during the day, with the consent of mothers, and at home in the evening. The necessary supervision, in the creches and subsequently at the children's homes, was feasible, but very time consuming.

White children. Once details of the procedure were made clear, these children's mothers were able to make the required observations satisfactorily.

Questionnaire forms. The forms for both black and white children included a brief description of the purpose of the study. Each form provided a table to be filled in for a four day period of observations on: (1) time of defecation; (2) consistency of stools (soft, hard, runny); (3) size of stools (appropriate pictures were given for grape size (5 ml), small sausage (25 ml), and large sausage (40 ml)); and (4) transit time. The latter was measured in the black children using purchased tinned sweet corn as

marker: beetroot was also used occasionally. Had carmine in gelatin capsules been used as a marker, many mothers would have refused to participate. In the white children, sweet corn was used as a marker. Previously undertaken, unpublished studies on rural black schoolchildren aged 7 to 8 years have indicated that the mean values for transit time using (1) carmine and (2) sweetcorn do not differ significantly.

Studies on defecation frequency, stool size, and consistency were carried out first, followed after an interval of a few days by the transit time studies. The marker was given early in the morning. Chamber pots were used throughout the investigations. Black mothers were given gifts of household goods or food for their cooperation.

Dietary history. Information was obtained on each child's food consumption for the previous day, also for Sunday, from the first to the last meal or snack of the day.

Results

Dietary history.

Rural black children ate a predominantly vegetarian diet. Maize meal porridge with sugar was eaten in the early morning. 'Stiff' porridge, occasionally with some egg, fish, 'samp' (partially crushed maize), and beans or brown bread and peanut butter, were eaten at midday. At supper, more porridge was consumed with some soup and vegetables. Meat was eaten only occasionally, with spinach or wild 'spinaches', and beans and potatoes. Reconstituted powdered milk was often consumed, but not daily.

Urban black children ate a fairly mixed diet. Each morning they had maize meal or 'maltabella' (*Sorghum vulgare*) porridge, with a little milk and sugar. At the creche at noon they had one of the following—some cheese, egg, bean soup, fish, or 'somos' (vegetable protein) with some cooked or raw vegetables. Supper usually included brown bread with margarine, jam, or peanut butter, with a little milk or cocoa, and occasionally meat with vegetables.

White children consumed a diet similar to that of British children,⁵ with a meat dish each day. These children, however, had a greater variety of vegetables, cooked and raw, and probably more fruit and fruit juices, and brown rather than white bread. Milk was drunk once or more daily. The food was mostly cooked at home since only a very small number attended nursery school.

Table 1 Defecation frequency in South African rural and urban black and white preschool children

	Rural black children	Urban black children	White children
No	81	117	77
Age			
1 year	12	16	16
2 years	30	38	25
3 years	28	38	14
4 years	11	25	22
Mean daily frequency of defecation	1.9	1.8	1.5
% under 1 per day	2	2	14
% 1 per day	25	36	47
% 2 per day	61	52	30
% 3 or more per day	14	10	9

Table 2 Stool size, consistency, and transit time of South African rural and urban black, and white preschool children

	Rural black children	Urban black children	White children
Stool size			
% 5 ml	26	24	11
% 25 ml	58	56	32
% 40 ml and over	16	20	57
Stool consistency			
% soft	77	74	88
% hard	9	13	10
% runny	15	13	2
Transit time			
No studied	55	80	45
Median time (hours)	6.5	7.0	27.0
Range (hours)	3-1-23.5	3.3-26.5	7.5-53.0
% under 12 hours	77	74	12
% over 12 hours	24	26	88
Median transit times according to age			
1 and 2 years (hours)	5.5	5.8	23.0
3 and 4 years	7.4	7.9	32.5

Data on frequency of defecation, size and consistency of stools, and transit time, for the children studied, are given in Tables 1 and 2.

Discussion

Mean or median values, or percentage data, for the groups of boys did not differ from those of the corresponding groups of girls in any of the variables measured.

Frequency of defecation. The higher daily frequency found in the black children (rural and urban, 1.9 and 1.8 respectively), compared with white children (1.5), agrees with data on rural black children aged 7 to 8 years (frequency 2.1) studied some years ago,² who had a higher fibre intake at that time. It may be

noted that the frequency in the black children aged 1 to 4 years is similar to that reported for young white children at 1 year, namely, 1.7.⁶ Thereafter, as indicated by Weaver and Steiner,⁵ a fall in frequency occurs, to about 1.2 at 4 years. Defecation frequency in the black children was significantly higher ($P < 0.05$, Student's *t* test) than that in the white children studied. It must be understood that in rural areas seasonal variations in fibre intake from plant sources undoubtedly modify bowel behaviour.

