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Organization as author:

The Cardiac Society of Australia and New Zealand. Clinical exercise stress testing. Safety and performance guidelines. *Med J Aust* 1996;164:282-4.

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Volume with supplement:

Shen HM, Zhang QF. Risk assessment of nickel carcinogenicity and occupational lung cancer. *Environ Health Perspect* 1994; 102 Suppl 1:275-82.

Issue with supplement:

Payne DK, Sullivan MD, Massie MJ. Women's psychological reactions to breast cancer. *Semin Oncol* 1996; 23(1 Suppl 2): 89-97.

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Issue with part:

Poole GH, Mills SM. One hundred consecutive cases of flap lacerations of the leg in ageing patients. *N Z Med J* 1994; 107(986 Pt 1): 377-8.

Issue with no volume:

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Type of article indicated as needed:

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Article containing retraction:

Garey CE, Schwarzman AL, Rise ML, Seyfried TN. Ceruloplasmin gene defect associated with epilepsy in EL mice [retraction of Garey CE, Schwarzman AL, Rise ML, Seyfried TN. In: *Nat Genet* 1994; 6:426-31]. *Nat Genet* 1995; 11:104.

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Liou GI, Wang M, Matragoon S. Precocious IRBP gene expression during mouse development [retracted in *Invest Ophthalmol Vis Sci* 1994; 35:3127]. *Invest Ophthalmol Vis Sci* 1994; 35:1083-8.

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Hamlin JA, Kahn AM. Herniography in symptomatic patients following inguinal hernia repair [published

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Bengtsson S, Solheim BG. Enforcement of data protection, privacy and security in medical informatics. In: Lun KC, Degoulet P, Piemme TE, Rienhoff O, editors. MEDINFO 92. Proceedings of the 7th World Congress on Medical Informatics; 1992 Sep 6-10; Geneva, Switzerland. Amsterdam: North-Holland; 1992. p. 1561-5.

Scientific or technical report:

Issued by funding/sponsoring agency: Smith P, Golladay K. Payment for durable medical equipment billed during skilled nursing facility stays. Final report. Dallas (TX): Dept. of Health and Human Services (US), Office of Evaluation and Inspections; 1994 Oct. Report No.: HHSIGOEI69200860. Issued by performing agency: Field MJ, Tranquada RE, Feasley JC, editors. Health services research: work force and educational issues. Washington: National Academy Press; 1995. Contract No.: AHCPR282942008. Sponsored by the Agency for Health Care Policy and Research.

Dissertation:

Kaplan SJ. Post-hospital home health care: the elderly's access and utilization [dissertation]. St. Louis (MO): Washington Univ.; 1995.

Patent:

Larsen CE, Trip R, Johnson CR, inventors; Novoste Corporation, assignee. Methods for procedures related to the electrophysiology of the heart. US patent 5,529,067. 1995 Jun 25.

Other Published Material**Newspaper article:**

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Legal material:**Public law:**

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Un enacted bill:

Medical Records Confidentiality Act of 1995, S. 1360, 104th Cong., 1st Sess. (1995).

Code of Federal Regulations:

Informed Consent, 42 C.F.R. Sect. 441.257 (1995).

Hearing:

Increased Drug Abuse: the Impact on the Nation's Emergency Rooms: Hearings Before the Subcomm. On Human Resources and Inter governmental Relations of the House Comm. on Government Operations, 103rd Cong., 1st Sess. (May 26, 1993).

Map:

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Book of the Bible:

The Holy Bible. King James Version. Grand Rapids (MI): Zondervan Publishing House; 1995. Ruth 3:1-18.

Dictionary and similar references:

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Editorial

MEASLES OUTBREAKS AND CHILD DEATHS IN BANGLADESH: A PREVENTABLE TRAGEDY

Md. Ziaul Islam

Professor and Head, Department of Community Medicine, Director, National Institute of Preventive and Social Medicine (NIPSOM), Mohakhali, Dhaka

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Introduction

Measles is a highly contagious disease caused by the measles virus (MV), a single-stranded negative-sense RNA virus belonging to the genus morbillivirus, with humans as its only natural host. The virus spreads efficiently through aerosol droplets, and in a confined setting, up to 90% of unvaccinated individuals may become infected. Although historically considered a common and self-limiting childhood illness, measles can lead to severe complications including blindness, deafness, intellectual disability, and death¹.

A particularly dangerous feature of measles is its ability to induce immune suppression through a phenomenon known as immune amnesia. During the acute phase of infection, the virus weakens immune memory, leaving children vulnerable to secondary infections for months after recovery. Temporary immune amnesia caused by depletion of B-cell and T-cell memory by the measles virus has recently been shown to be a mechanism for longer-term susceptibility to secondary infections in persons who have had measles. This immune amnesia may persist for five months to one year and contributes to increased long-term morbidity and mortality following measles infection^{2,3}.

Global Resurgence of Measles

Measles outbreaks are rising rapidly worldwide. Despite the existence of safe and effective vaccines, measles outbreaks continue to occur worldwide, particularly in developing countries. According to a report published by UN News on 28 November 2025, global measles mortality has declined by approximately 88% since 2000. However, despite this substantial progress, an estimated 95,000 deaths—predominantly among children—were still attributed to measles in the previous year, underscoring the continued public health burden of the disease⁴. According to WHO and CDC estimates, approximately 9 million cases and 136,000 deaths occur annually, predominantly among children⁵. In 2024, a total of 59 countries reported large or disruptive outbreaks—nearly three times higher than in 2021—and about one-quarter of these countries had previously achieved measles elimination⁴. In the previous year, over 58,000 measles cases were recorded across 41 of the 53 Member States in the Region spanning Europe and Central Asia, leading to thousands of hospitalizations and 10 related deaths. The 2023 figures mark a sharp increase compared to the preceding three years and highlight an ongoing risk for individuals who remain unprotected in the Region⁶.

Measles Situation in Bangladesh

An examination of long-term trends reveals both progress and persistent vulnerability in Bangladesh. In 2004, there were 9,743 reported measles cases⁷. This number rose sharply to 11,632 in 2019 during the COVID-19 pandemic, reflecting disruption of routine immunization services. Subsequently, reported cases declined to 1,102 in 2021, followed by 311 in 2022, 281 in 2023, and 247 in 2024⁸. Despite this decline, measles transmission has not been fully interrupted. According to the Directorate General of Health Services, 98 children died from suspected measles between 15 March and 4 April, with 16 deaths confirmed. Additional deaths continue to be reported, marking the highest measles mortality in the past two decades in Bangladesh⁷.

Drivers of the Current Outbreak

The resurgence of measles in Bangladesh reflects broader global trends. One major contributing factor is the disruption of routine health services during the COVID-19 pandemic, which diverted healthcare workers and resources away from immunization programs. Additionally, a growing number of zero-dose children have created clusters of susceptibility, particularly in marginalized populations. Weaknesses in routine immunization systems and declining herd immunity have further contributed to the outbreak. At the same time, vaccine misinformation and barriers to access have reduced vaccine uptake in certain communities⁹.

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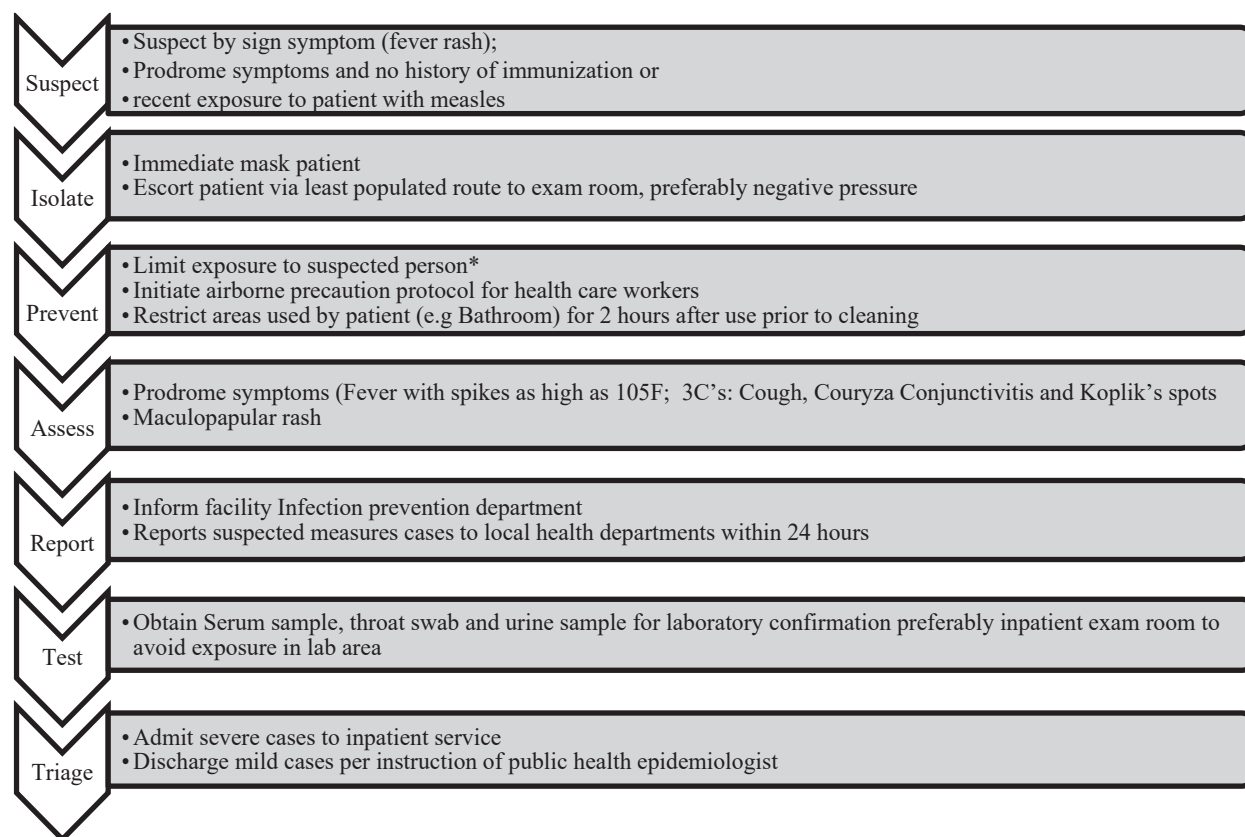
From a public health perspective, measles serves as a critical indicator of the strength of immunization systems. Due to its high transmissibility, even small gaps in vaccine coverage can rapidly lead to outbreaks. For this reason, global health agencies consider measles a sentinel disease signaling declining herd immunity. The live measles vaccine, introduced in 1963, dramatically lowered these numbers. The vaccine was initially given as one dose; however, due to an epidemic in 1989 to 1990, a second dose for children ages 4 to 6 years became the standard of care¹. Bangladesh introduced the vaccine in 1979 under the Expanded Programme on Immunization. The current schedule includes two doses: the first at 9 months and the second at 15 months.¹⁰ Coverage has improved over time, with MR1 reaching 96% and MR2 reaching 93% in 2024¹¹. However, even small pockets of unvaccinated children can sustain transmission. The importance of the two-dose schedule lies in ensuring full immunity. While the first dose provides protection to most children, approximately 5–15% does not develop immunity, a phenomenon known as primary vaccine failure¹². The second dose increases protection to approximately 99%.¹³

Herd Immunity and Ongoing Risk

Measles is among the most infectious diseases, with a single infected individual capable of transmitting the virus to up to 18 others. Achieving herd immunity requires approximately 95% vaccination coverage.⁹ When coverage falls below this threshold, outbreaks can occur even in populations with relatively high immunization rates. Current vaccination rates aren't high enough to achieve herd immunity. Below this threshold, outbreaks and preventable deaths will continue to occur, which is why routine immunization and catch-up campaigns are so important¹⁴. However, herd immunity protects not only vaccinated individuals but also those who cannot be vaccinated, including newborns and immune-compromised individuals.

Clinical Management and Response¹

For every isolated case of measles, a rapid and aggressive public health response is required to identify, educate, quarantine, immunize and to protect susceptible contacts. Overview of general steps to manage patients with suspected measles as follows:



Timely reporting within 24 hours enables rapid containment measures. Laboratory confirmation through serum, throat swab, or urine testing is required. Severe cases require hospitalization, while mild cases can be managed under public health guidance.¹

Management after recovery

Even after recovery, children who have had measles are at high risk for late complications such as pneumonia, malnutrition, and blindness. Blindness is usually due to severe corneal ulceration, and sometimes corneal perforation, in children who are deficient in vitamin A. In addition to supportive care, the World Health Organization recommends vitamin A supplementation at diagnosis, particularly in areas with deficiency. This intervention reduces mortality and prevents complications such as blindness.

Strengthening Prevention Strategies

Preventing future outbreaks requires strengthening immunization systems and addressing vaccine hesitancy. The AAA approaches—assumes, advice, and answer—provides an effective framework for communication. Providers should assume acceptance, strongly recommend vaccination, and address concerns empathetically¹. Improving public awareness, ensuring equitable access, and implementing catch-up vaccination campaigns are critical steps toward closing immunity gaps.

Conclusion

Diana Chang-Blanc, Head of WHO's Essential Programme on Immunization, stated: "Measles knows no borders. A country can only be protected when every child, everywhere, is fully immunized"⁹. The current measles outbreak in Bangladesh represents a preventable tragedy and highlights the fragility of immunization systems. Despite high reported coverage, gaps in vaccine delivery and missed populations have allowed the disease to resurge.

Measles is not merely a childhood illness but a warning signal of systemic weaknesses in public health infrastructure. Urgent action is needed to strengthen routine immunization, rebuild trust in vaccines, and ensure that every child is reached. Without such efforts, preventable deaths will continue to occur.

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Original Article

PHYSICAL ACTIVITY AND ITS ASSOCIATION WITH NON-COMMUNICABLE DISEASES:
FINDINGS OF A POPULATION-BASED CROSS-SECTIONAL STUDY IN BANGLADESH

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ABSTRACT

Background: Low physical activity is a leading risk factor for non-communicable diseases (NCDs). The present study aimed to assess physical activity and its association with NCDs in the context of Bangladesh.

Methods: The study was a population-based cross-sectional study. We used the data generated by the country-wide survey conducted in Bangladesh in 2018. The survey was conducted using 496 primary sampling units developed by the Bangladesh Bureau of Statistics. Following the step-wise approach of the World Health Organization, the survey enrolled 8185 participants aged 18-69 years using a multi-stage sampling technique. The study conducted a face-to-face interview with Global Physical Activity Questionnaire to collect data on physical activity.

Results: The average duration of physical activity was 244.8 minutes per day, while the median duration was 128.6 minutes. The prevalence of low physical activity was 12.6%, and it was higher among the participants aged 55-69 years (19.5%), women (14.7%), and urban dwellers (14.3%). Low physical activity was also higher (17.7%) among the participants with more than secondary level education. Participants with low physical activity were 1.36 times (OR=1.36, $p=0.006$) more likely to have diabetes mellitus, 1.53 times (OR=1.53, $p<0.001$) more likely to have hypertension, 1.58 times (OR=1.58, $p<0.001$) more likely to have dyslipidemia, and 1.18 times (OR=1.18, $p=0.020$) more likely to have obesity than those without low physical activity.

