

No Child's Play: Under-five Child Feces Management in a Rural Area of Bengaluru Urban District, India

Anissa Mary Thomas Thattil, Twinkle Agrawal¹, Abdul Kader Surti¹, Stallon Sebastian¹, Kiyana Mirza¹, George Jacob¹, Farah Naaz Fathima¹

Department of Community Medicine, Father Muller Medical College, Kankanady, Mangalore, Karnataka, ¹Department of Community Health, St. John's Medical College, Karnataka, India

Abstract

Background: Inappropriate feces disposal leads to environmental contamination, and increases the risk of exposure to children. We aimed to estimate the proportion of rural households with knowledge and practice of safe management of feces (SMoF) among under-five children and to identify associated factors. **Materials and Methods:** A cross-sectional study was conducted in eight villages in Bengaluru Urban district over 2 months, using a face-validated semi-structured interview schedule. SMoF was defined based on five criteria – defecation site, transport tool, feces disposal, cleaning of transport tool, and hand washing. **Results:** Out of 320 under-five children surveyed, 15.7% were pre-ambulatory and 84.3% were ambulatory. The majority of the caregivers (92.5%) felt that children should defecate in the latrine and only 23.7% were aware that child feces were more infectious than adult feces. SMoF was only practiced by caregivers of ambulatory children (52.6%). Households with older caregivers ($P = 0.01$) and those living in a pucca house ($P = 0.02$) with a latrine inside ($P = 0.04$) were found to practice SMoF. Children of households that practiced unsafe disposal of child feces experienced more diarrheal episodes ($P = 0.04$). Caregivers >20 years were found to have better odds of SMoF [20–25 years (adjusted odds ratio, aOR: 9.02), 26–30 years (aOR: 12.17), >30 years (aOR: 8.93)] compared to those <20 years. **Conclusion:** The proportion of households with knowledge and practice of SMoF was low. Awareness of SMoF is essential to reduce the incidence of diarrheal diseases and improve sanitation. Our findings also call for awareness building at schools and colleges.

Keywords: Child, defecation, feces, sanitation, under-five

INTRODUCTION

India accounts for 59.0% of the global burden of open defecation, with diarrhea accounting for 9.5% of the cause-specific under-five mortality rate.^[1,2] A significant proportion of this mortality and morbidity can be successfully prevented by safe water, hygiene, and sanitation.^[3] Inappropriate disposal of feces (adult or child) leads to environmental contamination, thereby increasing the risk of fecal exposure to children who exhibit behaviors such as mouthing and geophagia. The safe disposal of child feces is key, as child feces contain more pathogenic organisms.^[4,5]

Despite efforts, the incidence of diarrhea in India has not decreased, perhaps due to the focus on diarrheal case management rather than prevention.^[6] This study, therefore, attempted to estimate the proportion of rural households with knowledge and practice of safe management of feces (SMoF) among under-five children in a rural area of Bengaluru and to identify its associated factors.

MATERIALS AND METHODS

Study design and study setting: This community-based cross-sectional study was conducted over 2 months in eight villages located in a rural area of Bengaluru Urban District, Karnataka. Out of 25 villages under the jurisdiction of the Sarjapura Primary Health Centre, eight villages were chosen based on convenience.

Study population: All households with an under-five child were included in the study. Houses that did not have an under-five child during the study period were excluded. The primary

Address for correspondence: Dr. Farah Naaz Fathima, Associate Professor, Department of Community Health, St. John's Medical College, Bengaluru, Kanataka-560 034, India.
E-mail: doc.farah@gmail.com

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caregiver (>18 years) of the child was interviewed for data collection. A primary caregiver was defined as an individual who was most responsible for the supervision and care of the child on a day-to-day basis.^[7] Although the mother is the primary caregiver most often, it could also be the child's father, a relative, or a neighbor.^[8] In case a household had more than one under-five child, the youngest ambulatory (a child who can walk) and pre-ambulatory children (a child who has not yet attained the milestone of walking) were included in the study. Houses that were inaccessible during the initial visit, either due to being locked or lacking a primary caregiver present at the time, were revisited later to gather the necessary data.