Size of stools. The percentages given in Table 2 are necessarily approximate since the size of each stool was classified according to its being *nearest* one of the sizes depicted (that is 5 ml, 25 ml, 40 ml, or more). Clearly, the black compared with the white children voided smaller stools, but more frequently.

Consistency of stools. The stool consistency in the two ethnic groups was similar, except that the black children had a slightly higher proportion of 'runny' stools.

Transit time. Because the data on transit time in the black children were less reliable than data on white children it was deemed that median rather than mean times would reflect the situation more accurately. The reasons are as follows. The black children were under careful observation from breakfast time until late afternoon. By this time the faeces of more than half of the children had shown evidence of the marker. There was thus certainty over the accuracy of the median transit time, that is when 50% of the children had passed the marker. Once the children returned home, their mothers were asked to observe all stools passed overnight and early next morning. The black mothers were, however, less skilled in description, and, more importantly, lighting in their homes was often poor. It was thought, therefore, that less accuracy could be attached to their observations. As indicated, the median times of 6.5 and 7 hours are very much shorter than the time for the white children of 27 hours. The latter is somewhat shorter than the time reported by Weaver and Steiner⁵ (33 hours), and may reflect a higher intake of fruit and vegetables and of brown bread, in the local white children. It is noteworthy that Lesné *et al.*,⁷ using carmine, reported a transit time of 10 hours for white children aged 1 to 2 years. An increase in transit time with age, usual to white children, was far less evident in the black children.

Blood in stools. No mother of a white child reported the presence of blood in stools. In the rural and urban black children, blood was noted in 2 of 81 (2.5%) and 3 of 117 (1.5%) children respectively. It

is questionable whether any importance can be attached to these data.

Because the information obtained on the series of white preschool children studied differed little from that reported by Weaver and Steiner⁵ it is considered that the experimental procedure we followed was satisfactory.

The studies carried out on the black preschool children were attended by numerous difficulties which had to be surmounted. The black mothers were amazed that observations on faeces excretion could be of any value to health understanding. Despite some uncertainties, however, we have no doubt that the general conclusions reached from the data secured are valid.

Although the black, preschool children studied are now accustomed to a diet of reduced fibre content, the pattern of bowel behaviour of both rural and urban dwellers still differs considerably from that of the white, preschool children. In particular, the black children's frequency of defecation is higher, and their median transit time far shorter. Moreover, it is noteworthy that in these two respects, the behaviour of black children aged 3 to 4 years scarcely differed from that of those aged 1 to 2 years. This contrasts with the decrease in defecation frequency, and the increase in transit time between ages 1 to 2 and 3 to 4 years which prevails in white children. The differences in behaviour between the two ethnic populations of preschool children are not explicable on the basis of differences in fibre intake.

What bearing is the pattern of bowel behaviour displayed by these young black children likely to have on the frequency of bowel diseases in subsequent years? It could be argued that the recent fall in fibre intake will need perforce to continue for several years before its ramifications are likely to affect frequencies of bowel diseases. This argument, however, is not valid in the case of appendicitis. During World War II, in certain countries, dietary changes which included, inter alia, an increased intake of fibre-containing foods, and which lasted for only a very few years, were associated with a fall in appendicitis frequency.^{8,9} Yet, as has been noted, frequency of this disease in urban children and adolescents remains low;¹⁰ moreover, the conclusions from the surveys undertaken in this respect are in agreement with the still stable occurrence of acute appendicitis, as seen at Baragwanath Hospital, Soweto.

As Weaver and Steiner⁵ and others¹¹ have emphasised, it is very important to obtain information on the bowel habits of preschool children living in communities where a high dietary fibre intake is habitual. It should be possible to obtain this information from studies carried out in remote

regions where the maize meal is less refined (that is made in small local mills), where a proportion of the maize consumed is eaten off the cob or is home 'stamped', and where seasonal vegetables, wild 'spinaches' and fruit, are more available for purchase or for gathering than is the case in urban and near urban centres. It is planned to carry out such a study once it can be arranged.

The investigations undertaken and described have shown there to be pronounced differences in bowel habits between white preschool children and black preschool children consuming a partly westernised diet. While the conclusion reached is that the phenomenon is not explicable on the basis of differences in dietary fibre intake, this does not imply that this variable is irrelevant or unimportant in the contexts studied. It implies that other factors are in operation in the regulation of *milieu intérieur* and bowel physiology, the nature of which are unknown at present.

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