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Community faecal sludge management strategy among urban slum people of Khulna city-Bangladesh

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ABSTRACT

Faecal sludge management (FSM) has conquered notable recognition by all authorities for its importance. Because it has large scale impacts on human-environment. This study was an initiation to explore the current situation and the prevalent practice of FSM among slums people of Khulna city-Bangladesh. Applying face-to-face interview technique household survey was conducted through a structured questionnaire, where 104 participants were purposively selected for taking interview. This study was carried out in slums area of Khulna city Bangladesh. The people of Khulna particularly slums people are not so aware of using sanitation properly. Findings of this study exerts that a very large portion of slums people here are having not enough knowledge about sanitation issues and Faecal Sludge Management. Off the 100% (92/82.5%) respondents of the study area have never taken any training on FSM. A large volume of people used to use community latrine, where lack of privacy, scarcity of water, absence of hand wash facilities and unsafe manual emptying are still the major problems. Until now a large number of toilets are directly connected to drain, and whereas 23 (22%) asserted that human excreta directly goes into open water i.e. (river and pond that so deplorable. The result elucidates that within (1 or 2 years) (75/72.12%) septic or other tanks didn't get emptied whether (18/62.07%) were unfilled through unsafe manual process. In fine, it can be said that alongside arranging different awareness programme alternative small emptying devices like Vacutug must be arranged here with low cost for the disadvantaged. Therefore, a comprehensive detailed scientific study demands this sector for further designing any strategic plan.

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I. Introduction

Bangladesh is a lower-middle income faster growing country in the globe. Having with a large population Bangladesh is relentlessly working to make an equitable just society. The government of the People's Republic is determined to make sure all public amenities to its citizens adequately. But high dense population with low area and paucity of resources make uneasy the way of providing enough amenities. To ensure a safe sanitation system is obliged by SDGs. Though, in the last few decades Bangladesh obtained commendable progress in total sanitation system. The MDGs report demonstrates that Bangladesh has reached to her goal of improving sanitation system and mostly accomplished the (MDG-7) by 2015 (JMP 2015). Still pollution and resource degradation through livelihood, agricultural inputs, urbanization, land degradation, water and environmental quality are active issues of the country (Hossain et al. 2019; Hossain and Siddique, 2015; Khan et al. 2016; Sultana et al. 2015). Undoubtedly this study parameter, open defecation has significantly reduced in Bangladesh in the past few decades (BD FSM Network 2016) but not yet fully resolved in slum areas.

Faecal sludge management (FSM) is a faster-growing burning issue which has attained remarkable recognition by all authorities. In addition, United Nations General Assembly (UNGA) recognized FSM for its necessary and importance. Consequently, UNGA inserted it into the portion of the human right section, that sanitation included FSM as "a system for the collection, transport, treatment, and disposal or reuse of human excreta and associated hygiene." Further it is elaborated by (Singh et al. 2017) Faecal Sludge Management (FSM) includes the storage, collection, transport, treatment and safe endues or disposal of Faecal Sludge (FS) that means all five components of the sanitation value chain. The state must ensure without discrimination that everyone has physical and economic access to sanitation, in all spheres of life, which is safe, hygienic, secure, socially and culturally acceptable, provides privacy and ensures dignity" (UN 2009). There is no doubt that if we just improved the accessibility to sanitation will not lead to health benefits unless the sludge is safely managed and dealt with.

Because the manual emptying, leakages of excreta, open dumping, and direct line into open water bodies (river, pond) can create a heavy damage to the environment. That may increase various diseases. As still there is no specific formal FSM system has established in Bangladesh an urgent appropriate intervention for FSM is required (Islam 2016). SNV, Practical-Action, are working on this issue but that is inadequate based on demand. There is therefore an urgent need to improve proper (FSM) systems in Bangladesh. Situated beside the Rupsha River, Khulna is the third largest divisional city in Bangladesh. According to (KCC 2017) 1.5 Million people are not having with sewer network. In addition, (68.4%) households possess septic tanks while 31.6% pits (Opel 2011) and large volumes are predominantly on-site technologies. Alongside population growth, the amount of fecal sludge production is increasing. Each year about 628,070 m^3 of human excreta is producing in Khulna city (Mondal 2018). Though in collaboration with SNV, KCC is attempting to improve this sector, but that not enough effective. Still this service is not reached to all. In addition, several NGOs like CDC are involved in this process. People are not much aware of about FSM; also, they are to some extent indifferent to safely emptying and septic tanks. Hence, the prime objective of this study was to understand the present situation and the prevailing practice of FSM among slums people of Khulna city-Bangladesh.