Study tool: A face-validated interviewer-administered, semi-structured questionnaire was constructed in English after a thorough literature review, translated into Kannada following the standard translation procedure, and back-translated to assess accuracy. The questionnaire captured the following sections: socio-demographic details, sanitation facilities (Cronbach's alpha 0.71), knowledge (Cronbach's alpha 0.73), attitude (Cronbach's alpha 0.71), and practices regarding sanitation (Cronbach's alpha 0.74). Each criterion for the SMoF was scored as "yes" or "no." Safe management of child feces was defined as the presence of all the following criteria^[9]:

1. Defecation site (latrine or cloth or diaper)
2. Transport tool (plastic or cloth or leaves)
3. Disposing the child's feces into a sanitary latrine or burying it
4. Washing the transport tool with soap and water or disposing it
5. Caregiver washing hands with soap and water.

The absence of even one of the five criteria was categorized as unsafe management of child feces.

The collection of data was done by interns who were trained in the uniform administration of the questionnaire and who were comfortable with the local language.

Sample size: The sample size for this study was calculated assuming the prevalence of safe disposal of under-five child feces to be 27.5%.^[10] The fixed precision was set at 5%, Type I error at 5%, power at 80% and a nonresponse rate of 5% giving a minimum sample size of 307. A total of 320 participants were included in this study.

Ethical statement: Institutional Ethics Committee clearance was obtained prior to study initiation (256/2018) and written informed consent was obtained from all participants before enrolment.

The data were entered into Microsoft Word and analysed using IBM SPSS V.16.(IBM Corp., New York, USA). Standard descriptive statistics such as frequency, percentages, median with inter-quartile range and mean with standard deviation, were used to describe categorical variables. SMoF was categorized as a binary outcome "safe" or "unsafe." Bivariate analysis was conducted using the Chi-square test

of significance (Fisher's test wherever necessary) in order to identify variables with significant association with the outcome of interest. A multivariate logistic regression was also performed with variables having a *P* value <0.05 to identify independent determinants of SMoF.

RESULTS

Socio-demographic profile

Among 320 participants, 314 (98.1%) were mothers of under-five children. The mean age of the mothers was found to be 25.43 ± 4.02 years while that of the primary caregivers was 52.8 ± 13.4 years. Almost all the participants were homemakers (98.1%), the median number of family members was 5 (interquartile range, IQR: 21–3) and the median monthly income was INR 12,000 (IQR: 16000–10000). The socio-demographic characteristics of the participants have been detailed in Table 1.

In our study, 270 (84.4%) were ambulatory children with a median age of 2.5 years (IQR: 4–1.5). The median age of pre-ambulatory children was found to be 7.9 months (IQR: 9.2–3.9). Both groups had a higher percentage of girls (54.0% and 53.4%, respectively). The period prevalence of diarrhea in the two weeks preceding the interview was reported to be 3.1%.

Sanitation facilities

A total of 314 (98.1%) reported that they had access to a latrine facility. Out of these, 174 (55.4%) reported that the latrine was located outside the house, and shared latrine facilities were reported by 34 (10.8%). Majority reported having an Indian type of closet 289 (92.0%) and 241 (76.8%) had water supply inside the latrine.

Knowledge regarding sanitation

While 191 (59.6%) respondents did not know whether child or adult feces was more infectious, 76 (23.7%) reported that child feces were more infectious. Majority of the respondents did not know that diarrhea 181 (56.5%) and helminthiasis 214 (66.8%) were spread feco-orally.

Table 1: Socio-demographic characteristics of the study participants (n=320)

Socio-demographic characteristics		Frequency (%)
Educational status of mother/caregiver	Illiterate	11 (3.4)
	Primary school	14 (4.4)
	Middle school	15 (4.7)
	High school	183 (57.2)
	PUC	74 (23.1)
	Graduate and above	23 (7.2)
Religion	Hindu	275 (85.9)
	Muslim	45 (14.1)
Type of house	Kaccha	5 (1.5)
	Pucca	231 (72.2)
	Semi-pucca	84 (26.3)

The median age at which a child should ideally start using the latrine was reported to be 2 years (IQR: 6–0.5 years). Only 10 (3.2%) reported attending sessions regarding diarrhea at the anganwadi and 35 (11%) were ever spoken to about feces disposal. Regarding hand washing, 314 (98.1%) said it had to be done after using the toilet, after cleaning the bottom of the child 315 (98.4%), before feeding the child 316 (98.8%), and before cooking 313 (97.8%).

