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Role of Sanitation Microfinance on the Improvement of Sanitation Condition and Nutrition Condition of Under-five Children in Rural Bangladesh

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Abstract **Original Research Article**

***Introduction*:** The sanitation requirement for the sustainable development goals (SDGs) is to certify household better sanitation, and it is the target of SDGs. Developed sanitation is that which ensures the hygienic separation of human excreta from human contact. The Government of Bangladesh has a strategy to safeguard sanitation at an agreeable level for all by 2030. ***Aim of the study*:** The study aims to investigate the relationship between sanitation microfinance and sanitation condition in Bangladesh. ***Methods*:** A cross-sectional study was carried out in each district of Dhaka, Chittagong, Rajshahi, and Khulna from August 2019 to September 2019 for five weeks Semi-structured questionnaires and face did data collection face interview techniques from the head of households. Verbal consent was taken before recruiting the study population. Completed data forms were reviewed, edited, and processed for computer data entry. The data analysis was performed using Statistical Package for the Social Sciences (SPSS) Version 25.0, two-sample t-test, binary probit model. ***Result*:** Among 120 participant households and 120 non-participant households in this microfinance program, household satisfaction in sanitation conditions among microfinance households is good. Microfinance is applicable for low economic households, where the annual income was 1501 to 3000 USD (I USD=84 local currency). Both sanitation outcomes and nutrition outcomes had a strong association with sanitation microfinance($p<.05$). With sanitation microfinance improved sanitation outcome (76.67%) is more than that without microfinance (47.50%). On the other hand, the nutrition condition of under-five children at the household level with sanitation microfinance was more (90%) than that of without microfinance (48.47%). ***Conclusion*:** Earning the Millennium Development Goal (MDG) to split the number of people without access to enhanced sanitation presents a substantial challenge for evolving and least developed countries. The 1st known search into the potential of microfinance to unleash latent claims for sanitation improvements among low-income households in a developing country.

Keywords: Sanitation, Microfinance, Rural People, etc.

INTRODUCTION

Sanitation is a global concern for sustainability. The sanitation requirement for the sustainable development goals (SDGs) is to ensure household improved sanitation, and it is the 6.2 target of SDGs [1]. Improved sanitation is that which ensures the hygienic separation of human excreta from human contact [2]. Only 68% of people worldwide have access to improved sanitation. [3] In a developing country, especially in rural areas, sanitation is a big problem. In South Asia, only 46% of households have good sanitation conditions. Improved sanitation is essential for good health, social, and spiritual well-being, and as

a symbol of prosperity. In Bangladesh, a South Asian country, 163 million people stay in a total land area of 147,570 square kilometres [4]. Bangladesh rural population for 2020 was 101,815,917, a 0.24% decline from 2019 [5]. Bangladesh is a land of rivers. Many hanging toilets are on rural riverbanks. Unimproved toilet pollutes the surrounding air and sources of water. Rural people use these sources of water for taking baths, washing household goods, and bathing cattle. Access to safe water with improved sanitation conditions is a big concern for rural people. Sanitary toilet is essential for quality of life and environmental protection [6]. Improved sanitation is also part of public Community-Led Total Sanitation (CLTS), which was started in 2000 to reduce the spread of disease by ensuring improved sanitation for all [7] The Government of Bangladesh has a plan to ensure sanitation at a satisfactory level for all by 2030. The United Nations have classed Bangladesh as one of the least developed countries (LDCs) for the last four decays [8]. The total number of under-five children is about 17.2 million. About 46% of under-five children are malnourished either reduced height for age or low weight for age or low weight height [7]. Under-five children's nutrition is given importance in different national initiatives like the National plan of action for nutrition (NPAN2) (2016-2025) [9]. Microfinance Institute (MFI) is an alternative bank for the poor to improve their livelihood. Ideas, relating to microfinance were found in the 1950s in this region. At that time, it was known as co-operative microfinance [10]. Modern microfinance was started in 1972 by the Bangladesh Rural Advancement Committee (BRAC) [11]. Sanitation microfinance is the provision of microfinance to households or small businesses related to sanitation materials to improve sanitation facilities [12]. The water supply, Sanitation, and hygiene (WASH) program is the pioneer of sanitation microfinance by the World health organization (WHO) and UNICEF since 1990, providing financial support through different local partner organizations [13]. Sanitation is a public good in the urgency of public funding that will let everybody advantage from enhanced health as well as social and economic enhancement. Poor sanitation creates thoughtful undesirable externalities, creating public health hazards and risking economic enhancement for all. Good sanitation creates economic benefits and unlocks human productivity. Instruction throughout the sanitation chain is important to ensure that the benefits are understood by all [14].