Sustainable Development Goals (SDGs) towards FSM

Bangladesh stood as the forerunner acquirer of MDGs and the present government is immensely determined to attain some goals of SDGs by gestation time. Among various goals SDGs embedded the following goal and targets regarding ensuring FSM and sanitation.

- **Goal 6** Ensure availability and sustainable management of water and sanitation for all
- **Target 6.2** by 2030, achieve access to adequate and equitable sanitation and hygiene for all and end open defecation, paying special attention to the needs of women and girls and those in vulnerable situations.
- **Target 6.3** by 2030, improve water quality by reducing pollution, eliminating dumping and minimizing the release of hazardous chemicals and materials, halving the proportion of untreated wastewater and substantially increasing recycling and safe reuse globally.

FSM in Bangladesh-an overview at a glance

In a statement of Islam (2016) an effective management of FS systems entails transactions and interactions among a variety of people and organizations from the public, private and civil society at every step in the service chain, from the household level user, to collection and transport companies, operators of treatment plants, and the final end user of treated sludge. But till today FSM coverage is low and problematic and complex not, which is creating environmental and public health threats (Tilley et al. 2010). The chief purpose of sanitation is to prevent the transmission of faecal-borne disease and reduce the risk of environmental contamination (Repon et al. 2015). Poorly and unscientifically designed onsite disposal facilities affect the sources of groundwater with substantial environmental and health hazards (Singh et al. 2017). Having with significant achievement in this sector, still it requests special attention to manage the huge volume of human excreta which is producing every day, because improper management and emptying leads the results of mixing with ground and surface water, which may enhance the probability of environmental, public health and economic impacts (Mondal 2018). Further, (Islam 2016) asserted that Bangladesh has made an admirable progress in improving the total FSM sector. However, the improper FSM questions the initiatives of FSM. The introduction and initiation of National Strategy for Water Supply and Sanitation (NSWSS) 2014 is an imperative step for FSM to consolidate and progress the present scenario of FSM. Furthermore, in collaboration with some development organizations Bangladesh has developed and trying to insert some rules and regulations focusing onto managing the FSM challenges in Bangladesh (Mondal 2018). In addition, Bangladesh National Building Code (BNBC-2014) addressed appropriately FSM related subject matter. BNBC strategy paper accumulates FSM in the section of (BNBC: 6.9.12.1; 3; 5; 8-13). The total description about FSM can be summarized in simply.

Table 01. BNBC about septic tank for FS

Parameter	Stated in BNBC
Minimum liquid depth	1m
Minimum Width	1m
Minimum Length	Thrice of width
Maximum Length	4 times of the width
Person uses	300 Nos.
Minimum liquid capacity (Septic tank)	2000 liters
Emptying interval frequency	▪ At least 6 months ▪ Maximum 1 year

Source: BNBC (2014), Adapted from Mondal 2018.

Schedule 3 of the City Corporation Act-2009, in its sub-clause 1.4 under clause 1, clearly mentions that "The City Corporation shall make adequate arrangements for the collection and removal of refuse from all public streets, public latrines, urinals, drains, and all buildings and land within the jurisdiction of the city corporation". Though the "fecal sludge or human excreta management" is not specifically mentioned in the City Corporation Act-2009, but it is transparent that the primary responsibility of management of "fecal sludge" [referred to in the Act as "refuse" accumulated in "public toilets, urinals, drains and all buildings and land"] lies with the City Corporation Act. Even now several sludge treatments plants have constructed in (Khulna, Jhenaidah, Kushtia, and Dhaka etc.) for managing this FS. With the help of Water Aid, Bill & Melinda Gates Foundation, UNICEF, Practical Action, etc. also manage several projects on FSM in different corner in Bangladesh. Along with these organizations, SNV (Netherlands Development Organization) already has started to take different initiatives to manage the human excreta for the urban context in Bangladesh (Mondal 2018).