Attitude regarding sanitation

Many participants 296 (92.5%) felt that children must defecate in the latrine and 317 (99.0%) felt that a constant supply of water in the latrine was essential. More than half the participants 180 (56.2%) reported that soap was not necessary in cleaning the bottom of the child and all the participants felt that feces management was not a waste of time.

Sanitation practices

A majority of the participants 314 (98.2%) reported using the latrine themselves, while others reported open defecation. All the mothers reported washing their hands after disposing off the child's feces while 306 (95.6%) reported washing the child's hands as well, after the child defecated. More than half of the participants 222 (69.3%) reported using soap and water to clean the child's bottom. However, only 198 (63.0%) reported the presence of soap inside the latrine super-structure, which can be considered as a surrogate marker for hand washing practices.

Safe management of feces (SMoF)

Our study found that only 44.4% reported safe management of child feces, nil among the pre-ambulatory children. Tables 2 and 3 provide details regarding individual components of SMoF.

Factors associated with SMoF

Older caregivers ($P = 0.001$), residing in a pucca house ($P = 0.021$), ambulatory children ($P < 0.001$), presence of a latrine inside the house ($P = 0.04$), and absence of shared latrines ($P = 0.02$) were found to be significantly associated with SMoF. It was also found that children of caregivers who practiced unsafe disposal of child feces had more diarrheal episodes ($P = 0.04$).

On multivariate logistic regression, caregivers >20 years were found to have better odds of SMoF [20–25 years (OR 9.02), 26–30 years (OR 12.17), >30 years (OR 8.93)] compared to those <20 years. These factors have been described in Table 4.

DISCUSSION

Our findings reveal that more than half of the under-five children are at a heightened risk of acquiring fecal pathogens due to inadequate SMoF. Child feces have a higher pathogen count as children suffer from more enteric infections than adults.^[11] Moreover, children tend to defecate in areas that are accessible to other children and, thereby increase the likelihood of feco-oral transmission. Exposure to fecal pathogens in children has been linked with impaired growth and environmental enteropathy and, our findings are of concern.^[12]

Regarding sanitation facilities, 98.1% reported that they had access to a latrine facility which is higher than the NFHS-4 estimate taken in 2015–2016 (86.2%).^[13] This may be attributed to the introduction of the Swachh Bharat Mission-Gramin, launched in 2014 by the Government of India. This mission aimed at the elimination of open defecation in rural areas via the construction of twin pit latrines.^[14] However, studies have established that the mere presence of a latrine need not translate into behavior, which has been confirmed by our study.^[15]

The majority of the latrines in our study area were situated outside the dwelling area. This aligns with the prevalent belief in certain regions of India, where it is considered essential not to retain waste, encompassing both fecal matter and refuse, inside the house. The placement of the latrine has a substantial impact on its usage, a critical factor that directly influences sanitation practices. Our on-site observations and existing literature have shown that certain households employ the latrine superstructure for activities such as bathing or laundry.^[16] This could partly explain why our study did not find latrine location or type of house to be significant factors.

Our results revealed that the majority (59.6%) of caregivers were unaware of whether child or adult feces was more infectious, which is lower than findings from Eastern Indonesia and Nigeria.^[9,17] The feces of exclusively breastfed infants are considered safe, as it is less foul-smelling, smaller in quantity, and contain less visible food remains, while children who eat the same food as adults are thought to have “dirty” feces. Consequently, SMoF increases as the child grows older and the fecal characteristics change, a finding that is mirrored in our study.^[18,19] While prior research reported a link between maternal education and SMoF, our study did not find this association.^[20,21]

Table 2: Safe management of feces (SMoF) and its individual components (n=320)

Component of SMoF	Using safe practices (%)		
	Total (%)	Pre-ambulatory (%)	Ambulatory (%)
Safe management of feces	142 (44.4)	0	142 (52.6)
Defecation site (Latrine/Cloth/Diaper)	55 (17.1)	34 (10.6)	21 (6.6)
Transport tool (Plastic/Cloth/Leaves)	281 (87.8)	65 (20.3)	216 (67.5)
Disposal of feces (Child used latrine/Put into latrine/Buried)	190 (59.3)	7 (2.2)	183 (57.2)
Cleaning of transport tool (Wash with soap and water/Thrown into garbage)	112 (35.0)	55 (17.1)	57 (17.8)
Hand washing with soap and water	319 (99.7)	50 (15.6)	269 (84.1)

The period prevalence of diarrhea in our study was found to be 3.1% which is lower than the data from rural Bangalore (5.1%). This might be explained by the presence of active women's groups in the study area. The empowerment of women has been clearly linked to improved child health.^[22] Moreover, the study area falls under the field practice area of a medical college and it is likely that awareness campaigns and health education sessions have influenced behaviors to a certain extent.