Objectives

- To find out the relationship between sanitation microfinance and sanitation condition
- To find out the relationship between the nutritional condition of under-five children and sanitation microfinance.
- To identify the household characteristics that influence to take Sanitation microfinance.

METHODS

A cross-sectional study was carried out in each district of Dhaka, Chittagong, Rajshahi, and Khulna from August 2019 to September 2019 for five weeks. The collected sample was 120 of each group, sanitation microfinance households, and non-microfinance households. Semi-structured questionnaires and face did data collection face interview techniques from the head of households. The questionnaire covered data on the household demographic and socioeconomic characteristics & Sanitation related information. Under-five children's information, which was necessary to measure nutrition condition, was taken from households. Seventy households of each group had under-five children. All observations were noted in the clinical data sheet. Different types of statistical methods were used for analyzing the collected data. The results were calculated and interpreted through appropriate statistical analysis with the help of a statistician. Verbal consent was taken before recruiting the study population. Ethical clearance was taken from the hospital. The information was kept confidential only to be used for the study purpose.

Data Analysis

The study coordinators performed random checks to verify data collection processes. Completed data forms were reviewed, edited, and processed for computer data entry. Frequencies, percentages, and cross-tabulations were used for descriptive analysis. To investigate the determinants of household decision to participate in that microfinance program binary probit model was used. To compare the mean value of the socio-demographic, sanitation and nutrition-related information, the two-sample t-test was used. χ 2 test was used to analyze statistical significance. The data analysis was performed using Statistical Package for the Social Sciences (SPSS) Version 25.0. The significance level of 0.05 was considered for all tests.

RESULT

Among 120 participant households and 120 non-participant households in this microfinance program, household satisfaction in sanitation conditions among microfinance households is good. A few household heads (9) are not satisfied as their toilets have been damaged by rain and flood. Non-microfinance households are trying to get this microfinance to improve their sanitation condition (Figure 1). The age of the household head was younger than that of the non-microfinance household, while the mean education, of both household head, and mother was more in participant households. The non-agricultural occupation was also more in sanitation microfinance households (Table 1). Microfinance is applicable for low economic households, where the annual income was 1501 to 3000 USD (I USD=84 local currency). It is more common in the lower range. Annual household income and household members are

more in the non-microfinance household (Figure 2). From the mean difference test, it was found that sanitation microfinance households and non-microfinance households are also different concerning the nutrition condition of under-five children. Under-five children, mothers, and household heads with sanitation microfinance are younger than those without microfinance but no significant difference. Annual income is more in non-microfinance households. Both household head and mother average education with under-five children is more in microfinance households, and mother education is significantly higher than that of non-microfinance. But higher education like college-level education where years of education were more than ten is higher (9) among non-microfinance than that of microfinance (6). As well as primary level education and non-educated mothers are more among non-microfinance households. It indicates that microfinance was not popular among extremely lower and upper-educated families, but a certain level of education is needed (Table 2). The probability of participation increased among households with a more educated mother. It is more in the non-agriculture household when heads of households in a different profession other than agriculture like a business. Sanitation microfinance was preferable among those households where the annual income was comparatively less than that of others, fewer family members and the household head had a certain level of education (Table 3). Both sanitation outcomes and nutrition outcomes had a strong association with sanitation microfinance($p<.05$). With sanitation microfinance improved sanitation outcome (76.67%) is more than that without microfinance (47.50%). On the other hand, the nutrition condition of under-five children at the household level with sanitation microfinance was more (90%) than that of without microfinance (48.47%) (Table 4). The results of the model predicted a positive effect on sanitation outcomes; the treatment effect on households was significant. It was found that the p-value was less than 0.05 and the coefficient was about 39% (Table 5). Regarding household, good nutrition outcomes, the result of the model predicted that the treatment effect of sanitation microfinance with various covariates is positively significant ($p<0.05$), and this treatment effect is about 50% (Table 6).