In a baseline study of conducted in three cities (Khulna, Kushtia, and Jhenaidah) indicates that only in Khulna though the open defecation is rarely happening, but majority of toilets have either a septic tank or pit as containment, but most of them don't have a soak well or, due to the high-water table, a soak well does not work. Therefore, the households are eager to connect the toilet to drain directly (Mondal 2018). A study of Kabir and Salauddin (2015) found that in Khulna city, almost 84% of the total have a septic tank that are connected to a drain or surface water straightly. Although, very recent years, vacutug

services has installed by KCC but the practice of safe septic tank evacuating and transporting is almost absent in Khulna city (Kabir and Salauddin, 2015). According to as cited in (Mondal 2018) moreover, over half of the total households, irrespective of wealth situation, either use unsafe emptying or do not at all practice fecal sludge emptying.

Below is the existing FSM processes of Bangladesh, drive to provide a comprehensive sustainable sanitation service chain [Adapted by WASH (2011), as cited in Mondal (2018)].

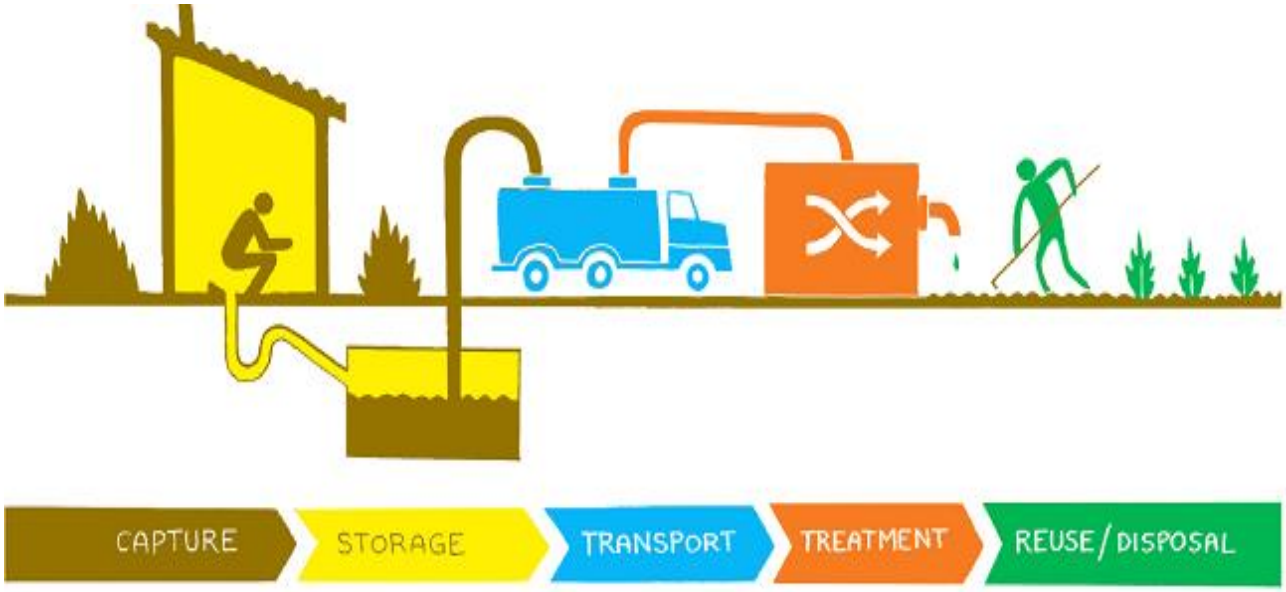

Figure 01. The key processes in a complete sanitation service chain.

II. Materials and Methods

Study design

In order to achieve the objective, the current study employed mixed method. Both qualitative and quantitative data were used to ascertain the objective. The quantitative data was collected by a series of household surveys through a structured questionnaire (Mondal 2018) inserting with various socio-economic parameters and other relevant factors. A total of 104 respondents were enumerated from different slums. This study was conducted in Khulna city of Bangladesh. Two slums were selected based on convenience sampling. After collecting the raw data, then it was processed through (SPSS 20) and relevant information means variables inserted into (SPSS 20). First section of this study explored the (frequency, mean, and Std. Deviation) and then inferential statistics Chi-Square test of association based on 95% Confidence Interval (CI) employed to find out the association among socio-demographic variables and practicing FSM properly. The mean score was calculated to rank the existing problems.