Under the Integrated Child Development Services (ICDS) scheme, anganwadis provide health education for pregnant and lactating mothers as well as women in the reproductive age.^[23] However, very few of our participants reported attending sessions regarding diarrhea at the anganwadi. Studies have found that caregivers who had heard or seen any messages about child sanitation or hygiene in the last 6 months, were 1.38 times more likely to practice safe disposal of child feces.^[19,24] Our finding emphasizes that SMoF is not considered to be an important determinant of child health. It is vital to recognize that constant health education can assist in converting knowledge into attitude change and subsequent adoption of safe practice.^[25]

Table 3: Various methods of feces disposal of pre-ambulatory and ambulatory children

Method of disposal	Number of pre-ambulatory children (%) <i>n</i> = 50	Number of ambulatory children (%) <i>n</i> = 270
Thrown along with solid waste	26 (52.0)	39 (14.4)
Thrown into a ditch/drain	16 (32.0)	21 (7.8)
Put into latrine	5 (10.0)	16 (5.9)
Child used the latrine	2 (4.0)	169 (62.6)
Left in the open	1 (2.0)	24 (8.9)

Majority of our participants reported satisfactory knowledge and practice regarding hand washing, while 95.6% reported washing the child's hands after defecation. Hygiene practices of the mother, before feeding the child and after cleaning them, can reduce the risk of diarrhea by 34%–50% and the risk of acute respiratory infections by 23%.^[26,27] Most studies have concentrated on the hygiene practices of the caregiver and failed to consider the hygiene of the child's hands. The United Nations Children's Fund (UNICEF) states that washing a child's hands lowers the risk of diarrhea by 40%.^[28] This behavior is probably one of the reasons for a low period prevalence of diarrhea in our area as well.

In our study, only 17.1% of the participants reported that the child defecated at a safe site. Interestingly, a higher percentage of pre-ambulatory children (10.6%) was reported to have safe defecation practices as compared to the ambulatory children (6.6%). This contrasts with findings from a study in West Bengal where 36.6% reported a safe child defecation site, and in rural Odisha where 46.9% of the pre-ambulatory children were found to defecate at a safe site.^[10,29] It is important to note that defecating on the floor or ground has been linked to increased microbial contamination and using water for cleaning the site leads to a spread of the contamination.^[29] There are many misconceptions surrounding the use of latrines by children. Parents often feel that the child is too small to comfortably squat over the pan, the child might fall down, the child might be afraid to use the latrine, or that it was difficult to teach the child to use the latrine.^[18,29,30] Some mothers reported that the toilet would be a source of infection, especially for girl children.^[31]

Open defecation is considered easy and reduces the need for parental supervision and regular cleaning and disinfection. In our study, the median age at which a child should start using the latrine was 2 years which differs from previous

Table 4: Multivariate logistic regression analysis showing the adjusted Odds ratio between age and safe management of feces (*n* = 320)

Variable	Categories	SMoF/Unsafe management of feces (<i>n</i>)	Odds ratio	95% CI	<i>P</i>
Age of the caregiver/ mother	<20	2/22	1	-	-
	20 – 25	73/89	9.02	0.02-0.45	0.003*
	26-30	52/48	12.17	0.01-0.36	0.001*
	>30	15/19	8.93	0.01-0.45	0.004*
Type of house	Kaccha	1/4	1	-	-
	Pucca	113/118	2.01	0.19-21.62	0.56
	Semi-pucca	28/56	0.66	0.37-1.17	0.15
Location of latrine	Inside	72/68	1	-	-
	Outside	69/105	0.32	0.03-3.07	0.98
Shared latrine	Yes	9/25	1	-	-
	No	132/148	2.14	0.90-5.07	0.08
Received formal education	Yes	129/152	-	-	-
	No	14/25	0.74	0.36-1.50	0.40
Monthly income	<10000	53/79	0.68	0.92-4.98	0.70
	10,001 to 25000	87/97	0.90	0.13-6.56	0.92
	>25001	2/2	1	-	-

**P* value significant at $\alpha=0.05$

studies.^[9,29,30] Child-size potties or fittings that can be installed over the toilet are usually used prior to latrine use. However, in rural areas of India, these are not traditionally utilized, making open defecation a cheaper alternative till children are old enough to use the latrine.^[18] A study in rural Odisha reported that although 32.9% of the households possessed a plastic potty, only 5.9% of children below 3 years, and 2.4% of children aged 3–5 years utilized it.^[29] Moreover, open defecation is considered a way of continuing rural behaviors and this feature is consistent with the rural communities.^[31] This might be the reason why fewer ambulatory children defecate in a safe site as compared to pre-ambulatory children.