Conclusion: Country-wide programs and interventions for promoting physical activity are essential to reduce the burden of NCDs in a developing country like Bangladesh.

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Key Words: Physical activity; Prevalence; Risk factor; Non-communicable disease; Population-based; Bangladesh;

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INTRODUCTION

The physical activity comprises behaviors that include various bodily movements, which result in energy expenditure. A study revealed that low physical activity accounts for 6-10% of non-communicable diseases (NCDs) and 9% of premature mortality from NCDs [1]. Another study depicted

that a higher proportion of death in Bangladesh was due to NCDs such as cardiovascular diseases, cancer, diabetes mellitus (DM), and chronic respiratory disease, which has already become a leading public health problem [2]. Most of the NCDs occur in low and middle-income countries due to an epidemiological transition caused by several risk

factors like urbanization, tobacco and alcohol consumption, low physical activity, overweight, and obesity, increased fat and salt intake, low intake of fruit and vegetable, and raised blood pressure, blood glucose, and cholesterol level, etc. [3]. According to 'Non-communicable Diseases progress monitor 2020' in Bangladesh, the prevalence of death from NCDs was 67%, and the total number of deaths due to NCDs was 572600 [4].

As a part of the Global Action Plan 2013, World Health Organization (WHO) proposed a 25% relative reduction in the risk of premature death due to NCDs by 2025 by reducing the prevalence of four major risk factors such as low physical activity, smoking, harmful use of alcohol, and unhealthy diet. WHO has defined physical activity as <150 minutes of moderate activity in a week or equivalent for adults aged 18 or over. The goal of WHO regarding physical activity is to achieve a 10% relative reduction in the prevalence of insufficient [5].

The Technical Note updated by WHO outlined a set of ten progress monitoring indicators to show the progress achieved in countries in the implementation of selected national commitments on NCDs. One of the crucial indicators was concerned about the member state's implementation of at least one recent public awareness program and motivational communication for physical activity, including mass media campaigns for physical activity behavioral change [4]. According to 'Non-communicable Diseases Progress monitor 2020,' five out of eleven countries have reached the target, and Bangladesh has not achieved the target yet [4]. A policy analysis study of Bangladesh revealed that, although the government of Bangladesh initiated many NCD-related policies or programs, there is still lacking proper planning, implementation, and monitoring [6].

Country prevalence (age-standardized) of low physical activity ranged from 1.6% to 52.6% for men and from 3.8% to 72.0% for women. Low physical activity was also higher in the older age group [7]. According to the report of the centers for disease control and prevention (CDC), more than 15% of adults in all states and territories were physically inactive, and these estimates ranged from 17.3 to 47.7% [8].

Low physical activity is a leading risk factor for life-threatening diseases like NCDs. Low physical activity is evident as the cause of 30% of cardiovascular diseases (CVD), 27% of diabetes mellitus (DM), and 25% of breast and colorectal cancer [9]. As per the Global Physical Activity Questionnaire (GPAQ) framework, the level of physical activity was divided into three groups; high,

moderate, and low [10]. The present study considered low and physically inactive levels as insufficient physical activity. The present study aimed to determine the profile of physical activity, prevalence of low physical activity, and its association with major NCDs in Bangladesh.

METHODS

Study design and setting

Our study obtained data from the STEPs survey 2018, a country-wide cross-sectional population-based study in Bangladesh. The data produced by the survey were made public in the open-access Dryad data repository (<http://datadryad.org/doi:10.5061/dryad.zkh18937f>) and the archive of the National Institute of Preventive and Social Medicine (NIPSOM). The sampling strategy and data collection methods for the survey were elaborately described in another article [11]. In short, the study recruited the participants by multi-stage and geographically stratified probability-based sampling from 496 Primary Sampling Units (PSUs) as updated by the Bangladesh Bureau of Statistics (BBS). One PSU was excluded later due to inaccessibility. Based on selection criteria, 8185 participants participated in STEP-1 and STEP-2, and 7208 participants joined in STEP-3.

Data collection

The STEPS survey 2018 used a standardized pre-tested questionnaire based on WHO STEPS questionnaire version 3.2 for data collection. The survey collected data through face-to-face interviews, physical measurements, and the collection of samples of body fluid (blood and urine). After collection, data were transferred into the cloud through Open Data Kit (ODK) software using an android device. Data were stored in the Organizational Network Analysis (ONA) database server. Field activities were actively supervised by investigators; instruments used for physical measurement and laboratory investigations were calibrated following standard procedure. The instruments were validated with the same sample findings of another standard national laboratory, and the central laboratory of NIPSOM tested all blood and urine samples. The survey took all possible measures to ensure quality data in every step. Our study retracted all other data related to NCDs like diabetes mellitus, dyslipidemia, salt consumption, etc., from the dataset generated by the STEPs survey 2018 of Bangladesh.

Measurements

Measurement of low physical activity: The STEPS survey used the Global Physical Activity Questionnaire (GPAQ) to collect data on physical activity and measure the prevalence of low physical activity. It was a previously developed questionnaire used by WHO for physical activity surveillance and measuring the level of physical activity. The survey inquired the respondents regarding the amount of time spent on physical activity in three key domains; work, transport, and recreational in moderate and vigorous-intensity levels on a typical day each week for obtaining data on total minutes of physical activity. The vigorous-intensity minutes were later converted into moderate-intensity minutes by multiplication with 2. The total physical activity (in minutes) was expressed as moderate-intensity minutes per day. Collected data on physical activity were then converted into Metabolic Equivalent Tasks (MET) values for calculating a person's overall energy expenditure. According to GPAQ data, the following MET values were used: for moderate work, MET value= 4.0, for vigorous work, MET value= 8.0, for cycling and walking, MET value= 4.0, for moderate recreation, MET value= 4.0, and vigorous recreation MET value= 8.0 [12]. The present study considered an adult (aged more than 18 years) as physically inactive who didn't meet WHO recommendations on physical activity for health. Criteria of low physical activity included doing less than 150 minutes of moderate-intensity physical activity or less than 75 minutes of vigorous-intensity physical activity, or less than an equivalent combination of moderate- and vigorous-intensity physical activity achieving at least 600 MET-minutes throughout a week [13].

Measurement of household wealth index: For estimating household wealth score, we used principal component analysis during survey data analysis to get scores for the household wealth index. Households were given scores based on the number and kind of consumer goods (television, bicycle, car, etc.) they own and housing roof characteristics. We compiled the National wealth quintiles by assigning the household score to sample individuals, ranking them by household score, and dividing the distribution into five equal categories, each comprising 20% of the population.

Statistical methods

Data were weighted by age, sex, and residence. We cautiously checked and verified the consistency and relevancy of the data. We used WHO STEPS recommended guidelines for cleaning and analyzing data. The prevalence of low physical activity was

estimated using the STEPS recommended cut-off values [13]. Data were analyzed using SPSS version 25.0. Descriptive statistics included frequency, percentage, mean, and median, while inferential statistics included the Chi-square test and logistic regression. Outcome measures and differences between groups were calculated with a 95% confidence interval and significant at a p-value <0.05.

Ethical considerations

The study obtained ethical approval from the National Research Ethics Committee (NREC) of Bangladesh Medical Research Council (Ref: BMRC/NREC/2016-2019/463, Date: 04/02/2018). Before completing the questionnaire, participants read the informed consent. The study enrolled only those participants who gave informed consent. Participation in this study was voluntary and anonymous. We didn't ask for any sensitive personal information. The survey used the WHO NCD STEPS survey consent form to obtain informed written consent from every participant. We strictly maintained the confidentiality and anonymity of data. We carried out all activities in conformity with the revised declarations of Helsinki.

RESULTS

Among all (8185) participants, 53.5% were women and 46.5% were men. The rural residents (51.1%) had a higher proportion than the urban (48.9%) residents.

Physical activity

The average duration of total physical activity of moderate intensity (267.2 minutes per day) and the median duration (145.7 minutes per day) were higher in the participants aged 40-54 years. The average energy expenditure (7482.4 MET-minutes/week) and the median energy expenditure (4080.0 MET-minutes/week) on physical activity were also higher in the age group 40-54 years. The average duration of physical activity of moderate intensity (minutes per day) was higher in men (357.8) and rural residents (281.2) than in women (146.8) and urban residents (207.5). The average energy expenditure on physical activity (MET-minutes per week) was higher in men (10019.6) and rural residents (7874.2) than in women (4111.2) and urban residents (5810.3). Overall, the average duration of physical activity of moderate intensity was 244.8 minutes, and the average energy expenditure on physical activity was 6854.3 MET minutes per week (Table 1).

Table 1. Total physical activity and energy expenditure by background characteristics (n=8185)

Background characteristics	Total (n)	Overall energy expenditure MET-min/week*		Total physical activity of moderate-intensity (min. per day)**	
		Average	Median (p25 - p75)	Average	Median (p25 - p75)
Age (Years)					
18-24	1026	5668.3	3110.0 (1315.0-6760.0)	202.4	111.1 (47.0-241.4)
25-39	3484	7036.0	3960.0 (1680.0-9100.0)	251.3	141.4 (60.0-325.0)
40-54	2490	7482.4	4080.0 (1680.0-10200.0)	267.2	145.7 (60.0-364.3)
55-69	1164	6081.8	3260.0 (840.0-8190.0)	217.2	116.4 (30.0-292.5)
Gender					
Women	4360	4111.2	3000.0 (1260.0-5280.0)	146.8	107.1 (45.0-188.6)
Men	3804	10019.6	6480.0 (1680.0-15840.0)	357.8	231.4 (60.0-565.7)
Residence					
Rural	4169	7874.2	4560.0 (1680.0-10800.0)	281.2	162.9 (60.0-385.7)
Urban	3995	5810.3	3240.0 (1140.0-7020.0)	207.5	115.7 (40.7-250.7)
Education					
No education / <Primary	3678	8379.9	5040.0 (1680.0-11880.0)	299.3	180.0 (60.0-424.3)
Primary	2533	6278.2	3360.0 (1600.0-7940.0)	224.2	120.0 (57.1-283.6)
Secondary	888	5790.0	3360.0 (1200.0-6720.0)	206.7	120.0 (42.9-240.0)
More than secondary	1065	3919.4	2280.0 (840.0-4900.0)	140.0	81.4 (30.0-175.0)
Wealth index					
Poorest	1632	7402.7	3850.0 (1680.0-10080.0)	264.4	137.5 (60.0-360.0)
Poor	1642	7659.1	4200.0 (1680.0-10515.0)	273.5	150.0 (60.0-375.5)
Average	1610	7210.4	3940.0 (1680.0-9600.0)	257.5	140.7 (60.0-342.9)
Rich	1639	6442.4	3360.0 (1400.0-8400.0)	230.1	120.0 (50.0-300.0)
Richest	1641	5615.1	3280.0 (1120.0-6720.0)	200.5	117.1 (40.0-240.0)
Total (18-69)	8185	6854.8	3600.0 (1480.0-8940.0)	244.8	128.6 (52.9-319.3)

*MET (Metabolic equivalent of task): for vigorous activity 1 minute equates to 8 units of MET; for moderate activity 1 minute equate to 4 units of MET.

**Minutes spent on vigorous-intensity activities per day are multiplied by 2, to derive equivalent minutes of moderate-intensity activities, which is then summed up to derive total physical activity in minutes of moderate-intensity activity per day.

p25 = 25th percentile; p75 = 75th percentile

Prevalence of low physical activity

Overall, the prevalence of low physical activity was 12.6% (95% CI=11.9-13.4) and it was higher among the participants aged 55-69 years (19.5%, 95% CI=17.3-21.9), women (14.7%, 95% CI=13.7-15.8), and urban respondents (14.3%, 95% CI=13.2-15.4).

Low physical activity was higher in the ever-married group (24.5%, 95% CI=20.4-29.0) and the respondents who had educational qualifications more than secondary level (17.7%, 95% CI=15.4-20.1). The prevalence of low physical activity was also higher among the richest (15.1%, 95% CI=13.4-16.9) participants (Table 2).

Table 2. Prevalence of low physical activity by selected background characteristics (n=8185)

Attributes		Total (n)	Prevalence, % (95% CI)
Age (in years)	18-24	1026	13.2 (11.1-15.4)
	25-39	3489	10.4 (9.4-11.4)
	40-54	2503	12.3 (11.1-13.7)
	55-69	1167	19.5 (17.3-21.9)
Gender	Men	3804	10.2 (9.3-11.2)
	Women	4381	14.7 (13.7-15.8)
Residence	Urban	4002	14.3 (13.2-15.4)
	Rural	4183	11.1 (10.1-12.1)
Marital status	Never married	535	10.8 (8.3-13.8)
	Currently married	7250	12.1 (11.4-12.9)
	Ever married*	400	24.5 (20.4-29.0)
Highest level of education	No education / <primary	3678	11.1 (10.1-12.2)
	Primary	2533	12.6 (11.3-13.9)
	Secondary	888	12.0 (10.0-14.4)
	More than secondary	1065	17.7 (15.4-20.1)
Wealth index	Poorest	1638	12.2 (10.7-13.9)
	Poor	1646	11.5 (10.0-13.1)
	Average	1615	10.6 (9.1-12.2)
	Rich	1645	13.7 (12.1-15.5)
	Richest	1641	15.1 (13.4-16.9)
Overall		8185	12.6 (11.9-13.4)

*Ever married: Separated/divorced/widow/widowed; %: Percentage; CI: Confidence Interval

Low physical activity and major non-communicable diseases

Low physical activity was prevalent among 15.7% of participants having diabetes mellitus (DM) and 16.3% of participants having hypertension (HTN). On the other hand, the prevalence of low physical activity was 16.0% among the participants having dyslipidemia and 13.6% among the participants having obesity. The study revealed that the participants with low physical activity were 1.36 times (OR=1.36, $p=0.006$) more likely to have

diabetes mellitus and 1.53 times (OR=1.53, $p<0.001$) more likely to have hypertension than those without low physical activity. Similarly, the participants with low physical activity were 1.59 times (OR=1.59, $p<0.001$) more likely to have dyslipidemia and 1.18 times (OR=1.18, $p=0.020$) more likely to have obesity than those without low physical activity (Table 3).