III. Results and Discussion

The undertaken study demonstrated the household FSM strategies and existing practice. Therefore, identifying household's demographic and socio-economic characteristics is essential to ascertain the objectives. These variables play as a role of influencing covariates for determining the outcomes.

Table 02. Socio-economic characteristics of the respondents

Variables	Category	Frequency	Percentage
Sex of The Respondents	Male	62	59.6%
	Female	42	40.4%
	18-25	16	15.4%
	26-33	28	26.9%
	34-41	22	21.2%
	42-49	20	19.2%

Age	50-57	10	9.6%
	58-65	8	7.7%
	Mean:37.66; Std. deviation:11.23; Minimum:18; Maximum:62		
Religion	Islam	91	87.5%
	Hindu	13	12.5%
Level of Education	No education	14	13.5%
	Signature only	28	26.9%
	Primary (1-5)	35	33.7%
	Secondary (6-8)	14	13.5%
	9-10 (SSC pass)	6	5.8%
	HSC	4	3.8%
	Honors	3	2.9%
Occupation	Informal Micro-Business	25	24.0%
	Driver	1	1.0%
	Day Laborer	58	55.8%
	Unemployment	6	5.8%
	Housewife	3	2.9%
	Others	11	10.6%
Practice of using sanitary latrine	Don't Use	15	14.4%
	Use	89	85.6%
Separate toilet for male and female	Yes	16	15.4%
	No	88	84.6%
Training related to FSM	Yes	12	11.5%
	No	92	82.5%

Above the given (Table 02) represents the demographic and socio-economic characteristics of the respondents. Majority (62/59.6%) respondents were male, while (42/40.4%) were female. Mean of the age of the respondents is (37.66), average age difference is quite notable (11.23), the highest respondents were age of 62-years.

More than half of the respondents (91/87.5%) were from Islamic religion, whereas only (13 /12.5%) were Hindu religion. A quite number of respondents just had from primary (Class 1 to 5) -(35/33.7%), while the second largest group (28/26.9%) only able to endorse their name. A remarkable portion of the respondents (14/13.5%) had not possessed any formal education. And the rest of respectively (14/13.5%; 6/5.8%;4/3.8%; 3/2.9%) were completed secondary (class Six to Eight); (Class-9 to 10 or SSC pass); HSC and Honors. The data above the (Table 02) elucidates the occupational status of the respondents. Almost above half of the respondents (58/55.8%) observed their livelihood as a day labour, while (25/24.0%) engaged different kinds of micro informal business (i.e. selling cakes beside roads, selling vegetables, road side tea stall etc.). As the study area was determined as slum, so except (3/2.9%) women were housewife, while other women engaged in different works. And the rest were involved in performing different works based on their capability.

The data above the (Table 02) indicates a praiseworthy practice that (89/85.6%) respondents use sanitary latrine, whereas a very small number (15/14.4%) was not used to using sanitary latrine. Of 100%, (88/84.6%) respondents answered there is no separate toilet for female. The results in the aforementioned (Table 02) present that (92/82.5%) respondents have never taken any training of FSM. However, a very minor portion (12/11.5%) had trained up on FSM.

Table 03. Characteristics of latrine

A. System of latrine use	Frequency	Percent
Free toilet	12	11.5%
Other's toilet	3	2.9%
Own	33	31.7%
Community toilet	39	37.5%
Joint toilet (two-three families)	17	16.3%
B. Types of latrine		
Hanging latrine	10	9.6%
Open pit/Pit toilet without slab	3	2.9%
Open toilet /Connected with drain	10	9.6%
Bucket toilet	2	1.9%
Composting toilet (eco sun)	2	1.9%
C. Number pits and fitting		
Direct one pit	86	82.7%
Office one pit	9	8.7%
Two pits	1	1.0%
More than three pits	8	7.7%
D. Component of rings		
Concrete	73	70.2%
Burn soil	6	5.8%
Only hole, no ring	13	12.5%
Don't know	12	11.5%
E. Are the rings and pit located under soil		
All the rings located over soil	14	13.46%
Some portions are above soil	24	24.80%
All the rings under soil	64	61.74%
F. Facilitation of toilet with seal		
Yes	28	26.9%
No water seal; with covered pan	67	64.4%
No water seal, with no covered pan	9	8.7%
G. Does the water seal work in your toilet?		
Yes	42	40.38%
No	62	59.62%