Table 1: Different variables sanitation microfinance households (n=120) and non-microfinance households with sanitation outcomes(n=120)

Variables (Independent)	**Participant household (120)**			**Non-participant Household (120)**			**Difference**	
	Mean	Min--Max	Std Dev	Mean	Min--Max	Std Dev	Mean Difference	t-value p-value
Household head age	34.87	28 46	4.40	38.91	28 56	6.61	-4.03	-5.55 0.001
Mother age	25.25	19 35	4.43	29.27	19 48	6.61	-4.03	-5.39 0.001
Household size	4.82	3 8	1.11	5.06	3 9	1.81	-.24	-1.63 0.10
Annual income (USD)	2087.92	1600 2750	211.35	2271.5	1700 2950	322.06	-183.58	-5.22 0.001
Household head education	10.1	0 16	3.56	9.17	2 16	3.41	.93	1.82 .04
Mother education	9.53	0 16	4.09	7.33	0 16	4.00	2.2	4.21 0.001
Household Occupation	.4	0 1	.49	.63	0 1	.48	-.23	-3.70 0.00
Handwashing	.83	0 1	.37	.62	0 1	.49	.22	3.86 0.00
Disposal of waste product in situ	.91	0 1	.29	.84	0 1	.37	.07	1.56 0.12
Variables(outcome)								
Sanitary toilet	.93	0 1	.25	.84	0 1	.49	.34	6.76 .001
Sanitation condition	.78	0 1	.42	.49	0 1	.50	.28	4.75 .001

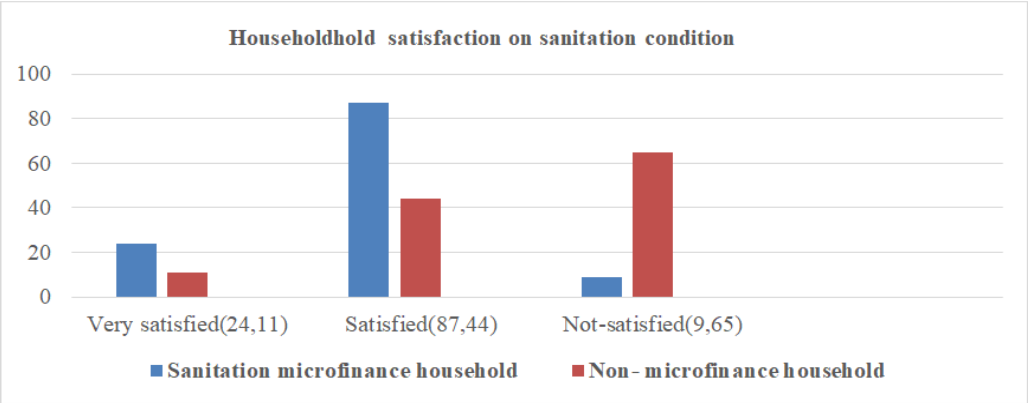


Figure 1: Figure showing the number of sanitation microfinance households(n=120) and non-microfinance households(n=120) with satisfaction levels with sanitation conditions

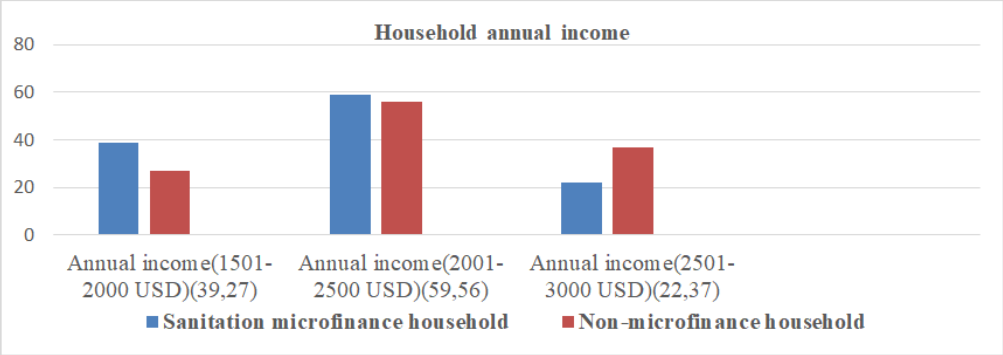


Figure 2: Figure showing annual household income of sanitation microfinance and non-microfinance households (n=120)