Table 3. Association between low physical activity and major non-communicable diseases

Major NCDs		Low physical activity		OR (95% CI)	Significance, (P-value)*
		Yes n (%)	No n (%)		
Diabetes Mellitus	Yes (n=677)	106 (15.7)	571 (84.3)	1.36 (1.09-1.70)	0.006
	No (n=6371)	764 (12.0)	5607 (88.0)	Reference	
Hypertension	Yes	337 (16.3)	1731 (83.7)	1.53	<0.001

	(n=2068)			(1.32-1.75)	
	No (n=6088)	690 (11.3)	5398 (88.7)	Reference	
Dyslipidemia	Yes (n=2164)	346 (16.0)	1818 (84.0)	1.59 (1.37-1.84)	<0.001
	No (n=4897)	525 (10.7)	4372 (89.3)	Reference	
Obesity	Yes (n=2403)	328 (13.6)	2075 (86.4)	1.18 (1.03-1.36)	0.020
	No (n=5607)	661 (11.8)	4946 (88.2)	Reference	

* $P < 0.05$, significant at 95% confidence interval; OR= Odds Ratio

DISCUSSION

The STEPs survey of Bangladesh was a country-wide cross-sectional population-based survey conducted in 2018 to determine the national prevalence of NCD risk factors like low physical activity. The present study estimated the prevalence of low physical activity by the background characteristics of the country's population. The study also identified major NCDs associated with low physical activity in Bangladesh.

In the present study, the average duration of moderate-intensity physical activity was 267.2 minutes/day in the age group 40-54 years, followed by 251.3 min/day in the age group 25-39 years. Overall energy expenditure was also higher in the participants aged 40-54 years (7482.4 MET-min/week) and 25-39 years (7036.0 MET-min/week). The prevalence of low physical activity was highest among the age group 55-69 years (19.5%) and lowest in the age group 25-39 years (10.4%). According to the STEPS survey of 2010 in Bangladesh [14, 15], the prevalence of low physical activity was 34.9% and 35.6% among the participants aged 55-64 years and 25-34 years. This difference indicates that low physical activity has decreased in Bangladesh, which may be due to rising awareness of people through mass media communication and health education interventions.

The present study included an almost equal percentage of men and women (46.5% vs. 53.5%) and found that the average duration of physical activity was lower in women than in men (146.8 min/day vs. 357.8 min/day). The average energy expenditure on physical activity was also lower in women than in men (4111.2 MET-min/week vs. 10019.6 MET-min/week). The prevalence of low physical activity was also higher in women than men (14.7% vs. 10.2%), but it was lower in comparison to 2010 (men, 14.8% and women, 50.3%) [14, 15]. This reduction in the prevalence of low physical activity could be due to the changes in lifestyle and occupational activities through diverse employment, especially among the women of Bangladesh. Another

national cross-sectional survey conducted in Bhutan [16] and Pakistan [17] also revealed a higher prevalence of low physical activity among women than in men. It may be because men are more involved in outdoor activities and earning livelihoods following the social and cultural norms of the countries like Bangladesh in Southeast Asia.

The average duration of physical activity was higher among rural residents (281.2 min/day) than in urban (207.5 min/day) residents. The prevalence of low physical activity was also higher in the urban (14.3%) than in the rural (11.1%) residents. Another study conducted in Kerala, India [18] also found a higher prevalence of low physical activity in urban residents. The rural residents of the countries like Bangladesh in the Indian subcontinent are used to walking, cycling, agricultural work, etc., due to their topographical location, occupational patterns, and scarce social and communication amenities. All of these enhance the physical activities of the rural residents in their daily life. On the other hand, increasing urbanization, lack of scope for sports and recreation, more automobile facilities, and a sedentary lifestyle forced urban residents to increase the prevalence of low physical activity.

The length of physical activity decreased with increasing levels of education and household wealth. The prevalence of low physical activity was comparatively higher among the respondents having a higher level of education (17.7%). It is a fact that educated people are more involved in official and intellectual activities with a sedentary lifestyle in Bangladesh. On the other hand, illiterate people with a lower level of education are used to doing agricultural, laborious, and energy intrusive activities, which require more body movements. This finding recommends promoting physical activities of the more educated urban residents with sedentary occupations within their residing and working environment.

The estimated prevalence of low physical activity was 12.6% in the current study, and it was 33.8% revealed by the STEPS survey 2010 in Bangladesh

[14]. It indicates that the prevalence of low physical activity has been decreasing gradually in Bangladesh due by dint of health promotional and awareness-raising interventions in the country.

The present study revealed that low physical activity was significantly associated with NCDs like DM, hypertension, dyslipidemia, and obesity. There was a 1.36 times higher chance of developing DM, 1.53 times higher chance of developing hypertension, 1.59 times higher chance of developing dyslipidemia, and 1.18 times higher chance of developing obesity among respondents having low physical activity. These findings depicted a higher risk of non-communicable diseases due to low physical activity among the population of Bangladesh.

Thus the study findings conserve enormous policy implications to devise country-wide effective programs and interventions to create amenities for enhancing physical activities with an especial emphasis on the women, elderly, urban residents, and people involved in a sedentary occupation. Community-based health education programs also must be launched to raise awareness among the country's people about the merits of physical activity and the risk of NCDs due to low physical activity through mass media communication and social mobilization.

CONCLUSION

Low physical activity is associated with major non-communicable diseases like diabetes mellitus, hypertension, dyslipidemia, and obesity. Reducing the prevalence of low physical activity and promoting physical activity could improve the health of the people and can prevent the burden of NCDs substantially in the country.

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Conflicts of interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Original Article

QUALITY OF LIFE OF POST-THYROIDECTOMY PATIENTS BEFORE AND AFTER THE RADIOACTIVE IODINE ABLATION THERAPY: A QUASI-EXPERIMENTAL STUDY

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ABSTRACT

Background: Following thyroid cancer surgery, patients receive radioactive iodine (RAI) ablation to eliminate any leftover malignant tissue in order to reduce their chance of recurrence and raise their quality of life (QoL). This study aimed to evaluate thyroid cancer patients' quality of life before and after undergoing RAI therapy following thyroidectomy.

Methods: A quasi-experimental investigation was carried out at the Institute of Nuclear Medicine in Dhaka from August 2022 to July 2025, included 218 thyroid cancer patients who had undergone thyroidectomy. The FACT-G scale was used to measure QoL during face-to-face interviews conducted one and three months following surgery (pre-RAI and post-RAI) using a semi-structured questionnaire that had been pre-tested and validated. Every participant gave their informed consent, which covered all the relevant ethical considerations.

Results: Males had slightly higher median QoL scores than females (97 vs. 96; $p < 0.05$) post-RAI therapy. Younger age, higher educational attainment, marital status, and employment were associated to higher median improvements in QoL scores. ($p < 0.05$). Significant increase in median overall QoL scores from 48 to 96 ($p < 0.01$), with notable improvements in the physical (7 to 25), social (17 to 24), emotional (7 to 23), and functional (16 to 25) domains. Advancing age and marital status emerged as significant predictors of diminished quality of life ($OR = 0.100$, $p < 0.05$). In contrast, attainment of higher levels of education demonstrated a robust positive association with quality of life, as reflected by a markedly elevated odds ratio ($OR = 1507.114$).

Conclusion: Radioactive iodine ablation significantly improves multiple Quality of life dimensions in thyroid cancer survivors underscoring its broad therapeutic value.

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INTRODUCTION

Thyroid cancer is the most prevalent cancer of endocrine system making up barely 1% of all malignancies worldwide, accounts for about 92% of all endocrine cancers. Significantly, many nations have seen a significant rise in its incidence over the last few decades.¹ Currently, the ninth most frequent cancer worldwide, it keeps showing an increasing trend.² Though mortality rates have been declining consistently, thyroid cancer incidence has grown in men and women worldwide mostly as a result of the

increased use of diagnostic imaging technologies. An estimated 44,020 new cases and 2,170 fatalities should occur in 2024.⁴ Projections show that the annual worldwide burden of thyroid cancer might reach roughly 1.1 million new cases and 91,000 fatalities by 2050, it will increase of around 34% and 90%, respectively if current trends continue.⁵ Early-onset thyroid cancer was recorded worldwide in 2022 in an estimated 239,362 cases, making it the second most frequent malignancy among people younger than 40 years of age. This rising trend in younger people emphasizes how more and more

crucial long-term survival and quality of life factors are becoming.⁶ Moreover, younger people and Asian males are showing an especially rapid rise in thyroid cancer incidence, which points to a significant demographic shift and changes in risk factor profiles.

⁷ At 98.4%, the five-year survival rate is generally excellent across all stages.⁸ Furthermore, women are roughly three times more likely than men to be diagnosed with thyroid cancer.⁴ Almost 20% of the Bangladeshi population suffers from thyroid problems, yet the exact extent of their impact is unknown.⁹

Conventionally, cancer treatment has concentrated mostly on patient survival; nevertheless, given improvements in treatment, QoL assessment has become increasingly crucial for judging treatment outcomes and directing healthcare policy, clinical decision-making, and resource allocation.¹⁰ According to the World Health Organization, quality of life is a person's view of their place in life in relation to cultural values, personal objectives, expectations, and worries.¹¹ Though thyroid cancer has great survival rates, its diagnosis and therapy might have a significant short- and long-term influence on the QoL of patients.¹² Therefore, apart from clinical results, the long-term consequences of therapy on the general well-being of individuals have to be assessed.¹³ Disease-related anxiety, hypothyroidism, and treatment side effects are among the variables influencing QoL in thyroid cancer patients.

The standard surgical treatment is total thyroidectomy, and effective surgical intervention is critical for achieving positive clinical results. Following surgery, patients frequently experience hypothyroidism as a result of the removal of their thyroid hormone. To guarantee that the next RAI treatment is as effective as possible, this is a required step.¹⁵ The benefits of RAI ablation include killing any remaining cancer cells, reducing the risk of recurrence, and facilitating remission. In the weeks following treatment, patients frequently experience an improvement in their quality of life as their hypothyroid symptoms gradually disappear. The majority of thyroid malignancies have a favorable prognosis, with remission rates approaching 90% after thyroidectomy and RAI therapy.¹⁸

Due to the increasing prevalence of thyroid cancer and the increasing attention on survivorship care, QoL has become an essential component of patient care. Even though survival is still a significant

clinical indicator, many survivors continue to have long-term social, psychological, and physical problems. In this regard, Bangladesh is particularly noteworthy because, despite the high prevalence of thyroid cancer, data on QoL among thyroid cancer survivors is still lacking. For this reason, the current study aimed to compare variations in QoL among thyroid cancer patients before and after RAI therapy following thyroidectomy, as well as to identify factors that have an impact on their health. The data is intended to offer insightful observations for doctors, legislators, and healthcare planners to improve survivorship care, direct targeted interventions, and facilitate efficient resource distribution.

METHODS

A quasi-experimental study was carried involving 218 thyroid cancer participants to assess the changes in quality of life before and after radioactive iodine (RAI) treatment after thyroidectomy at the Institute of Nuclear Medicine and Allied science (INMAS), Dhaka, Bangladesh. After surgery, cases passed thyroid hormone pullout, performing in an roughly one- month hypothyroid state, during which thyroid-stimulating hormone (TSH) were elevated above 30 mIU/ L to enhance the perceptivity of RAI in detecting residual complaint.¹⁹ Data were collected through face- to- face interviews using a validated semi-structured questionnaire at two time points one month post-thyroidectomy (pre-RAI) and three months after RAI therapy (post-RAI). Quality of life was measured using the FACT- G instrument, which evaluates four disciplines physical well- being(7 particulars, score range (0–28), social well- being(7 particulars,0–28), emotional well- being(6 particulars, 0–24), and functional well- being(7 particulars, 0–28), yielding a total score between 0 and 108, with advanced scores indicating better QoL. Statistical analyses were performed using SPSS interpretation 20.0 and included descriptive statistics, pairwise correlation analysis, Mann – Whitney U test, Kruskal – Wallis test, Wilcoxon inked- rank test, and multiple direct retrogression. A p- value of lower than 0.05 was considered statistically significant. Ethical approval was attained from the Institutional Review Board of Bangladesh University of Professionals, and written informed consent was secured from all participants in agreement with established ethical norms.

RESULTS

Table-I: Distribution of Patients According to Socio-Demographic Attributes (n=218)

Attributes	Number	Percentage
Sex		
Male	78	35.8
Female	140	64.2
Age(in years)		
20-40	107	49.1
41-59	63	28.9
60-78	48	22.0
Level of Education		
Illiterate	21	9.6
Primary to secondary	49	22.5
SSC	82	37.6
HSC	66	30.3
Occupation		
Service	57	26.1
Business	54	24.8
Housewife	76	34.9
Unemployed	31	14.2
Marital status		
Married	159	72.9
Unmarried	27	12.4
Widow	32	14.7
Monthly Income		
5000-20000	162	74.3
20001-50000	56	25.7

Table I summarizes the socio-demographic profile of the 218 study patients. Females constituted the majority (64.2%), compared to 35.8% males. Approximately half of the respondents (49.1%) were within the 20–40 years age group. In terms of educational status, 37.6% had attained education up

to the secondary (SSC) level, and housewives represented the largest occupational group (34.9%). The majority of participants were married (72.9%), and most (74.3%) reported a monthly household income ranging from 5,000 to 20,000 BDT.

Table-II: Median Quality of Life scores by Socio-Demographic characteristics in Post-RAI Thyroid Cancer Patients (n = 218)

	Total QoL Med (IQR)	PWB Med (IQR)	SWB Med (IQR)	EWB Med (IQR)	FWB Med (IQR)
Sex					
Male	97(94-98)	7(7-8)	17(10-19)	7(7-7)	16(8-18)
Female	96(80-98)	7(7-7)	18(6-19)	7(6-7)	15.5(8-18)
p value	^a 0.030 ^s	^a 0.660 ^{ns}	^a 0.913 ^{ns}	^a 0.901 ^{ns}	^a 0.564 ^{ns}
Age					
20-40	97(94-98)	7(7-8)	18(11-19)	7(7-8)	17(12-18)
41-59	96(81-98)	7(7-8)	17(6-19)	7(6-7)	15(8-18)
60-78	95(75-97.5)	7(7-7)	12(6-17)	7(5-7)	10(8-18)
p value	^b 0.005 ^s	^b 0.029 ^s	^b 0.001 ^s	^b 0.001 ^s	^b 0.038 ^s
Education					
Illiterate	79(71-82)	8(7-10)	5(4-6)	6(5-7)	7(6-8)
Primary to secondary	79(71-93)	7(7-7)	6(5-10)	7(5-7)	8(8-12)
SSC	97(96-99)	7(7-8)	19(17-19)	7(7-7)	18(16-18)

HSC	97(96-98)	7(7-7)	17(13-19)	7(5-8)	16(13-19)
p value	^b 0.001 ^s	^b 0.001 ^s	^b 0.001 ^s	^b 0.007 ^s	^b 0.001 ^s
Occupation					
Service	97(96-98)	7(6-7)	18(16-19)	7(7-7)	16(13-18)
Business	96(93-98)	7(7-8)	17(10-19)	7(6-7)	16(8-18)
Housewife	95(75-98)	7(7-7)	16.5(5-19)	7(5-7)	15(8-18)
Unemployed	95(81-98)	7(7-8)	18(7-19)	7(7-8)	14(8-18)
p value	^b 0.001 ^s	^b 0.016 ^s	^b 0.040 ^s	^b 0.376 ^{ns}	^b 0.109 ^{ns}
Marital status					
Married	97(92-98)	7(7-7)	17(9-19)	7(5-7)	16(8-18)
Unmarried	95(82-99)	7(7-8)	19(7-19)	7(7-8)	15(9-18)
Widow	95(75-97)	7(7-7)	18(5-19)	7(5.5-7)	14.5(8-18)
p value	^b 0.045 ^s	^b 0.133 ^{ns}	^b 0.254 ^{ns}	^b 0.036 ^s	^b 0.640 ^{ns}
Income					
5000-20000	96(80-98)	7(7-8)	17(6-19)	7(6-7)	15(8-18)
20001-50000	97(95.5-98)	7(7-7)	17(13.5-19)	7(5.5-8)	18(11-19)
p value	^a 0.062 ^{ns}	^a 0.010 ^s	^a 0.342 ^{ns}	^a 0.586 ^{ns}	^a 0.016 ^s

(Source: Researcher's Construct-2025)

s= significant

ns= not significant

^aP value reached form Mann-Whitney U

^bP value reached form Kruskal Wallis Test

Notes-PWB: Physical well-being, SWB: Social well-being, FWB: Family well-being, EWB: Emotional well-being.