The aforementioned (Table 03) illustrates the characteristics of the latrine, which is frequently used by the respondents of study area. As this study was conducted in slums, majority (39/37.5%) used to use community latrine, while (33/31.7%) occupied own family latrine. The study people altogether (20/19.2%) answered that they have hanging (means one hole and a ring) and open toilet or connected with drain directly. (86/82.7%) toilets have direct one pit toilet. The rings of the toilet were generally made of concrete (7/70.2%), whereas (13/12.5%) toilet doesn't have any rings. It is very admirable that (64/61.5%) respondents of the slums answered all the rings which they used for tanks are put under soil, so that the odor cannot come out. Over half of the respondents (67/64.4%) pointed out that their toilet doesn't have any water seal, just covered with pan, while (28/26.9%) toilet facilitated with seal. Although (28/26.9%) toilet has with seal but (62/59.62%) respondents reported that the seal doesn't work properly, but the rest of (42/40.38%) affirmed that the seal works properly.

Table 04. Existing facilities for latrine use

a. Within how many days the floor and pan of the latrine are being cleaned	Frequency	Percent
Every day	3	2.88%
1-3 times in a week	17	16.35%
4-6 times in a week	2	1.92%
Just when need	59	56.73%
Don't know	23	22.11%
b. Where do your family members wash their hand after toilet		
No specific space for hand wash	11	10.6%
Within toilet	22	21.2%
Within toilet block (in case of community toilet)	43	41.3%
Outside of toilet, but within house	27	26.0%
Outside the toilet block	1	1.0%
c. Is soap available for hand wash in the toilet		
Yes, soap/ detergent	89	85.6%
Yes, dust/ clay/ sand	7	6.7%
Nothing for washing	8	7.7%
d. Is supply of water is available for cleaning/washing yourself		
Not available for all time	71	68.3%
Available water	33	31.7%
e. How water is reserved for hand washing		
In an open pot/bucket	33	31.7%
Covered pot	9	8.7%
Covered pot connected with water tap	14	13.5%
No reservation	48	46.2%
f. Within last 1or 2 years did you empty the sludge from the septic tanks?		
Yes	29	27.88%
No	75	72.12%
g. What was the emptying method? (within last 1or 2 years)		
Manually emptying (Sweeper)	18	62.07%
Vacutug	7	24.14%
By own	4	13.79%

With a view to acquiring the objective this undertaken study asked to the respondents some questions to know about the available facilities existing in their toilets. The data before the (Table 04) represents the available facilities regarding toilet used. It is very deplorable that (59/56.73%) study people put forth that the toilet cleans up when it needs. There is no fixed date for cleaning up the floor or pan. While, (23/22.11%) told they don't know when it gets cleaned up. Of (17/16.35%) answered that generally 1 or 3 times the floor and pan get cleaned up in a week. The (Table 03) indicates that (39/37.5%) respondents use community latrine, consequently (43/41.3%) respondents wash their hand within toilet block (in case of community toilet), while (11/10.6%) pointed out that there in specific facilities for observing hand wash practice. Majority (71/68.3%) study people told that the is lack of water for cleaning or washing after latrine use and most often they had to face severe problems due to scarcity of water for sanitation as well as drink. However, one-third (33/31.7%) respondents' response that water is available for sanitation in the area of toilet or home, but (48/46.2%) respondents bring to light that there are separate water reservation facilities. And one-third (33/31.7%) told that water is being kept reserved in an open pot or bucket nearby toilet. But most often the pot remains empty for the lack of water or people are not aware of fulfilling the pot with water.