Other studies have demonstrated an association between access to water and safe disposal of feces, as, better accessibility of water makes it easier for the caregiver to safely dispose the feces into the latrine.^[10,32] This association was, however, neither found in our study nor in a study conducted in Ethiopia.^[33]

Majority of our participants reported the use of a safe tool to transfer the feces from the defecation site to the disposal site. The most commonly used materials were leaves, newspaper, or plastic bags. The use of shovels, scoops, cardboard, buckets, or baskets and nylon have also been documented in literature.^[9,29,30,34] The use of a safe transport tool was reported more among the caregivers of ambulatory (67.5%) than pre-ambulatory children (20.3%), in our study. This might be due to multiple reasons: pre-ambulatory children were more likely to defecate in a safe site thus alleviating the need for a transport tool and also because the feces of older children are considered to be more harmful.^[31] Most of our participants reported safely disposing child feces; very low (2.2%) among pre-ambulatory children and 57.2% among ambulatory children. This is higher than the prevalence found in Ethiopia (29.81%), West Bengal (27.6%), and Orissa (25.5%).^[10,24,33] Our study found that feces was most commonly thrown along with solid waste or into an open ditch or drain, as has been reported elsewhere.^[10,24,31,33] Although burial has also been documented as a mode of disposal, it was not reported in our study.^[30] Mothers have reported that since infant's stools were not dangerous, it could be disposed of in the open.^[19] Disposal of feces can be taken as proxy for behaviors such as food and environmental hygiene which are important determinants of diarrheal diseases and can be indirect indicators of caregiver attitude towards child-care practices.^[32]

The final component of SMoF, that is, hand washing with soap and water, was reported by all our participants, which is higher than in other studies.^[9,30]

Only 44.4% of the participants correctly fulfilled all the criteria of SMoF, higher than in rural Odisha (11.2%). None of the caregivers of pre-ambulatory children practiced SMoF in our study, which may be due to a lack of awareness or time. In contrast, 52.6% of the caregivers of ambulatory children fulfilled SMoF. This might be because the feces of older, ambulatory children are considered “dirty” and hence warrant

SMoF. Our cross-sectional study found a correlation between the young age of the mother and unsafe management of child feces. This might be attributed to the lower educational status of the mother and also because of lower awareness about child feces management practices.^[30] A study conducted in Bangladesh, found that adult open defecation practices, the presence of a child 18 months or above and practice of allowing the child to defecate on the ground or a nappy were associated with unsafe child feces disposal.^[35]

Our study has some limitations. The practices were reported rather than observed which might have led to social desirability bias. This could have been overcome by conducting spot checks or direct observation of child feces management. Although convenience sampling of the villages was done due to time and travel constraints, random selection of the villages would have strengthened the study design. Moreover, we did not explore the seasonal variations of feces management, which might also have been a determinant of SMoF.

In conclusion, only 44.4% reported SMoF in our study and young mothers were more likely to practice unsafe management of child feces than older mothers. Our study adds to the existing evidence that questions the effectiveness of increasing latrine coverage without simultaneous behavior change. The introduction of potties that require the child to squat, rather than sit, may also encourage their use while allowing for natural defecation behaviors. Sanitation programs must work closely with communities and identify behaviors that can be replaced by culturally acceptable and evidence-based behaviors. Holding demonstrations for caregivers regarding training children in latrine use might also prove to be impactful. Frequent health education programs with visual aids, involving all caregivers can be conducted so as to achieve a sustained change in practices. The promotion of safe sanitation is a public health intervention that will have benefits for child health, including decreased health expenses and fewer sick days for the child.

Ethical statement

Institutional Ethics Committee clearance was obtained prior to study initiation (256/2018) and written informed consent was obtained from all participants before enrolment.

Data availability statement

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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Nil.

Conflicts of interest

There are no conflicts of interest.

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