Table II indicates that male patients had slightly higher overall QoL scores compared to females following RAI therapy, with the difference reaching statistical significance ($p = 0.030$). Younger patients (20–40 years) demonstrated significantly better outcomes across multiple domains, including physical ($p = 0.029$), social ($p = 0.001$), emotional ($p = 0.001$), and functional well-being ($p = 0.038$), suggesting that younger age is associated with superior post-treatment QoL. Educational attainment was also strongly correlated with overall QoL, as

patients with higher education reported improved physical ($p = 0.001$), social ($p = 0.001$), emotional ($p = 0.007$), and functional well-being ($p = 0.001$), indicating a positive relation between education level and QoL across all domains. Occupational status significantly affected overall QoL, with employed participants achieving higher total scores, including better physical ($p = 0.016$) and social well-being ($p = 0.040$), highlighting the influence of employment on post-RAI quality of life.

Table- III: Comparison the median scores of different domains of QoL of participants before and after RAI (n=218)

	QoLBefore RAI	QoL After RAI	P value
	Med (IQR)	Med (IQR)	
Physical well being	7(7-8)	25(22-26)	0.001 ^s
Social well being	17(8-19)	24(22-24)	0.001 ^s
Emotional well being	7(6-7)	23(18-23)	0.001 ^s
Functional well being	16(8-18)	25(22-25)	0.001 ^s
Total QOL	48(28-51)	96(82-98)	0.001 ^s

s= significant, P value reached from Wilcoxon sign Rank test. Significant (p<0.05) P value reached from Wilcoxon sign Rank test. Domain scores are derived from the Fact-G scale, with higher scores indicating better quality of life. Improving Quality of Life based on median cut-off points for each domain involves using median values to set benchmarks for different aspects of well-being

Table III demonstrates that Radioactive Iodine (RAI)

therapy significantly improves quality of life in thyroid cancer patients across all domains. Median scores increased markedly for physical well-being (7 → 25), social well-being (17 → 24), emotional well-being (7 → 23), and functional well-being (16 → 25), all reaching statistical significance (p = 0.001). The total QoL score nearly doubled, rising from 48 to 96 (p = 0.001), indicating substantial post-treatment improvement. These findings strongly support the positive impact of RAI therapy on patient well-being.

Table-IV: Multivariable Analysis of Factors affecting QoL Before Radioactive Iodine Therapy (n=218)

Attributes	B	S.E.	p value	OR	95% C.I. for EXP(B)	
					Lower	Upper
Gender	0.595	0.421	0.157 ^{ns}	1.813	0.795	4.133
Age	-1.079	0.257	0.001^s	0.340	0.205	0.562
Education	1.862	0.300	0.001^s	6.437	3.573	11.599
Occupation	0.101	0.220	0.645 ^{ns}	1.106	0.719	1.701
Marital Status	-0.217	0.250	0.384 ^{ns}	0.805	0.493	1.313
Income	-1.399	0.560	0.012^s	0.247	0.082	0.739

s= significant, ns= not significant, Multiple regression analysis

Table- V: Multivariable Analysis of Factors affecting QoL After Radioactive Iodine Therapy (n=218)

	B	S.E.	p value	OR	95% C.I. for EXP(B)	
					Lower	Upper
Gender	-1.345	1.080	0.214 ^{ns}		-3.474	0.784
Age	-2.303	0.779	0.003 ^s	.100	-3.839	0-.767
Education	7.325	0.671	0.001 ^s	1506.28	6.002	8.648
Occupation	-0.611	0.568	0.284 ^{ns}		-1.731	0.510
Marital Status	-1.872	0.743	0.013 ^s	.154	-3.337	-0.407
Income	-3.598	1.381	0.010 ^s	.027	-6.320	-0.876

s= significant, ns= not significant

Table IV indicates that age and income were negatively associated with post-RAI quality of life. Specifically, older age (B = -1.079, p = 0.001, OR = 0.340) and lower income (B = -1.399, p = 0.012, OR = 0.247) were linked to poorer QoL, whereas higher educational attainment was positively associated (B = 1.862, p = 0.001, OR = 6.437), suggesting that more educated participants were significantly more likely to report better QoL.

Table V further confirms these associations. Older age (OR = 0.100, 95% CI: -3.839 to -0.767) and lower income (OR = 0.027, 95% CI: -6.320 to 0.876, p < 0.05) were significantly associated with reduced QoL. Higher education showed a strong positive association (OR = 1507.114, 95% CI: 6.002–8.648), while marital status was negatively associated (OR = 0.154, 95% CI: -3.337 to -0.407), indicating that certain marital conditions corresponded to lower QoL.

DISCUSSION

This quasi-experimental design involving 218 purposively selected thyroid cancer patients was carried at the Institute of Nuclear Medicine and Allied Sciences (INMAS), Dhaka, to assess the changes in QoL before and after radioactive iodine ablation following thyroidectomy.

Socio-demographic attributes

The average respondent age was 44.14 ± 15.41 years (range: 20–85), and 49.1% were under the age of 40 according to the present research. These findings are consistent with a study that reported a mean age of 46.53 ± 13.92 years (range: 20 to 82).¹⁷ The consistent mean ages indicate a comparable demographic profile across study populations. (Table-I)

The study revealed a diverse distribution of occupations among patients, with 34.9% were housewives and 26.1% worked in service positions. In a study, 27.6% of those surveyed were involved in housework and 29.3% held clerical jobs.²¹ Occupational variables might indirectly increase the likelihood of cancer through associated environmental exposures and lifestyle choices. Study depicted that most of the patients had secondary or beyond schooling; 37.6% had SSC and 16.1% had HSC qualifications. These findings are consistent with a study that reported similar educational levels.²¹ Higher education can raise health literacy, promote good behavior, and broaden access to healthcare facilities.(Table- I)

In terms of marital status, most of the patients were married (72.9%), consistent with earlier studies indicating 77% and 79% of participants were married respectively..^{21,22}This alignment suggests that marital status may provide social support that improves cancer diagnosis and treatment outcomes.(Table- I)

In this study, 74.3% of participants were from the lower income range (5,000–20,000 TK). These findings highlight how financial status influences patients, 62.5% of whom were in comparable low-income levels, according to studies.²²These findings highlight the impact of economic status on healthcare access, treatment quality, and overall well-being.(Table- I)

Comparison of median score of QoL of respondents by socio-demographic character after RAI

Younger participants (aged 20–40 years) revealed higher median QoL scores in all domains compared their older counterparts. This finding aligns with a study that reported increased quality of life among individuals aged 30–39 following RAI therapy.²³Enhanced QoL in younger patients may stem from better physical health, psychological resilience, and stronger social support, promoting effective coping and overall well-being. (Table- II)

The study found that male participants reported slightly higher median quality of life (QoL) scores than females, consistent with previous studies.^{24,25}Gender differences in QoL may reflect distinct physical, emotional, and social responses to illness. Men often report fewer psychological symptoms like anxiety and depression, which are more common in women and negatively impact QoL.(Table-II)

Individuals with higher levels of education demonstrated significantly better quality of life (QoL) scores across all domains. This finding aligns

with previous research showing that people with greater educational attainment tend to experience more favorable QoL outcomes.²²This association may be influenced by demographic factors like age, socioeconomic status, and health, which can mediate the link between education and perceived QoL.(Table-II)

Comparison the median scores of different domains of QoL for thyroid cancer patients

Physical well-being

The study showed a notable rise in physical well-being scores following RAI treatment (from 7 to 25) and quality of life (QoL).^{17,22} However, conflicting findings in other studies underscore the impact of variations in methodologies, patient populations, and treatment protocols on these outcomes.^{23,24}(Table-III)

Social well-being

Following RAI treatment, the median social well-being score rose from 17 to 24, showing a considerable improvement. This result is consistent with studies reporting improved social functioning after RAI therapy^{17, 22}. These gains are likely linked to a reduced disease burden and overall better health. However, another study noted a temporary decline in social functioning, which was attributed to the physical recovery period and lingering stress related to cancer.²³ (Table-III)

Emotional well-being

The study found a substantial improvement in emotional well-being with average scores rising from 7 to 23, therefore showing clear psychological and emotional advantages for thyroid cancer patients. This finding is in line with research indicating that structured psychological support during RAI therapy can enhance emotional well-being and lead to better clinical outcomes.²⁶Similarly, one study found better quality of life and lower psychological discomfort one year after RAI treatment; another emphasized the harmful effect of psychological distress. Stress on many quality-of-life domains stressed the advantages of early psychiatric intervention. Together these studies underline the necessity to combine psychological and emotional care with RAI treatment.^{14,27} Collectively, these studies highlight the need to integrate psychological and emotional care with RAI treatment. (Table-III)

Functional well-being

The increase in functional well-being scores from 16 to 25 suggests a notable improvement in patients'

daily functioning following treatment with radioactive iodine (RAI). This aligns with a study that reported a median cognitive functioning score of 67.01 post-RAI.¹⁸ The relief of symptoms probably causes improvements in functional status which improves patients' capacity to complete daily tasks. Three months post-RAI, studies reported improvements in quality of life, cognitive performance, and functional well-being, supporting RAI's beneficial effects.^{17,28} (Table-III)

Total QoL Score

Almost twofold rise in the total QoL score points to a significant improvement in general QoL following radioactive iodine treatment, consistent with earlier studies finding decreases in anxiety and melancholy after RAI therapy, yet another study notes major improvements in quality of life within four weeks post-RAI treatment as well as another study noting significant worldwide changes in QoL^{14, 23, 28} These results further substantiate the positive impact of RAI on overall quality of life. (Table-III)

Multivariable Analysis of Factors affecting QoL of thyroid cancer patients

The multivariable analysis exploring factors that influence quality of life after radioactive iodine (RAI) therapy in thyroid cancer patients provides valuable insight into how socio-demographic characteristics shape post-treatment QoL.

QoL declined with **increasing age**, therefore age was negatively related to QoL. This result is consistent with a study claiming lower QoL. Greater comorbidities, lower physiological resilience, and age-related frailty in older patients.²⁴ (Table-IV)(Table-V)

Consistent with results from earlier research, greater **educational attainment** was substantially linked with better quality of life (QoL).^{22, 29} On the other hand, lower educational levels were related under lower quality of life in another study.³⁰ Better post-RAI treatment is probably helped by education since it improves healthcare access, raises health literacy, and strengthens coping mechanisms. (Table-IV)(Table-V)

In this study, **marital status** was inversely linked with QoL, opposite to findings from a prior study that noted greater QoL among married people.²⁹ Variations in care giving load or relationship quality may explain this difference. In some situations, the stress of care giving or emotional strain inside the marriage might counteract the usually protective benefits marriage has on well-being. (Table-IV)(Table-V)

Lower income people reporting lower QoL probably suffer from restricted access to medical care, decreased social support, and more financial stress. Higher incomes, however, seems to raise QoL, especially when combined with other defensive elements including social support and education. A similar result was noted in a past study further supporting the connection between financial condition and quality of life, study found a negative correlation between income and QoL.³¹ (Table-IV)(Table-V)

LIMITATIONS OF THE STUDY

Thyroid cancer patients frequently face psychological stress, which might have impacted their involvement in interviews and the accuracy of their answers. Some of the data was based on patients' memory, which could lead to recall bias. Furthermore, differences in how doctors make decisions and provide care may result in varying treatment approaches, possibly affecting patients' quality of life.

CONCLUSION

In this study, the patient cohort was predominantly female, with most participants being married, having secondary-level education, belonging to lower-income households, and primarily engaged as housewives. Socio-demographic factors such as male gender, younger age, higher educational attainment, marital status, and employment were positively associated with better quality of life (QoL) outcomes, whereas older age was linked to lower QoL, potentially due to co-morbidities and diminished physiological resilience. Higher educational levels correlated with improved QoL, likely reflecting greater health literacy and enhanced access to healthcare resources, while lower income consistently predicted poorer QoL, underscoring the adverse effects of financial constraints on access to care and overall well-being. Overall, the findings highlight the beneficial effects of radioactive iodine (RAI) therapy on physical, emotional, and social well-being, emphasizing the need for holistic survivorship care that integrates mental health support, social resources, and coping strategies. Future research should examine the long-term impact of RAI therapy on QoL, with particular attention to personalized care pathways and promoting sustained well-being among thyroid cancer survivors.

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Original Article

JOB SATISFACTION AND ASSOCIATED FACTORS AMONG HEALTH ASSISTANTS IN BANGLADESH

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ABSTRACT

Background: Job satisfaction is the foundation of professional life which determines the purposes, efficacy, and identification with the culture of the organization. To determine the level of job satisfaction and associated factors among Health Assistants in Bangladesh.

Materials and methods: The cross-sectional study was conducted from January to May 2025 using proportionate multi-stage sampling across 15 districts in all 8 divisions of Bangladesh. The study was carried out in 47 Upazilas across 15 districts in all 8 divisions of Bangladesh. A total of 1181 health assistants were selected, considering a 10% non-response rate. Data were collected via face-to-face interviews using a modified pre-tested semi-structured questionnaire adapted from the QPS (Nordic), mostly based on a 5-point Likert scale. Data were analyzed in SPSS 25 using descriptive statistics and inferential tests including Pearson Chi-Square and correlation analysis to explore associations between key variables.

Results: The majority of respondents were aged 30–49 years, had over 10 years of service, and 70.2% had education above HSC. High intrinsic motivation was evident. About 94.2% found their work meaningful, and 87.6% showed strong organizational commitment. Social support was strong, with high peer and supervisory support and low interpersonal conflict. Systemic challenges were severe - 89% reported high job demands, 82.1% faced managerial unpredictability, and 57.9% received inadequate task support. Though direct bullying and abuse were uncommon (experienced by 3% and 2% respectively), their presence helps to create a stressful environment. Correlation analysis revealed that the most powerful negative influence was perceived inequality ($r=0.305$; $r=0.318$) whereas a "positive challenge at work" was the strongest positive predictor of motivation ($r=0.379$ intrinsic; $r=0.444$ extrinsic). With statistically lower levels of job control ($p=0.007$) and predictability ($p=0.000$) than their male counterparts, significant sex differences also appeared in female HAs.