Table 05. Problem related to FSM

A. Problems related to use latrine	Mean Score	Rank
▪ Spread odor	.73	V
▪ Paucity of water	.80	IV
▪ Lack of privacy	.87	II
▪ Contaminated area	.83	III
▪ Shortages of toilet	.90	I
B. Problems related to FSM or latrine management		
▪ Overflowing pits	.83	III
▪ Emptying interval is very low	.87	I
▪ Lack of separate fund	.79	IV
▪ Inconvenience road for Vacutug	.84	II
▪ No committee for maintenance the latrine or septic tank	.70	V
▪ Not enough equipment for cleaning up	.67	VI
▪ High number of users	.66	VII
▪ Users are unaware during their turn to clean up	.58	VIII

This study also carried out to find out the prevailing problems related to FSM in slums area of Khulna city-Bangladesh. The authors predetermined some problems which then measured by using mean score to order problem in accordance with severity. The answer of the variables arranged (0 to 1), the closer to (1) indicates the severe problems, and close to (0) means lower problems. In the question of problems related to use latrine, the highest mean score achieved (Shortages of toilet-.90) it is noted that the above (Table 03) mentioned (39/37.5%) respondents use community latrine, consequently the ratio of latrine and people are very low. Which means the number of community latrine should establish through NGOs or Govt. with a view to ensuring safe sanitation or FSM.

The second highest mean score obtained by (Lack of privacey-.87), that carry the meaning the latrine is not well decorated. The (Table 03) demonstrated that (88/84.6%) respondents asserted there is no separate toilet for female. As a result, female feels lack of privacy to use latrine. As the study area was slums, so generally this area would be contaminated that was initially hypothesized. The calculated mean score (.83) acquired which stood third severe problem for the area of the study.

The second section indicates the problems related to FSM or latrine management. Emptying interval is very low (mean score .87) obtained the higher mean value, which means the people of the study area are not very much conscious about cleaning up their septic or other types of tanks. The slum area is very much jeopardized and congested with narrow road facilities. Therefore, Vacutug (special car for conveyance human excreta) cannot enter the slums area, so it is very hard for them to vacant the septic or other tanks regularly. As a result, inconvenience road for Vacutug (mean score-.87) acquired the second serious problems. And rest of the problems achieved mean score which lies through (.70 to .58). This is therefore; means the related problems need to be addressed and necessary initiative must be implemented within short very short interval.

Knowledge on sludge: The current study was intended to ascertain the knowledge of the study people related to FSM. Results in (Figure 02) indicate that majority 21(20.20%) respondents don't know where the sludge (human excreta) goes. The answers of the respondents present that 19(18.90%) slum people know that the sludge goes to sewerage line, while altogether 23(22%) told that human excreta directly goes into open water i.e. (river and pond). A very small portion 10(9.60%) answered that the sludge goes into drain, whereas 13(12.50%) put forth that it goes into septic tanks and the rest of 18(17.30%) pointed out that the sludge mixed with mud. This therefore, means still half of the total respondents don't have any knowledge about where the sludge goes. So, initiative needs to be taken into consideration to make people aware of FS. This may enhance the FSM practice among the slums people.