Table 2: Different variables of sanitation microfinance household(n=70) and non-microfinance households with the nutritional outcome of under-five children (n=70)

Variables (Independent)	**The participant household with under-five children (70)**			**The non-participant household with under-five children (70)**			**Difference**	
	Mean	Min--Max	Std Dev	Mean	Min--Max	Std Dev	Mean Difference	t-value p-value
Household head age	34.31	28 46	4.30	35.83	28 44	4.69	-1.51	-.78 0.44
Mother age	25.44	19 35	4.26	25.92	19 34	4.51	-.48	-0.34 0.73
Household size	4.7	3 8	.15	5.0	3 9	.16	-.3	-1.35 0.18
Annual income (USD)	2056	1700 2750	26.34	2067	1700 2700	28.16	-11.14	-0.29 0.77
Household head education	8.66	2 15	3.01	8.18	0 16	3.07	.47	0.92 0.36
Mother education	7.46	0 14	3.71	5.66	0 15	3.69	1.8	2.88 0.005
Number of under-five children	1.46	1 3	.56	1.32	1 3	.51	.11	1.27 0.10
Household head Occupation	.46	0 1	.50	.69	0 1	.47	-.23	-2.79 0.006
Sanitation condition	.8	0 1	.45	.49	0 1	.50	.28	4.92 .001
Variable(Outcome)								
Nutrition condition of under-five children	.9	0 1	.04	.49	0 1	.06	.41	5.90 0.00

Table 3: Probit estimation (Household decision on participating in microfinance)

Variables	Coefficient	Standard Error	Z	P>z	Marginal effect
Annual income	-0.002**	0.00	-5.21	0.00	-0.0008
Mother education	0.23**	0.05	4.91	0.00	0.094
Household head education	0.19**	0.06	3.38	0.001	-0.076
Household head occupation: Agriculture dummy	-0.56**	0.19	-3.00	0.003	-0.219
Household head age	-0.10*	0.05	-2.09	0.04	-0.042
Mother age	-0.08	0.05	-1.73	0.08	-0.037
Household size	-0.02	0.11	-0.22	0.83	0.004
_cons	6.05	1.16	5.22	0.00	

(* at 5% significant level<.05; **at 1%significant level<.01)

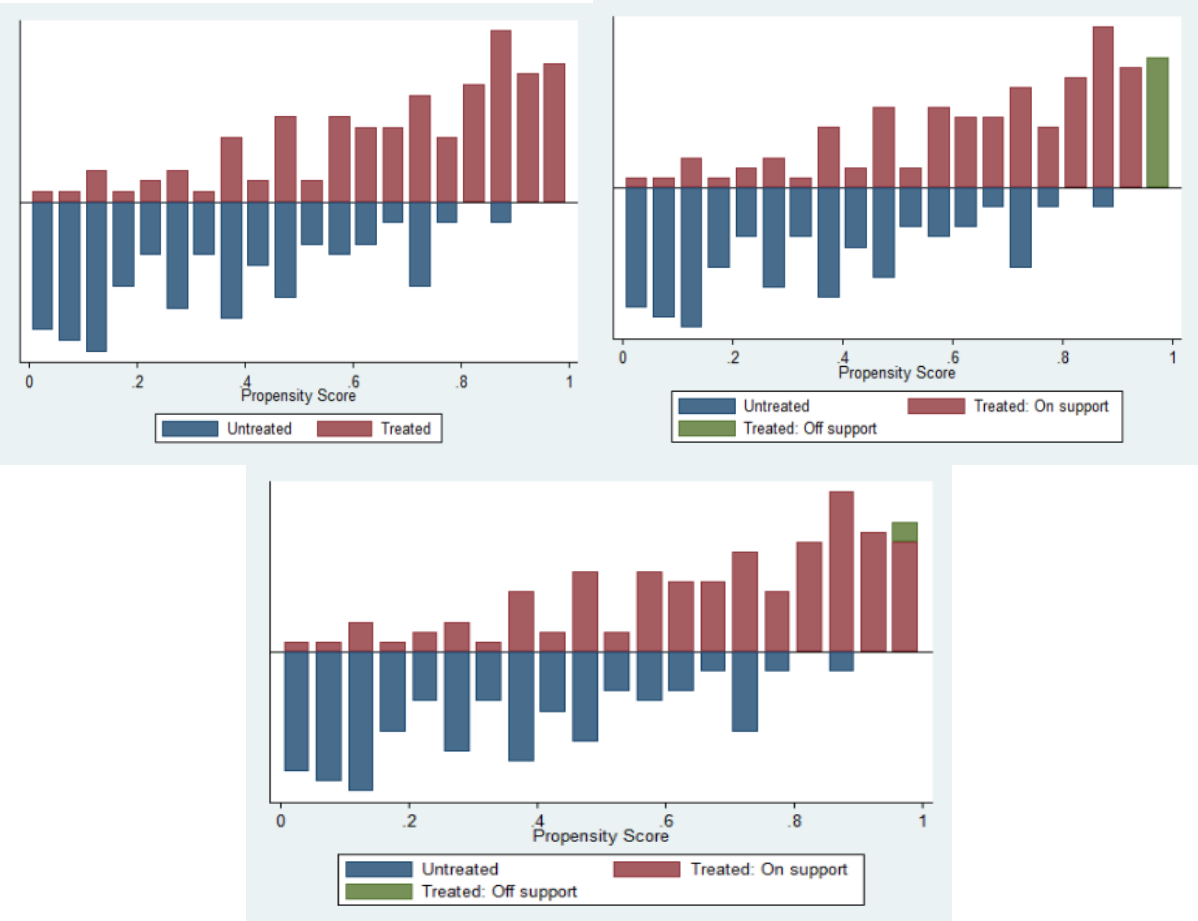
Table 4: Association of outcomes with household sanitation microfinance