Conclusion: Despite high motivation and support, job satisfaction remains fragile due to systemic issues. Sustainable improvement requires structural reforms in healthcare delivery.

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INTRODUCTION

Job satisfaction is more than satisfaction; it is more or less the foundation of the professional life, that which determines his purpose, efficacy, and identification with the culture of his organization. It is a multifaceted construct impacted by conditions at work, autonomy, opportunity for advancement, recognition, and congruence between individual values and company mission⁽¹⁻³⁾. As a foundation stone of workplace well-being, job satisfaction is crucial in maintaining employee retention, productivity, creativity, and stress resistance. Consequently, organizations, especially those working in high-stress occupations like healthcare, have to create particular strategies to enable their employees and relate their jobs to broader organizational goals^(4,5).

The implications of job satisfaction are profound. Higher job satisfaction is linked to higher engagement, innovation, and retention, while dissatisfaction leads to costly burnout and turnover⁽⁶⁻¹⁰⁾. Therefore, the focus on employee satisfaction is included in organizational sustainability^(11,12). The level of job satisfaction has direct implications for an individual's work performance and overall mental and physical health. Chronic dissatisfaction can be one of the major sources of stress, which may result in burnout and imbalance, both of which are detrimental to one's ability to function effectively. Organizational policies must prioritize the well-being of the workers so that productivity and health are not affected^(13,14). The fundamental causes of job satisfaction are job security, meaningful work, positive relationships, autonomy, and opportunities for career growth^(5,15,16). Satisfaction flourishes when employees feel valued and that they are making a tangible impact in their environment, especially when their abilities and personal values align with their work roles^(17,18).

Healthcare workers worldwide are shaped by a myriad of economic and cultural determinants, leading to wide variations in remuneration, work-life balance, autonomy, care, and professional development among healthcare workers^(19,20). For developing nations, these problems are often added to by institutional inequalities and resource shortages, making culturally tailored measurement instruments for healthcare worker satisfaction essential. Motivation in this case is a complex, context-specific issue driven by factors like safety, recognition, economic stability, and organizational fairness. Ignoring these nuances has the potential to create policies that raise burnout, turnover, and unequal application to already strained systems⁽²¹⁾.

Frontline health workers in Bangladesh play a vital role in delivering key services like immunization and maternal care to poor communities. Motivation among them is influenced by the workload, presence of resources, training, interpersonal relationship with the community, and recognition. If left unaddressed, these factors may lead to low morale and turnover, compromising health access and worsening inequalities in high-need, resource-constrained environments⁽²²⁾. Sustainability of a strong healthcare system, particularly rural, is contingent upon equitable resource distribution, workforce retention, and adaptable infrastructure to mitigate socioeconomic obstacles, geographical isolation, and staff limitations. Localized interventions, combined community engagement, and targeted training are pivotal in enhancing the delivery of services and health system trust.

Since the Alma-Ata Declaration in 1978, Bangladesh prioritized equitable, community-based healthcare to achieve "Health for All." The strategy emphasizes social determinants of health, prevention, and education of grass-root health workers. While there has been progress, there are still gaps in funding and rural-urban inequities, so that continuous development is necessary, in part by embracing digital health programs and partnerships with non-governmental organizations⁽²³⁾. Health Assistants (HAs), being frontline domiciliary staff of the Upazila Health System (UHS), are central to the provision of primary care in Bangladesh, particularly in rural and slum areas where they address socioeconomic and geographical determinants of care. Supported by community clinics, HAs perform disease surveillance, health education, and prevention services. However, the effectiveness of this decentralized system is undercut by poor resources, training shortages, and high patient loads, creating the need for investment in infrastructure and workforce development in the long term⁽²³⁾.

Though there has been considerable work within Bangladesh on job satisfaction among medical doctors and hospital-based staff, experiences of frontline fieldworkers like HAs have not yet been adequately examined. Such workers are responsible for the delivery of primary care services, including vaccinations, maternal care, and disease prevention, often in resource-constrained areas. Practical problems and research bias toward clinical environments have left a gap in investigations of their job satisfaction.

This study aims to bridge this gap in knowledge through examination of the job satisfaction level of HAs within the public health system in Bangladesh and identification of the associated factors. Understanding these dynamics is essential to inform policies that improve retention, optimize delivery of services, and enhance community-based healthcare systems' ability to respond to national health equity targets.

MATERIALS AND METHODS

A descriptive, cross-sectional study was conducted from January 2025 to May 2025 to assess the level of job satisfaction and its associated factors among Health Assistants in Bangladesh. The study was conducted in 47 selected Upazila Health Complexes (UHCs) from 15 selected districts, where participants were chosen through a proportionate multi-stage sampling technique from all eight administrative divisions of Bangladesh. About 1,181 Health Assistants formed the final sample calculated on a total population of 9,632 HAs and for a non-response rate of 10%. The study population comprised only those Health Assistants who had one or more years of working experience, and the unwilling ones were excluded. Data was collected through face-to-face interviews with a pre-tested, semi-structured questionnaire adapted from the Questionnaire for Psychological and Social factors (QPS Nordic)⁽²⁴⁾. The instrument included 115 questions in 24 scales, of which a 5-point Likert scale was applied for most. The questionnaire was pre-tested in 10% of the sample size calculated previously at Keraniganj UHC, and necessary changes were made to determine

its feasibility. Ethical approval for the research was provided by the Institutional Review Board (IRB) of the National Institute of Preventive and Social Medicine (NIPSOM). Consent was sought from all respondents after the objective of the study had been clarified, and participation was voluntary with strict confidentiality and anonymity. Following data collection, data were edited, coded, and entered for analysis using the Statistical Package for the Social Sciences (SPSS) version 25. Descriptive statistics including frequencies, percentages, means, and standard deviations were applied in the analysis, while Pearson Chi-Square (χ^2) test was utilized to assess association between categorical variables. Bivariate correlation was conducted with Pearson's coefficient, and internal consistency of the questionnaire scales was measured with Cronbach's alpha.

RESULT

The details the socio-demographic profile of the 1181 respondents are shown in Table 1. Age of the respondents ranged from 20 years to more than 59 years, with an average of 42.60 ($\pm$ 7.97) years. More than two-fifth (44.8%) of the respondents were aged between 40 to 49 years. Gender-wise, sample was almost evenly divided with 53.3% of the respondents were male and 46.7% were female. As per their educational qualification, the sample was highly educated as 70.2% had an educational qualification above HSC level.

As per the number of years respondents were working in the current post, a plurality (49.2%) of the respondents had 11 to 15 years of work experience.

Table 1: Socio-Demographic Characteristics of the respondents (n=1181)

Variables	Total	
	Sample (n = 1181)	
	Number	Percentage (%)
Age range		
20 to 29 years	48	4.1
30 to 39 years	368	31.2
40 to 49 years	529	44.8
50 to 59 years	236	20.0
Mean $\pm$ SD	42.60 $\pm$ 7.97 years	
Sex		
Male	630	53.3
Female	551	46.7
Educational qualification		
Above HSC	829	70.2
HSC	306	25.9
SSC	46	3.9
Length of service in current position		

1 to 5 years	133	11.3
6 to 10 years	101	8.6
11 to 15 years	581	49.2
16 to 20 years	132	11.2
21 to 25 years	128	10.8
26 to 30 years	36	3.0
31 to 35 years	67	5.7
36 to 40 years	2	0.2
41 to 45 years	1	0.1

The modified QPS (Nordic) questionnaire which was created in Scandinavian countries (Sweden, Norway, Finland, and Denmark) was used in this analysis. The reliability of job demands analysis, that is, consistency of the answers between the scales is presented by alpha coefficient. The scale for "learning demands" had the lowest alpha coefficient (alpha 0.24), and "decision demands" also showed poor reliability (alpha 0.38). The second scale with lower reliability was "control of decision" (alpha 0.46). Regarding the average answers in this module, the highest mean value was for "role clarity" ($\bar{x}$ = 4.63), followed by "positive challenge at work" ($\bar{x}$ = 4.51). Differences in middle offered answers between scales in the job demand module are presented in Table 2.

In the organizational module, the scale with the lowest reliability was "fair leadership" (alpha 0.25),

while the majority of other scales demonstrated good to excellent internal consistency, such as "empowering leadership" (alpha 0.89) and "inequality" (alpha 0.86). The scales testing "support from coworkers" and "support from superior" had the highest mean values, 4.14 and 4.05, respectively. The differences in middle answers between scales in the area of organizational module are given in Table 2.

Regarding the individual level module, the highest mean value was for the scale which tested "extrinsic motivation to work" (mean value 4.60), and this scale also showed the highest reliability in this module (alpha 0.84). Conversely, the "preference for challenge" scale had the lowest internal consistency in this section (alpha 0.52). Differences in middle answers are presented in Table 2

Table 2: Mean values, standard deviations and consistency for specific scales

Scales	Average of answers ($\bar{x}$ ± SD)	Alpha (Cronbach's)
Job demands module		
Quantitative demands	3.61±0.77	0.75
Decision demands	3.50±0.72	0.38
Learning demands	3.98±0.63	0.24
Role clarity	4.63±0.54	0.52
Role conflict	2.82±0.89	0.50
Positive challenge at work	4.51±0.66	0.70
Control of decision	3.25±1.22	0.45
Control of work pacing	2.37±0.90	0.62
Predictability of the next month	1.88±0.93	0.62
Organizational module		
Support from superior	4.05±0.84	0.75
Support from coworkers	4.14±0.86	0.67
Empowering leadership	3.73±1.13	0.89
Fair leadership	3.41±0.73	0.25
Social climate	3.51±0.75	0.56
Innovative climate	3.64±0.82	0.63
Inequality	1.93±1.14	0.86
Human resource primacy	2.78±1.08	0.77
Perception of group work	3.96±0.77	0.71

Interaction between work and private life	2.97±1.15	0.80
Individual level module		
Preference for challenge	3.41±1.13	0.52
Perception of mastery	3.98±0.90	0.70
Commitment to organization	4.06±0.87	0.76
Intrinsic motivation to work	4.44±0.61	0.65
Extrinsic motivation to work	4.60±0.61	0.84

$\bar{x}$ – mean value; SD – standard deviation.

Table 3 shows coefficients of correlation between motivation aspects (intrinsic and extrinsic) and other scales. In terms of intrinsic motivation, the variables significantly and positively correlated with this dimension were “Positive challenge at work” ($r = 0.379$, $p < 0.01$) which showed the highest correlation, “Commitment to organization” ($r = 0.236$, $p < 0.01$), “Learning demands” ($r = 0.233$, $p < 0.01$) and “Perception of group work” ($r = 0.233$, $p < 0.01$), while “Inequality” ($r = -0.305$, $p < 0.01$), “Control of decision” ($r = -0.220$, $p < 0.01$) and “Fair leadership” ($r = -0.180$, $p < 0.01$) were negatively correlated with it.

In terms of extrinsic motivation, “Positive challenge at work” was also the variable with the highest positive correlation with this dimension ($r = 0.444$, $p < 0.01$) followed by other significant positive relationships with “Perception of group work” ($r = 0.219$, $p < 0.01$), “Innovative climate” ($r = 0.201$, $p < 0.01$) and “Interaction between work and private life” ($r = 0.171$, $p < 0.01$). While the variable with the highest negative correlation with extrinsic motivation was “Inequality” ($r = -0.318$, $p < 0.01$) followed by “Fair leadership” ($r = -0.178$, $p < 0.01$). Several scales, including Role conflict and Support from coworkers, did not have a statistically significant link with either intrinsic or extrinsic motivation

Table 3: Correlation between motivation to work and other examined scales

Scales	Intrinsic motivation to work (r)	Extrinsic motivation to work (r)
Quantitative demands	0.175**	0.150**
Decision demands	0.158**	0.136**
Learning demands	0.233**	0.207**
Role clarity	0.158**	0.144**
Role conflict	-0.017	-0.008
Positive challenge at work	0.379**	0.444**
Control of decision	-0.220**	-0.085**
Control of work pacing	0.016	0.018
Predictability of the next month	-0.088**	-0.065*
Support from superior	0.134**	0.109**
Support from coworkers	0.017	0.016
Empowering leadership	-0.109**	-0.053
Fair leadership	-0.180**	-0.178**
Social climate	0.068*	0.030
Innovative climate	0.212**	0.201**
Inequality	-0.305**	-0.318**
Human resource primacy	0.062*	0.001
Perception of group work	0.233**	0.219**
Interaction between work and private life	0.168**	0.171**
Preference for challenge	0.083**	0.006
Perception of mastery	0.139**	0.093**
Commitment to organization	0.236**	0.192**

** Correlation is significant at the 0.01 level (2-tailed)

* Correlation is significant at the 0.05 level (2-tailed)

Table 4 outlines the results of the Pearson correlation analysis, which was performed to assess the relationships between socio-demographic variables (Age, Sex, Education, and Duration of Service) and the other scales examined in the study.

Age was found to be significantly and positively correlated with "Commitment to organization" ($r = 0.092$, $p < 0.01$), "Support from superior" ($r = 0.087$, $p < 0.01$), and "Inequality" ($r = 0.085$, $p < 0.01$). In contrast, age demonstrated a significant negative relationship with "Intrinsic motivation to work" ($r = -0.100$, $p < 0.01$) and "Decision demands" ($r = -0.087$, $p < 0.01$).

Sex showed a strong, significant negative correlation with "Preference for challenge" ($r = -0.210$, $p < 0.01$), indicating a gender-based difference in this preference. Other significant negative correlations were found with "Inequality" ($r = -0.092$, $p < 0.01$)

and "Control of work pacing" ($r = -0.083$, $p < 0.01$). A significant positive correlation was noted between sex and "Innovative climate" ($r = 0.084$, $p < 0.01$).

The Education level of respondents correlated positively and significantly with job demands, including "Quantitative demands" ($r = 0.102$, $p < 0.01$) and "Decision demands" ($r = 0.100$, $p < 0.01$). Significant negative correlations were observed with "Perception of mastery" ($r = -0.103$, $p < 0.01$) and "Inequality" ($r = -0.101$, $p < 0.01$).

Duration of service was significantly and positively associated with "Quantitative demands" ($r = 0.096$, $p < 0.01$), "Support from superior" ($r = 0.086$, $p < 0.01$), and "Commitment to organization" ($r = 0.074$, $p < 0.05$). A significant negative, but weak, correlation was found with "Preference for challenge" ($r = -0.072$, $p < 0.05$).