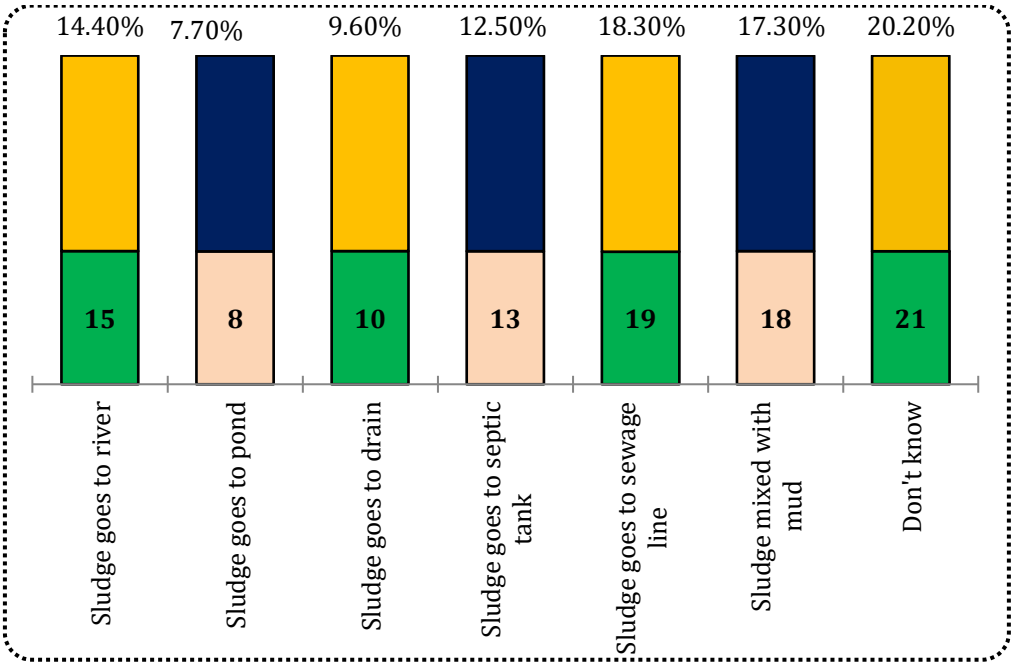

Figure 02. Knowledge on where the sludge goes?

Table 06. Chi-square test of association

Variables	Following FSM strategy		P-value
	Don't Follow	Follow	
Sex(Count Within)			
Male	9(14.52%)	53(85.48%)	.604
Female	6(14.28%)	36(85.71%)	
Education			
No education	12(11.54%)	2(1.92%)	
Only Sign	2(1.92%)	26(25%)	
Primary (1-5)	11(10.58%)	29(27.88%)	
Secondary (6-8)	3(2.88%)	11(10.58%)	.039*
9-10(SSC pass)	2(1.92%)	4(3.85%)	
HSC	-	4(3.85%)	
Honors	-	2(1.92%)	
Religion (Count Within)			
Islam	14((15.38%)	77(84.62%)	.406
Hindu	1(7.69%)	12((92.31%)	
Occupation			
Small businessman	4(3.85%	21(20.19%)	
Driver	-	1(0.96%)	
Day laborer	9(8.65%)	49(47.11%)	.860
Unemployment	-	6(5.77%)	
Household	-	3(2.89%)	
Others	2(1.92%)	9(8.65%)	
Income of the respondents			
Below 2000	11(10.58%)	2(1.92%)	
2001-3500	3(2.88%)	64(61.54%)	.000*
3501-5000	1(0.96%)	14(13.46%)	
Up 5001	-	9(8.65%)	

Training on FSM (Count Within)			.206
Yes	3(25%)	9(75%)	
No	11(12.08%)	80(87.91%)	

The above-mentioned (Table 06) demonstrates the inferential statistics. The present study was primarily hypothesized that there is no relation among socio-demographic-economic variables and observe proper FSM strategy. Based on (CI-95%) the test of association indicates that except education and income other variables are independent. This therefore, decided that observing appropriate FSM strategy is not influenced by other demographic variables. The study found that education (X2=.039<.05) and income (X2=.000<.05) influence people to follow proper FSM strategy i.e. (cleaning, managing, installing septic tank, practicing proper hand wash, practicing safe emptying techniques, transporting sludge, reuse the sludge etc.). It is clearly seen in the (Table 06) that higher the income and education group are more careful to follow proper FSM strategy. So, the null hypothesis is accepted except the two variables i.e. (education and income).

IV. Conclusion

Bangladesh is very populous and congested country in the world having with around 16 million people. Recent various achievements make us proud to be as Bangladeshi. But some prevailing issues related to hygiene and sanitation makes us dissatisfy and dare to question the inbuilt process of ameliorating the FSM or sanitation system. Although, we are in a good position than other neighboring countries in ensuring total sanitation amenities, and to reduce open defecation Bangladesh achieved admirable success. Nevertheless, challenges are more. In response to the challenges, this research was an effort to look into the FSM practice at marginal level (slum). The whole paper tried to present the actual scenario based on the field level primary data. As results, there is no scope to be biased to uphold the truth. Thus, the results of this study may assist the appropriate authorities for further taking any initiatives to develop, implement or decorate any strategy concerning FSM programme.

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