Variable 1	Variable 2	Person Chi value	p-value
Sanitation microfinance	Sanitation outcome	21.63	.001
	Nutrition outcome	28.22	.001

Table 5: Average treatment effect on treated (ATT) of sanitation microfinance on household improved sanitation outcome(n=240)

Treated: Sanitation microfinance Outcome: Sanitation condition	t-stat	p-value	Coefficient	Std Error
Nearest Neighbor Matching	2.35*	0.02	0.39	0.17
Radius Matching	2.80*	0.019	0.38	0.14
Kernel matching	2.68**	0.008	0.40	0.14

(* at 5% significant level<.05; **at 1%significant level<.01)



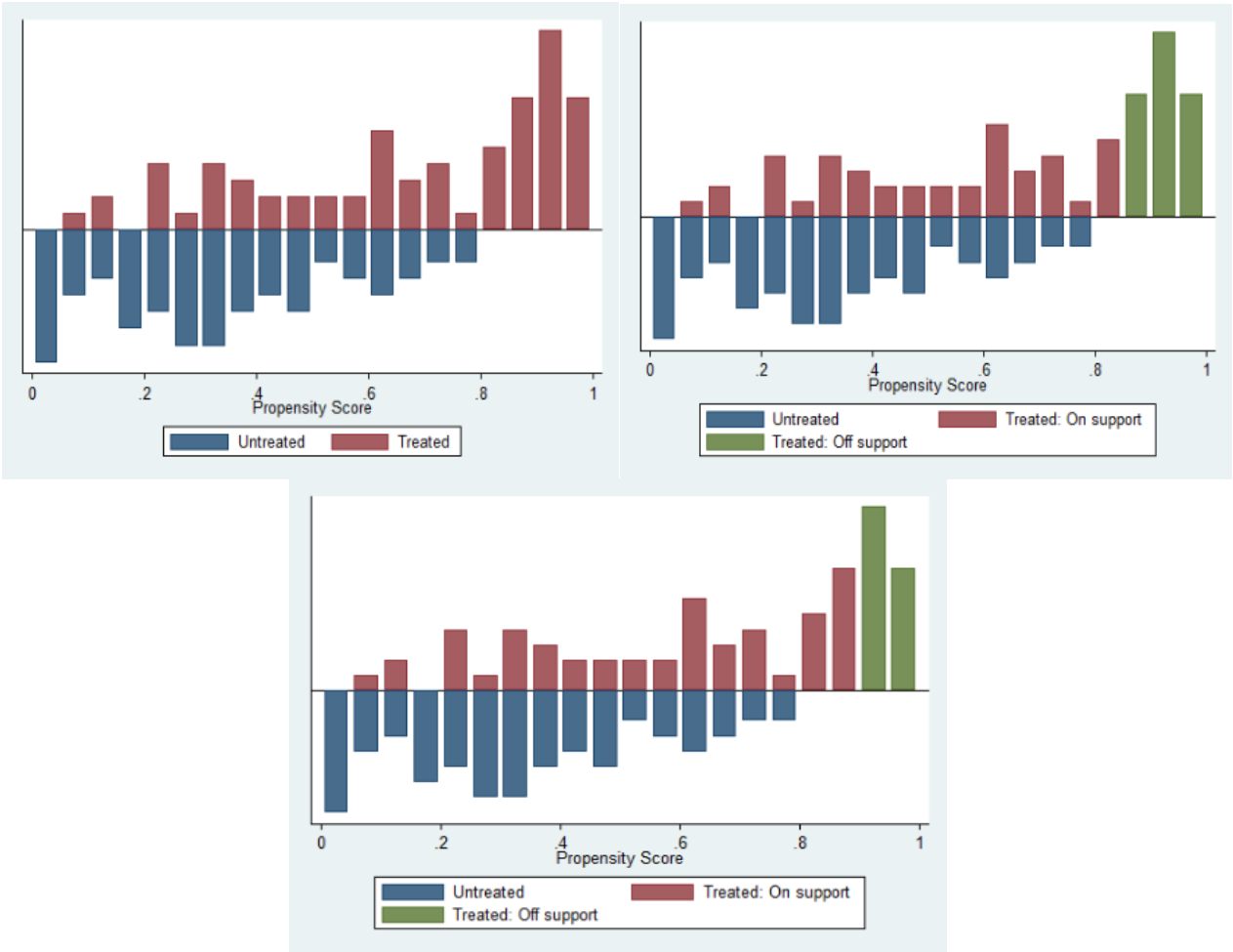
Nearest neighbour (1) matching Kernel matching Radius (.1) matching