Table 4: Correlation between Socio-Demographic Characteristics and other examined scales

Scales	Age (r)	Sex (r)	Education (r)	Duration of service (r)
Quantitative demands	0.054	0.016	0.102**	0.096**
Decision demands	-0.087**	-0.047	0.100**	-0.048
Learning demands	-0.046	-0.006	0.081**	-0.037
Role clarity	0.059*	0.048	0.062*	0.068*
Role conflict	-0.038	-0.053	0.015	-0.042
Positive challenge at work	-0.057	0.015	0.010	-0.021**
Control of decision	0.003	-0.073*	0.033	-0.038
Control of work pacing	-0.021	-0.083**	-0.001	0.010
Predictability of next month	-0.048	-0.079**	-0.047	-0.060*
Support from superior	0.087**	0.069*	-0.009	0.086**
Support from coworkers	0.055	0.003	-0.031	0.053
Empowering leadership	0.081**	0.046	-0.029	0.034
Fair leadership	0.021	-0.015	0.033	-0.051
Social climate	0.055	0.030	0.024	0.027
Innovative climate	0.072*	0.084**	-0.024	0.064*
Inequality	0.085**	-0.092**	-0.101**	0.042
Human resource primacy	0.055	-0.008	-0.083**	0.043
Perception of group work	0.048	0.043	0.010	0.026
Interaction between work and private life	0.033	0.034	0.007	0.035
Preference for challenge	-0.057	-0.210**	-0.055	-0.072*
Perception of mastery	-0.013	0.012	-0.103**	0.004
Commitment to organization	0.092**	0.064*	0.022	0.074*
Intrinsic motivation to work	-0.100**	0.023	-0.024	-0.052
Extrinsic motivation to work	-0.058*	0.049	-0.017	-0.015

** Correlation is significant at the 0.01 level (2-tailed)

* Correlation is significant at the 0.05 level (2-tailed)

DISCUSSION

This study aimed to determine the level of job satisfaction and its associated factors among Health

Assistants (HAs) in Bangladesh. The findings present a significant paradox with a highly experienced and educated workforce that demonstrates strong intrinsic

motivation and organizational commitment, yet simultaneously endures severe systemic and organizational deficiencies. This "fragile satisfaction" appears to be sustained by a supportive microenvironment and the meaningful nature of the work itself, which buffers the impact of broader systemic failures.

A central finding of this study is the high value HAs place on intrinsic rewards. A remarkable 94.2% found their work meaningful, and 85.4% reported a high sense of mastery. This aligns with foundational job satisfaction theories, such as those outlined by Spector⁽⁵⁾, which posit that the nature of the work itself is a primary driver of satisfaction. The strong correlation between "positive challenge at work" and both intrinsic ($r=0.379$) and extrinsic ($r=0.444$) motivation further reinforces the importance of workplace empowerment, a concept that Cicolini et al.⁽²⁾ found to be a significant predictor of nurses' job satisfaction in their systematic review. The HAs' high sense of mastery, despite systemic constraints, suggests a high level of professional empowerment that fuels their motivation.

However, this intrinsic satisfaction is starkly contrasted by overwhelming job demands and a lack of resources. The findings show that 89.0% of HAs perceived their job demands as 'High' or 'Highest', and 57.9% were frequently assigned tasks without adequate support. This situation resonates directly with the findings of Roy et al.⁽¹⁸⁾, who, in their study of doctors in the Bangladeshi public-private health system, identified high workload and lack of resources as significant contributors to burnout and turnover intention. While the HAs in our study reported high commitment, this combination of high demands and low control is a well-established precursor to burnout, which can ultimately erode commitment and increase turnover, as demonstrated by Scanlan and Still⁽¹²⁾ in their study of Australian mental health personnel.

The supportive immediate work environment appears to play a crucial role in mitigating these systemic pressures. The high levels of support from coworkers (75.7%) and appreciation from superiors (75.2%) are critical buffering resources.

This finding is consistent with research by Goetz et al.⁽²²⁾ in Kenya, which identified a positive working atmosphere and good relationships with colleagues as key determinants of job satisfaction among healthcare staff, even amidst systemic challenges. The importance of positive workplace relationships as a cornerstone of job satisfaction and organizational performance has also been highlighted by Bakotić⁽¹⁷⁾. The reliance on this social support in our study,

however, further highlights the fragility of the HAs' job satisfaction; should this support falter, the negative impact of the systemic issues would likely become more pronounced.

The most powerful negative influence on motivation was perceived inequality ($r=-0.305$ for intrinsic, $r=-0.318$ for extrinsic). This is a critical finding, suggesting that feelings of unfairness in the system are highly detrimental to morale. This finding underscores the critical role of organizational justice, a factor strongly linked to turnover intention in empirical studies such as Yücel's⁽³⁾. The detrimental impact of perceived unfairness on motivation has been noted in other healthcare contexts as well; Djordjević et al.⁽¹⁹⁾ found that factors related to remuneration and fairness were central to the motivation and satisfaction of health workers in Serbia. This suggests that policy interventions aimed at ensuring fairness and equity may have a more significant impact on satisfaction and retention than other initiatives.

The demographic correlations reveal further nuances. The negative correlation between age and intrinsic motivation ($r=-0.100$), while age was positively correlated with organizational commitment ($r=0.092$), suggests a complex dynamic. It may be that older, more experienced HAs become more committed to the organization due to job security, but their intrinsic motivation wanes after years of exposure to systemic frustrations. Furthermore, the significant gender differences observed, particularly the strong negative correlation between being female and "preference for challenge" ($r=-0.210$), alongside lower levels of job control, point towards potential gender-based inequities. This resonates with the work of Tolbert and Moen⁽²¹⁾, who documented how definitions of a "good job" and workplace experiences can differ significantly by gender and age, suggesting that a one-size-fits-all approach to improving job satisfaction may be ineffective.

LIMITATIONS

There are some limits to this research. Its cross-sectional approach means that the correlations found do not imply causality. The results come from self-reported information, which could be influenced by social acceptability bias. The low Cronbach's alpha for a number of measures, including "learning demands" and "fair leadership," indicates that the adapted QPS (Nordic) instrument needs more validation in the Bangladeshi setting.

CONCLUSION

The study shows that Health Assistants in Bangladesh have a fragile and paradoxical level of job satisfaction. These Health Assistants have a lot of intrinsic drive and work well with their colleagues. Severe systemic problems including excessive workloads, resource constraints, and negative views of injustice have devastatingly compromised danger. This dependence on team and individual resilience is unsustainable and calls for a deliberate change toward creating a fair and encouraging environment. Therefore, it is strongly advised that government officials give tackling institutionalized inequality top priority by means of clear processes and a formal complaint system, all while also carrying out a formal workload. Examining to match available resources and staff levels with the requirements of a role.

At the management level, better workplace predictability by means of clear scheduling and increased job control via encouraging supervision can help to instantly reduce main stressors. Future longitudinal studies should monitor turnover and burnout in addition to qualitative investigations to investigate the notable gender differences noted, therefore ensuring that therapies are effective for all employees and supported on evidence.

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Original Article

AN EXPERIMENT ON THREE DIFFERENT RESTORATIVE MATERIALS IN THE
MANAGEMENT OF CLASS V NON-CARIOUS CERVICAL LESIONS

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ABSTRACT

Background: To obtain the best performance in management of non-carious cervical lesion, many restorative materials and technique have tried. The success of the treatment depends on the materials which should be identical to natural tooth structure, adhesive, abrasion resistance, good marginal integrity with excellent surface texture.

Hypothesis: The clinical application and performance of Giomer is superior to Flowable composite and Resin modified glass ionomer cements (RMGIC) in the management of class V non-carious cervical lesions. **Objectives:** Evaluation of the clinical performance of Giomer, Flowable Composite and Resin Modified Glass Ionomer Cements (RMGIC) in the management of class V non-carious cervical lesions.

Methods: An experimental was done among thirty-two healthy adult having at least three non-carious cervical lesions on buccal surface (size 1-2mm) of teeth were selected for the study. The method of sampling was simple random sampling by lottery method. After clinical evaluation, 150 teeth were selected. These 150 samples were divided equally into three groups. Group 1: Giomer, Group 2: Flowable Composite and Group 3: Resin Modified Glass Ionomer Cement. Restoration was assessed by Modified Ryge's Criteria by means of retention, color matching, marginal integrity and surface texture. Patients were recalled after 3, 6, and 12 months for follow up observation. Statistical analysis was performed by one way ANOVA and Tukey's post hoc test, where p value < 0.05 was considered as statistically significant.

Results: The result of this study showed that at 12 months follow up, the retention was 48(93.8%), 43(87.5%) and 43(91.5%) for Giomer, Flowable Composite and RMGIC, respectively. There were no statistically significant differences among the retention ability of these materials. Regarding color matching, Giomer and Flowable composite were more color stable than RMGIC ($p < 0.05$) where statistically significant difference were observed. The marginal integrity of Giomer was also significantly better than RMGIC ($p < 0.05$). Further more polished enamel surface texture was achieved in 35 (77.8%) Giomer, 32 (76.2%) Flowable composite and 14 (32.6%) RMGIC at 12 months observation ($p < 0.05$).

Conclusion: It can be concluded that Giomer is more effective than the Flowable composite and RMGIC in respect to surface finish, color stability and marginal integrity.

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Key words: Restorative Materials, Giomer, Flowable composite, Resin Modified Glass Ionomer Cement, Class V Non-Carious Cervical Lesions

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INTRODUCTION

Class V lesions are those occurring at the cervical aspect of the buccal or lingual surfaces of teeth. A non-carious cervical lesion is defined as the loss of tooth structure at the cemento-enamel junction that is nonrelated to dental caries¹. The non-carious cervical lesions are further categorized into abrasion, erosion and abfraction². There can be many causes of this condition, including bruxism, clenching, disease, dietary factors, habits and lifestyle, improper tooth brushing, abrasive dentifrices, the craniofacial complex, iatrogenic dentistry, and aging³. The decision to treat a cervical lesion should be based on careful consideration of the etiology, the patient's complaints and the extension and depth of the defect. Several preventive and restorative treatment modalities, such as occlusal adjustment, tooth brushing instructions, dietary advice, application of desensitization products and restorative procedures, have been proposed for non-carious cervical lesions⁴.

Conventional glass ionomers, resin-modified glass ionomers, compomers and several types of resin composites have been used for cervical restorations. Glass ionomers have been used due to their ease of use, adhesion to tooth substance and release of fluoride. The disadvantages of these materials include sensitivity to moisture, low wear resistance and fracture toughness and poor esthetic properties. Recent years, compomers and resin composites have become popular alternatives to conventional glass ionomer cements for the restoration of cervical lesions, based on their satisfactory esthetic properties and high wear resistance⁵.

Resin-modified glass ionomer cements (RMGICs) are hybrid restorative materials that combine the properties of conventional glass ionomers and resin composites. They are commonly used in Class V cavities and in the management of rampant caries. RMGICs offer several advantages, including extended working time, controlled setting, good marginal adaptation, and chemical adhesion to enamel and dentin. They also provide fluoride release, improved esthetics, reduced interfacial shrinkage stress, and enhanced mechanical strength.

However, limitations include relatively low wear resistance, reduced fracture toughness, polymerization shrinkage, and potential intrinsic color changes over time. Clinically, the overall success rate of Class V restorations was 72.9% after 2.5–3.5 years of follow-up. RMGIC (Fuji II LC) restorations demonstrated significantly higher success compared to conventional GIC (Fuji IX) ($p = 0.0104$), with better retention ($p = 0.0034$) and color match ($p = 0.0023$)⁶.

Flowable composites are low-viscosity restorative materials with particle sizes and distributions comparable to hybrid composites but with reduced filler content. The increased resin matrix lowers viscosity, enhancing handling and adaptability. However, the lower filler loading results in reduced wear resistance in stress-bearing areas, increased polymerization shrinkage, and challenges in achieving a smooth surface finish. These limitations may affect their long-term clinical performance in load-bearing restorations⁷.

Recent advancements in restorative dentistry have led to the development of novel materials for managing cervical lesions. Gionomers represent one such category, based on pre-reacted glass (PRG) filler technology, in which pre-reacted glass particles are incorporated into a resin matrix. PRG fillers are produced through an acid-base reaction between fluoride-containing glass and polyacrylic acid in the presence of water, forming a wet siliceous hydrogel. This technology is classified into full pre-reacted glass (FPRG) and surface pre-reacted glass (SPRG). In FPRG, the entire glass particle undergoes reaction, whereas in SPRG only the surface reacts, preserving an unreacted glass core. Gionomers demonstrate improved handling characteristics, enhanced esthetics, superior shade matching, and excellent polishability, while maintaining fluoride release, anti-plaque properties, and adequate mechanical strength and durability⁸.

This study aims to inform the selection of restorative materials for Class V non-carious cervical lesions (NCCLs) and to determine the proportion of dentists who consider lesion etiology prior to treatment, thereby guiding future research. The study hypothesizes that gionomer demonstrates superior clinical performance compared to flowable composites and resin-modified glass ionomer cements (RMGICs) in the management of NCCLs. Accordingly, the primary objective of this study is to evaluate and compare the clinical performance of gionomer, flowable composite, and RMGIC materials in restoring Class V non-carious cervical lesions under clinical conditions.

METHODS

A experimental study was conducted in the Department of Conservative Dentistry and Endodontics, Faculty of Dentistry, Bangladesh Medical University, Dhaka, over a period of 18 months. The study included 150 teeth as the study population. Eligible participants were adults aged 30–50 years presenting with at least three non-carious

cervical lesions (1–2 mm) on the buccal surfaces, with intact occlusion, proximal contact, and good oral hygiene. Exclusion criteria comprised immunocompromised status, poor oral hygiene, gingivitis or periodontitis, parafunctional habits (e.g., bruxism), fractured, carious, or discolored teeth, and occlusal disharmony. Participants were selected using simple random sampling through a lottery method.

Sample Size: It was calculated by

$$n = \frac{\left\{ u \sqrt{\left[\pi_1(1-\pi_1) + \pi_0(1-\pi_0) \right]} + v \sqrt{2\pi(1-\pi)} \right\}^2}{(\pi_0 - \pi_1)^2},$$

The sample size was calculated using a standard formula for comparing two proportions. Here, n denotes the required sample size per group; u represents the standard normal deviate corresponding to the desired power ($Z\beta = 0.842$ for 80% power), and v represents the standard normal deviate corresponding to the level of significance ($Z\alpha = 1.96$ for a 5% significance level). The expected proportions were assumed as $\pi_0 = 0.558$ and $\pi_1 = 0.82$. Based on these assumptions, the calculated sample size was 45.33 per group. This was rounded up to 50 participants per group to ensure adequate precision. Considering the possibility of loss to follow-up, a total sample size of 150 participants (50 in each of the three groups) was finally included in the study, maintaining 80% power at a 5% level of significance.

Study Materials

The materials used in this study included:

- Giomer (Beautifil Injectable)
- Flowable composite (Filtek Flow)
- Resin-modified glass ionomer cement (Fuji II LC)
- Adhesive system (BeautiBond)
- Dentin conditioner

Randomization and Study Procedure

This study was conducted in the Department of Conservative Dentistry and Endodontics at Bangladesh Sheikh Mujib Medical University (BMU), following approval from the Institutional Ethical Review Committee (Ref: BSMMU/2014/3722).

A total of 150 teeth were selected from 32 subjects who presented with at least three non-carious cervical lesions (NCCLs) on the buccal surfaces. The included lesions had a depth ranging from 1–2 mm

and were morphologically classified as either saucer-shaped or V-shaped. The minimum required sample size was calculated to be 45 per group. To compensate for potential loss to follow-up, the sample size was increased to 50 per group, resulting in a total of 150 samples.

Randomization Technique

Simple random sampling was employed using the lottery method to assign restorative materials to the selected teeth. Each lesion was randomly allocated to one of the three study groups:

- **Group I:** Giomer
- **Group II:** Flowable composite
- **Group III:** Resin-modified glass ionomer cement (RMGIC)

Clinical Procedure

The study protocol consisted of three phases: pre-restorative, restorative, and post-restorative procedures.

Pre-restorative Phase

A detailed history was obtained, including dietary habits and oral hygiene practices. A comprehensive clinical examination of the teeth was performed. All participants underwent oral prophylaxis within two weeks prior to the placement of restorations.

Restorative Phase

Restorations were placed according to standard clinical protocols using the assigned materials.

Post-restorative Phase and Follow-up

Clinical evaluations were conducted at baseline (immediately after finishing and polishing), and at 3, 6, and 12 months post-restoration.

Outcome Assessment¹⁰

All restorations were evaluated using a dental mirror and probe by two independent evaluators who were blinded to the type of restorative material used.

The clinical performance of restorations was assessed using the Modified United States Public Health Service (USPHS) Ryge criteria as described by Barnes et al. (1995). The scoring system was defined as follows:

- **Alpha (A):** Restoration fully intact
- **Bravo (B):** Restoration partially intact
- **Charlie (C):** Restoration completely missing

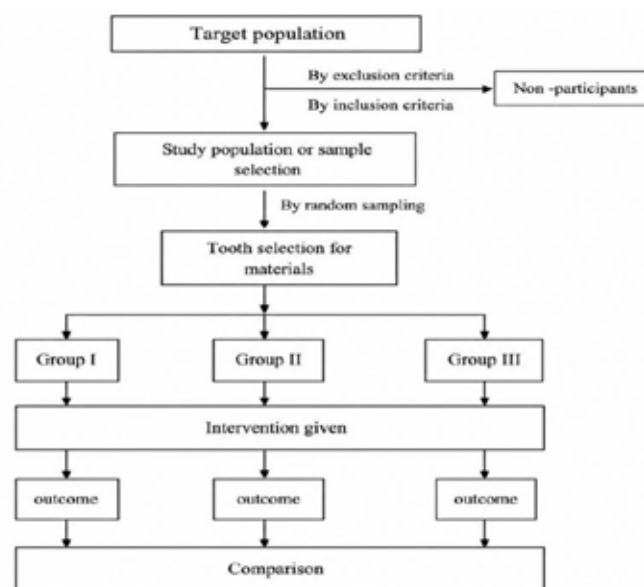
Table 1: Modified Ryge's criteria for clinical evaluation¹⁰

Modified Ryge's criteria for clinical evaluation Criteria	Test procedure	Rating	Ryge Criteria
Retention	Visual inspection with mirror	Alpha (A) Bravo (B) Charlie (C)	Restoration is fully intact Restoration is partially intact Restoration is completely missing
Color Match	Visual inspection with mirror	Alpha (A) Bravo (B) Charlie (C)	Matches the adjacent tooth structure in color, shade and translucency. Light mismatches in color, shade and translucency between the restoration and adjacent teeth. Mismatches in color, shade and translucency is outside the acceptable range of the tooth color and translucency.
Marginal integrity	Visual inspection with mirror and explorer	Alpha (A) Bravo (B) Charlie (C)	No visual evidence of a crevice along the margin and explorer does not catch Visual evidence of a crevice along the margin into which the explorer will penetrate. The explorer penetrates crevice detect extended to the dentino-enamel junction
Surface Texture	Visual inspection with mirror and explorer	Alpha (A) Bravo (B) Charlie (C)	Similar to polished enamel Gritty or similar to a surface subjects to a white or similar to a composite containing or supramicron-sized particles. Surface pitting is sufficiently coarse to inhibit the continuous movement of an explorer across the surface

Statistical analysis: After completion, the data was presented in the form of tables, figures, and graphs as necessary and statistical analysis of the results was done by using computer based statistical software, SPSS 20.00 version (SPSS Inc. USA). The result was expressed as mean $\pm$ SD (standard deviation). One

way ANOVA test was done to compare among the groups. Tukey's post hoc test was done for comparison between the groups. 95% confidence level (p value<0.05) was followed for testing level of significance.

Basic design of the study: (Flow chart)



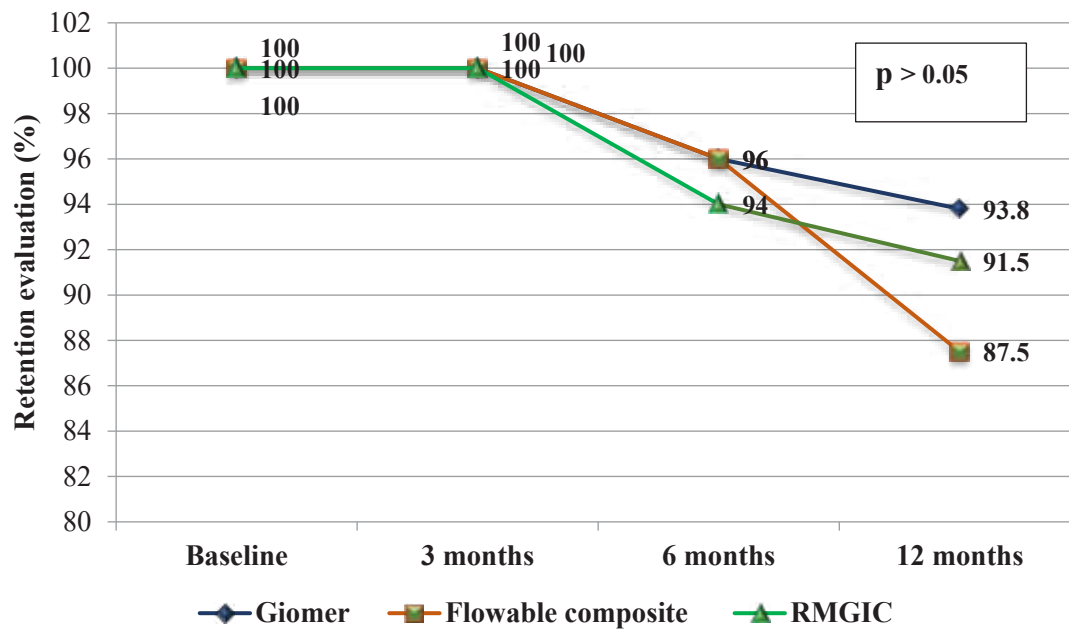
RESULTS

Retention status:

The retention outcomes are summarized in figure 1. At baseline and the 3-month follow-up, all restorations in the three groups remained intact (100%). Among the materials, giomer demonstrated the highest retention over the observation period. At 12 months, 45 restorations (93.8%) remained intact, while 3 restorations (6.2%) were lost. For the flowable composite group, 42 restorations (87.5%)

were intact at 12 months, with 2 restorations (4%) lost at 6 months and 6 restorations (12.5%) lost at 12 months. In the RMGIC group, 43 restorations (91.5%) were intact at 12 months, with 6% lost at 6 months and 4 restorations (8.5%) lost at 12 months. No statistically significant differences in retention were observed among the three groups ($p > 0.05$). The teeth which loss their retention were replaced and discarded from the study.

Figure 1: Retention evaluation of three groups



The results of color matching are summarized in Table 2. At baseline and 3 months, all restorations exhibited satisfactory color match with adjacent teeth, except for 2 RMGIC restorations (4%) at 3 months, which showed a slight mismatch within the acceptable range. At 6 months, 46 giomer restorations (95.8%) maintained color match, slightly decreasing to 41 (91.1%) at 12 months. For flowable composites, 40 restorations (83.3%) matched at 6

months, declining to 32 (76.2%) at 12 months. RMGIC restorations demonstrated progressive color deterioration; 7 restorations (14.9%) showed slight mismatch at 6 months, while 5 (10.6%) and 8 (18.6%) restorations exhibited unacceptable color mismatch at 6 and 12 months, respectively. At 12 months, the differences in color match among the three materials were statistically significant ($p < 0.05$).

Table 2: Color matching evaluation of three groups

Evaluation Period	Score	Groups		
		I (n=50)	II (n=50)	III (n=50)
Baseline	Alpha (A)	50 (100%)	50 (100%)	50 (100%)
	Bravo (B)	0 (0.0%)	0 (0.0%)	0 (0.0%)
	Charlie (C)	0 (0.0%)	0 (0.0%)	0 (0.0%)

After 3 months	Alpha (A)	50 (100%)	50 (100%)	48 (96%)
	Bravo (B)	0 (0.0%)	0 (0.0%)	2 (4.0%)
	Charlie (C)	0 (0.0%)	0 (0.0%)	0 (0.0%)
After 6 months	Alpha (A)	46 (95.8%)	40 (83.3%)	35 (74.5%)
	Bravo (B)	2 (4.2%)	8 (16.7%)	7 (14.9%)
	Charlie (C)	0 (0.0%)	0 (0.0%)	5 (10.6%)
After 12 months	Alpha (A)	41 (91.1%)	32 (76.2%)	20 (46.5%)
	Bravo (B)	4 (8.9%)	10 (23.8%)	15 (34.9%)
	Charlie (C)	0 (0.0%)	0 (0.0%)	8 (18.6%)

A = Matches the adjacent tooth in color shade and translucency

B = Light mismatches with adjacent teeth

C = Mismatches in color with adjacent teeth which is not acceptable

Table 3 presents the comparison of color match among the three groups at each observation period. At 6 and 12 months, RMGIC restorations showed a

statistically significant difference in color match compared to both giomer and flowable composite restorations ($p < 0.05$).

Table 3: Statistical analysis of the results shown in table III

Groups	At baseline	p value		
		After 3 months	After 6 months	After 12 months
I Vs II Vs III	-	0.133 ^{ns}	0.004 ^{ns}	0.001 ^{**}
I Vs II	-	1.00 ^{ns}	0.184 ^{ns}	0.193 ^{ns}
I Vs III	-	0.082 ^{ns}	0.001 ^{**}	0.001 ^{**}
II Vs III	-	0.082 ^{ns}	0.040 [*]	0.001 ^{**}

ns = not significant; * $p < 0.05$; ** $p < 0.001$

The results of marginal integrity are presented in Table 4. At baseline and 3 months, all restorations showed no visible crevices along the margins, and explorers did not catch, indicating intact marginal adaptation. At 6 months, 46 giomer restorations (95.8%) demonstrated no marginal defects, decreasing slightly to 41 (91.1%) at 12 months. For

flowable composites, 41 restorations (85.4%) were intact at 6 months and 35 (83.3%) at 12 months. In the RMGIC group, 32 restorations (74.4%) maintained intact margins at 12 months, while 11 (25%) showed detectable crevices. Statistically, giomer exhibited significantly better marginal integrity than RMGIC at 12 months ($p < 0.05$).

Table 4: Marginal integrity evaluation of three groups

Evaluation Period	Score	Groups		
		I (n=50)	II (n=50)	III (n=50)
Baseline	Alpha (A)	50 (100%)	50 (100%)	50 (100%)
	Bravo (B)	0 (0.0%)	0 (0.0%)	0 (0.0%)
	Charlie (C)	0 (0.0%)	0 (0.0%)	0 (0.0%)
After 3 months	Alpha (A)	50 (100%)	50 (100%)	50 (100%)
	Bravo (B)	0 (0.0%)	0 (0.0%)	0 (0.0%)
	Charlie (C)	0 (0.0%)	0 (0.0%)	0 (0.0%)
After 6 months	Alpha (A)	46 (95.8%)	41 (85.4%)	40 (85.1%)
	Bravo (B)	2 (4.2%)	7 (14.0%)	7 (14.9%)
	Charlie (C)	0 (0.0%)	0 (0.0%)	0 (0.0%)
After 12 months	Alpha (A)	41 (91.1%)	35 (83.3%)	32 (74.4%)
	Bravo (B)	4 (8.9%)	7 (16.7%)	11 (25.6%)
	Charlie (C)	0 (0.0%)	0 (0.0%)	0 (0.0%)

A = No visual evidence of a crevice

B = Visual evidence of a crevice

C = Explorer penetrate up to the dentino-enamel junction

Table 5 – shows the compares of marginal integrity among three groups following each observation period. It was found that differences between Giomer

and RMGIC only statically significant in the 12 months. ($p > 0.05$)

Table 5: Statistical analysis of the results shown in table V

Groups	p value			
	At baseline	After 3 months	After 6 months	After 12 months
I Vs II Vs III	-	-	0.169 ^{ns}	0.115 ^{ns}
I Vs II	-	-	0.107 ^{ns}	0.333 ^{ns}
I Vs III	-	-	0.099 ^{ns}	0.038*
II Vs III	-	-	0.962 ^{ns}	0.273 ^{ns}

ns = not significant; * $p < 0.05$

The results of surface texture are summarized in Table 6. At baseline, all restorations exhibited surface texture comparable to polished enamel. At 3 months, 3 RMGIC restorations (6.0%) showed minimal surface defects, which were considered clinically acceptable. The differences between RMGIC and both giomer and flowable composite were statistically significant ($p < 0.05$). At 6 months, 40 giomer restorations (83.3%) maintained enamel-like surface texture, decreasing to 35 (77.8%) at 12 months. For flowable composites, 38 restorations (79.2%) were intact at 6 months, declining to 32 (76.2%) at 12 months. In contrast, 17 RMGIC restorations (36.2%) exhibited altered surface texture at 6 months, increasing to 29 (67.4%) at 12 months. Statistically, RMGIC performed significantly worse than giomer and flowable composite throughout the follow-up period ($p < 0.05$).

Table 6: Surface texture evaluation of three groups

Evaluation Period	Score	Groups		
		I (n=50)	II (n=50)	III (n=50)
Baseline	Alpha (A)	50 (100%)	50 (100%)	50 (100%)
	Bravo (B)	0 (0.0%)	0 (0.0%)	0 (0.0%)
	Charlie (C)	0 (0.0%)	0 (0.0%)	0 (0.0%)
After 3 months	Alpha (A)	50 (100%)	50 (100%)	47 (94%)
	Bravo (B)	0 (0.0%)	0 (0.0%)	3 (6.0%)
	Charlie (C)	0 (0.0%)	0 (0.0%)	0 (0.0%)
After 6 months	Alpha (A)	40 (83.3%)	38 (79.2%)	30 (63.8%)
	Bravo (B)	8 (16.7%)	10 (20.8%)	17 (36.2%)
	Charlie (C)	0 (0.0%)	0 (0.0%)	0 (0.0%)
After 12 months	Alpha (A)	35 (77.8%)	32 (76.2%)	14 (32.6%)
	Bravo (B)	10 (22.2%)	10 (23.8%)	29 (67.4%)
	Charlie (C)	0 (0.0%)	0 (0.0%)	0 (0.0%)

A = Similar to polished enamel

B = Gritty or white or similar supramicron- sized particales.