Figure 3: Figure showing PSM graph on sanitation outcome

Table 6: Treatment effect (ATT) of sanitation microfinance on nutrition condition(n=140)

Treated: Sanitation microfinance **Outcome: Nutrition condition**	t-stat	p-value	Coefficient	Std Error
Nearest Neighbor Matching	2.7**	0.008	0.34	0.16
Radius Matching	3.18**	0.002	0.44	0.14
Kernel matching	4.83**	0.000	0.62	0.12

(at 1%significant level<.01)**



Nearest neighbour (1) matching Kernel matching Radius (.1) matching

Figure 4: Figure showing PSM graph on the nutritional outcome

DISCUSSION

Bangladesh has earned significant advancement in certifying access to improved sanitation facilities in recent years. Abundant progress has also been established in the sanitation sector with 61% of the population having entrée to better sanitation facilities, up from 33% in 1990 [3]. Challenges still have because of the immediacy of tube wells and latrines pits, unsanitary conditions surrounding tube wells, lack of cleanliness of water reservoirs, and insufficient faecal slush management, which is exacerbated by periodic monsoons and flooding [15,16]. The poor and non-agriculture people received this kind of microfinance facility. This result also supported the previous research finding based in Hyderabad, India [17]. In this present study, a few household heads (9) are not satisfied as their toilets have been damaged by rain and flood. Non-microfinance households are trying to get this microfinance to improve their sanitation condition, 24 sanitation microfinance household heads were satisfied with their sanitation condition. Another study described that 79% of the household had the inconvenience of using the sanitation facility was a leading cause of dissatisfaction [18]. In this current study, microfinance was appropriate for low economic households, where the annual income was 1501 to 3000 USD (I USD=94.70 local currency). It is more common in the lower range. Annual household income and household members are more in the non-microfinance household. Handwashing practices, proper establishment of the sanitary toilet, and sanitation conditions are significantly more in participant households. Properly disposing of waste products in situ presents more in

participant households, but not significantly. Another study in Bangladesh also suggested that 1-2% of annual household income was used as a rough guide and this had been converted to 20% of monthly expenses to provide that service to ensure financial barriers to access to care were reduced, especially for the poorest households and bamboo superstructure was affordable for the poorest people [19]. In this study, from the mean difference test, it is found that sanitation microfinance households and non-microfinance households are also different concerning the nutrition condition of under-five children. Under-five children, mothers, and household heads with sanitation microfinance are younger than those without microfinance but no significant difference. Annual income is more in non-microfinance households. Both household head and mother average education with under-five children is more in microfinance households, and mother education is significantly higher than that of non-microfinance. But higher education like college-level education where years of education were more than ten is higher (9) among non-microfinance than that of microfinance (6). As well as primary level education and non-educated mothers are more among non-microfinance households. It indicates that microfinance was not popular among extremely lower and upper-educated families, but a certain level of education is needed. Household income is a decision-making factor for taking sanitation microfinance. The non-agricultural occupation of the household head and education, especially mother education, provokes the decision of sanitation microfinance. Sanitation microfinance is more among the younger age group [20]. The present study portrayed that, the probability of participation increased among households with a more educated mother. It was more in the non-agriculture household when heads of households in a different profession other than agriculture like a business. An educated mother or wife was more creditworthy and more concerned about sanitation. The result was consistent with another finding [21]. Sanitation microfinance was preferable among those households where the annual income was comparatively less than that of others. It was found that younger and more educated household heads would like to participate in this sanitation microfinance program. Multicollinearity test was performed by estimation of variance inflation factors (VIF) [22]. Test for Heteroscedasticity was done by the Breusch-Pagan test. It is found that variables are constant. Chi=2.58 and p=.108. Variables are not Heteroscedasticity [23]. In his analysis, the Chi-square test was performed as these three variables, sanitation microfinance, sanitation outcome (improved sanitation), and nutrition outcome (well nutrition condition of under-five children in the household are categorical variables. The lowest value means the highest success with a probability and sanitation outcomes and nutrition outcomes have a strong association with sanitation microfinance($p<.05$). In this study, the author determined the covariates and estimated the propensity score by using the Probit regression method, estimated the average treatment effect of treated (ATT) on improved sanitation outcomes and nutrition outcomes of under-five children at the household level by using the Nearest Neighbor matching algorithm, Kernel matching, and Radius (0.1) matching [24]. Here covariates are annual income, household size, household head occupation, household head education, mother education, household head age, and maternal age. On household nutrition outcomes of under-five children number of under-five children was also included. In this current study, regarding household, good nutrition outcomes, the result of the model predicted that the treatment effect of sanitation microfinance with various covariates is positively significant ($p<0.05$), and this treatment effect is about 50%.

CONCLUSION

The Logistic regression estimation was used to investigate the determinants of the household decision on participating in the program. The results indicate that those who had fewer family members and had a certain level of education and annual income were most likely to participate in the program. The household mother's education level was a crucial factor in receiving this microfinance. From the propensity score matching estimation, it was seen that sanitation microfinance had a significant positive effect on the improvement of sanitation and nutrition conditions of under-five children in terms of household income, family members, and education. It was an excellent opportunity to improve the sanitation condition and nutrition conditions of under-five children in rural Bangladesh by developing sanitation microfinance. This can apply to other south Asian as there is a social and cultural similarities among the south Asian countries, and rural sanitation is a big issue in every south Asian country [25].

LIMITATION

For conducting the research, time was limited. A qualitative study required good quality of time for insightful learning of focus. Sanitation microfinance was a new window of microfinance from 2009, previous studies were deficient. There was no health card with documentation of health parameters like weight, height, and disease profiles in the rural areas of Bangladesh. This research did not cover different types of areas. Household characteristics were considered after participation in the sanitation program. For calculating the treatment effect, it should be previous data. Some challenges in data interpretation were associated with shaping the paper.

RECOMMENDATIONS

Governments should incorporate microfinance into border sanitation coverage. Non-government organizations (NGOs), like Grameen Bank, commercial

banks, government organizations like Bangladesh Rural Development Board (BRDB), and NGO-MFIs licensed by Microcredit Regulatory Authority (MRA) [26]. Non-Government organizations are now funding sanitation microfinance. The Government should incorporate sanitation microfinance as a financial partner. Governments should take long-term policy giving more importance to the poor rural woman, disabled, indigenous people and to those who stay in remote communities**.** Sanitation microfinance should be a part of the social movement. Donors should actively engage and support sanitation financing institutes: Donor agencies should give subsidies to those organizations that provide sanitation microfinance in the form of training and capacity building.

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Conflict of interest: None declared

Ethical approval: The study was approved by the Institutional Ethics Committee

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