C = Surface pitting is sufficiently coarse

Table 7 shows the comparison of surface texture among three groups following each observation period. It was observed that at 3, 6 and 12 months

follow up, the results of RMGIC was statistically significant with the Giomer and Flowable composite ($p < 0.05$).

Table 7: Statistical analysis of the results shown in table VII

Groups	p value			
	At baseline	After 3 months	After 6 months	After 12 months
I Vs II Vs III	-	0.047*	0.067 ^{ns}	0.001**
I Vs II	-	1.000 ^{ns}	0.633 ^{ns}	0.867 ^{ns}
I Vs III	-	0.032*	0.027*	0.001**
II Vs III	-	0.032*	0.082 ^{ns}	0.001**

ns = not significant; * $p < 0.05$; $p < 0.001$

DISCUSSION

The success of cervical restorations is influenced by factors such as retention, color stability, marginal integrity, and surface texture. In the present study, baseline evaluations showed that all restorations were intact, with acceptable color match, proper marginal adaptation, and surface texture comparable to polished enamel.

Retention: At 12 months, 45 giomer restorations (93.8%), 42 flowable composite restorations (87.5%), and 37 RMGIC restorations (91.5%) remained retained within the cavity. These findings are consistent with Jyothi et al. (2011), who reported retention rates of 87.5% for giomer and RMGIC after one year, and with Celik et al. (2007), who reported 98% retention for flowable composites. Complete loss of some restorations in the present study may be attributed to differences in isolation techniques; previous studies used rubber dam isolation, whereas cotton rolls were employed in this study. Additional factors, such as improper brushing technique or lack of occlusal adjustment, may have also contributed to restoration failure.

The choice of adhesive system may have influenced retention outcomes. Previous studies used two-step self-etch bonding agents, whereas the present study employed a one-step self-etch adhesive. Clinical evidence suggests that two-step self-etch adhesives generally provide improved retention and bonding durability compared to one-step systems¹¹. Additionally, flowable composites contain lower filler content and higher resin proportion, which may increase polymerization shrinkage and reduce bond strength, contributing to lower retention⁵. The lower flexural strength of RMGIC may also partially explain its slightly reduced retention compared to giomer¹¹.

The presence of sclerotic dentin and hypermineralized surfaces in cervical lesions may further compromise adhesion, as these substrates are resistant to conventional acid etching, limiting hybrid layer formation and reducing restoration longevity¹¹.

Color Matching: At three months, 2 RMGIC restorations (4%) showed slight mismatch, considered clinically acceptable. At six months, 95.8% of giomer, 83.3% of flowable composite, and 74.5% of RMGIC restorations matched adjacent teeth in shade and translucency. By 12 months, only 46.5% of RMGIC restorations perfectly matched adjacent teeth, 34.9% showed slight mismatch (acceptable), and 18.6% were unacceptable. Changes in color of RMGIC over time may result from chemical

alterations in the resin matrix, water absorption, and surface characteristics of the set material. These findings are in agreement with earlier studies reporting gradual discoloration of resin-based and resin-modified materials due to their organic content and water sorption properties^{12,13}. Flowable composites, with higher organic matrix content, are similarly prone to discoloration over time^{12,13}.

Marginal Integrity: At baseline and three months, all restorations exhibited intact margins, with no detectable crevices. At 12 months, intact margins were observed in 91.1% of giomer, 83.3% of flowable composite, and 74.4% of RMGIC restorations. These results correspond to Jyothi et al. (2011), who reported 87.5% and 77.5% intact margins for giomer and RMGIC, respectively. Slight discrepancies in flowable composite marginal integrity may relate to variations in adhesive systems used^{5,14}.

Surface Texture: Surface texture depends primarily on filler size and composition, influencing polishability. At three months, 3 RMGIC restorations (6%) showed slight roughness. At six months, roughness was observed in 8 giomer (16.7%), 10 flowable composite (20.8%), and 17 RMGIC (36.7%) restorations. By 12 months, 10 giomer (22.2%), 10 flowable composite (23.8%), and 29 RMGIC (67.4%) restorations exhibited slight roughness. Giomer consistently demonstrated superior surface texture compared to RMGIC across all observation periods ($p < 0.001$). These findings are consistent with Jyothi et al. (2011) and Celik et al. (2007), which reported 17% and 34% surface roughness for giomer and RMGIC, respectively. Differences in surface texture may be due to microstructure and mean particle size, with RMGIC, flowable composite, and giomer ranging from 4.5–4.8 μm , 1–2 μm , and 20–40 nm, respectively¹². Additional factors affecting RMGIC include air entrapment during powder-liquid mixing and weaker filler-matrix coupling, increasing susceptibility to abrasive wear. Giomer surfaces can be polished to high luster, which remains stable over time due to the water-stable PRG fillers^{12,16}.

All participants adhered strictly to treatment instructions, and confounding variables were controlled during the study, making it unlikely that the results were influenced by external factors.

Limitations: This study was small, with a limited sample size and short follow-up period, which may restrict the generalizability of the findings.

CONCLUSION

This study demonstrates that giomer exhibits superior clinical performance compared to flowable composite and resin-modified glass ionomer cement (RMGIC) in the management of non-carious cervical lesions. Giomer showed excellent retention, stable color, intact marginal integrity, and smooth surface texture over the observation period. Its performance can be attributed to the pre-reacted glass (PRG) filler technology, optimal particle size, and a stable resin matrix, which collectively provide predictable aesthetics and durable clinical outcomes. Flowable composites performed adequately but were slightly inferior in terms of retention and surface smoothness, likely due to higher resin content and lower filler loading. RMGIC showed more noticeable changes in color, marginal adaptation, and surface texture, possibly related to its lower flexural strength, powder-liquid mixing technique, and weaker filler-matrix coupling.

RECOMMENDATION

Giomer may be considered a preferred restorative material for non-carious cervical lesions, providing superior aesthetics and clinical durability. Further long-term studies with larger sample sizes are recommended to validate these findings and to explore the influence of different adhesive protocols, occlusal adjustments, and patient-specific factors on restoration success.

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Original Article

DIETARY PATTERN AND NUTRITIONAL STATUS AMONG CHRONIC KIDNEY DISEASE PATIENTS

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ABSTRACT

Background: Chronic kidney disease is recognized as a serious health problem in both developed and developing countries. In recent years, an increasing incidence of chronic kidney disease has been observed worldwide, and the number of patients need special attention. The study was conducted to assess the dietary pattern and nutritional status of the patient with chronic kidney disease.

Methods: A cross-sectional study was carried out among 253 respondents of National Institute of Kidney Disease and Urology (NIKDU) and Anwer Khan Modern Medical College Hospital, Dhaka. Data were collected by convenient sampling through face-to-face interview using a semi-structured questionnaire. For nutritional assessment, “Asian criteria” BMI cut-off was performed. Dietary pattern was assessed with food frequency questionnaire, number of major meals per day, light meal, skipped meal for last 7 days. Data were analysed by SPSS 25 software.

Results: The study found that highest number (23.7%) of the respondents were in age group 46 to 55 years and about 51% of the respondents were male. Assessment of nutritional status (BMI) of the respondents who were not oedematous (n=83) showed that 68.7% of the respondents were pre obese, 9.6% were obese and 14.5% were overweight. Among the respondents 85.4% took three meals a day and 53.3% took 1.5 litres of water daily, 68.8% of them did not take extra salt during meals, 36% of them strained vegetables in boiling water prior cooking. Older CKD patients (>45 years) showed higher proportion of obesity ($p<0.05$).

Conclusion: Dietary restrictions of CKD were followed by most of the respondents of this study. Most of the respondents who were assessed for BMI were overweight, pre obese and obese. Proportion of obesity increased with age.

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Key words: Chronic Kidney Disease; Dietary Pattern; Nutritional status

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INTRODUCTION

Chronic kidney disease (CKD) is recognized as an important non communicable disease in both developed and developing countries with a

prevalence of approximately 8 to 16% in adult population [1,2]. In recent years, an increasing incidence of chronic kidney disease has been observed worldwide and the number of patients need special attention. At early stage of the disease

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patients need costly medications, but as the disease progresses to an end stage kidney disease (ESKD), it turns to critical and costly problem [2]. Chronic kidney disease (CKD) is a global health burden with a high economic cost to health system. All stages of CKD are associated with increased risk of mortality, and/or decreased quality of life [3]. In Bangladesh the prevalence is 22.4% [4], which is higher than global rate [5] The overall mortality rate has increased by 41.5% between 1990 and 2017 worldwide [6].

It is estimated that 5-10 million people die annually due to kidney diseases [7]. Malnutrition occurs commonly in the CKD populations [8], although prioritizes medical treatment for CKD patients in Bangladesh, medical nutrition therapy is an area that is largely neglected. Nutritional intervention in early stages of chronic kidney disease may prolong life. Modification of diet reduces levels or concentration of urine parameters of kidney injury [9,10], decrease the production of potential uremic toxin through the alteration of gut flora, controlling body weight and improved cardiovascular outcomes [11]. A kidney friendly diet may help to protect kidneys from further damage. Patients with kidney damage should limit the intake of certain foods to reduce the accumulation of un-excreted metabolic products and also to protect against hypertension, proteinuria and other heart and bone health problems [12].

CKD patients and their clinicians seek ways to modify the kidney disease course in order to reduce the risk of developing end stage renal disease (ESRD), death and other complications of CKD. One such possible avenue is by adopting dietary modifications. Understanding the dietary intake of CKD patients and barriers to its improvement may lead to the formulation of strategies effective at reducing the burden of CKD [13].

Effective management of CKD should lead to longer survival, decreased morbidity, and improved quality of life. Diet is a daily challenge as well as an educational opportunity that interfaces with all other aspects of effective treatment of CKD [14]. Healthful dietary patterns should be encouraged in patients with CKD, and clinicians managing such patients should seek to understand barriers to dietary adherence that are specific to their culture, geographical region and resources. Globally, there has been an increase in CKD morbidity, mortality and disability-adjusted years of life, with an increased burden of CKD. There are many complications related to CKD including anaemia, malnutrition, anorexia, mineral and bone disease, electrolyte disturbances, cardiovascular disease and progression to end-stage kidney disease (ESKD) [15]. Dietary and fluid restrictions are

disorienting and an intense burden for patients with CKD. Patient-prioritized education strategies, harnessing patients' motivation to stay well for a transplant or to avoid dialysis, and viewing adaptation to restrictions as a collaborative journey are suggested strategies to help patients adjust to dietary regimens in order to reduce their impact on quality of life [16].

Medication and hemodialysis both are costly, which has become a burden for the families having CKD patients. Without a definite dietary advice, patients may not follow appropriate dietary practices according to their need, which may lead to malnutrition. Such patients observe increased morbidity, a decrease in functional capacity, and a greater number and duration of hospital admission, all of which may cause a low health related quality of life. It is crucial to yield needed data regarding dietary pattern and nutritional status of the CKD patients so that the magnitude of the problem faced by CKD patient can be assessed and invite appropriate steps from responsible communities including policy makers, attending physicians and dieticians.

METHODS

Study design & setting: This was a cross-sectional study conducted from January 2022 to December 2022 at Anwer Khan Modern Medical College hospital and NIKDU, Dhaka.

Study population: 253 patients with chronic kidney disease

Selection Criteria:

Inclusion criteria: Patients of CKD (all stages), age 18 to 65 years. Willing to participate.

Exclusion criteria: Critically ill patient.

Data collection and analysis: Data were collected through face-to-face interview using a pre-tested data collection sheet. Before preceding the data collection, the detail of the study was explained to each eligible patient and written consent from the patient was obtained. The relevant socio-demographic data along with anthropometric data of the patients were collected and recorded. Computer based statistical analysis were carried out with appropriate techniques and systems. Quantitative data were expressed as mean and standard deviation and qualitative data were expressed as frequency distribution and percentage. Statistical analysis was performed by using Statistical Packages for Social Sciences (SPSS version 25). Dietary pattern was assessed with food

frequency questionnaire, number of major meals per day, light meal, skipped meal for last 7 days. For nutritional assessment, “Asian criteria” BMI cut-off was performed. The patient was then assigned a rating of underweight (<18.5), normal (18.5-22.9), overweight (23-24.9), pre-obese (25-29.9), obese (≥ 30), obese type-1(30-40), obese type 2 (40.1-50, super obese) and obese type 3 (>50, morbid obese). * Anthropometric parameters, such as height (cm), weight (kg), BMI (kg/m^2) were recorded. Height was measured with measuring tape and weight was measured with weight machine (CAMRY, Model-EB938).

Diet composition was measured with FCS. In Bangladesh, the **Food Consumption Score (FCS)** is a standardized index used by the **World Food Programme (WFP)** and the **Bangladesh Bureau of Statistics (BBS)** to assess household food security based on dietary diversity and frequency of consumption over a seven-day period. The Food Consumption Score (FCS) in Bangladesh measures household dietary diversity and quality, categorizing food security into Poor (≤ 28), Borderline (>28 and ≤ 42), and Acceptable low (43-52), Acceptable high (>52) with weights adjusted for local staples like rice, fish, and oil [17].

[*WHO Expert Consultation. Appropriate body-mass index for Asian populations and its implications for

policy and intervention strategies. Lancet. 2004;363:157–163. doi: 10.1016/S0140-6736(03)15268-3]

Ethical considerations: Ethical clearance of the study was obtained from the Institutional review board of NIPSOM, Bangladesh. Informed written consent was obtained from the respondents after describing the objectives and procedure of the study and ensuring that there was no chance of any physical, mental, social and economic harm to them. Each participant voluntarily took part in the study. Privacy and confidentiality were maintained strictly. Participants had the liberty to refuse to participate at any point of the study. Anonymity of data was maintained and access to data was restricted to the Principal Investigator.

RESULTS

Table-1 shows that about 24% of the respondents belonged to age group 46-55 years, mean ($\pm$ SD) of the age of the respondents was 52.25 ($\pm$ 13.76) years. Most of the respondents (51.4%) were male. About 38% of the respondents had their educational qualification up to college, 42% of the respondents were house wife, 79% were married, 36% had monthly income within TK 50,001- 75000.

Table 1 Baseline characteristics of the respondents (n=253)

Baseline characteristics	Frequency	Percentage
Age in years		
18-25	6	2.4
26-35	26	10.2
36-45	55	21.7
46-55	60	23.7
56-65	58	22.9
>65	48	19
mean ($\pm$SD)	52.25	($\pm$ 13.76)
Sex		
Male	130	51.4
Female	123	48.6
Educational status		
Primary school	23	9.1
High school	77	30.4
College	97	38.4
University	54	21.3
Never went to school	2	0.8
Employment status		
House wife	107	42.3
Business	53	20.9
Private job	47	18.6

Unemployed	35	13.8
Student	10	4
Day labour	1	0.4
Marital status		
Unmarried	13	5.1
Married	200	78.7
Separated, divorced, widowed	40	16.2
Family size		
1-5 persons	188	74.3
>5 persons	65	25.7
Monthly family Income		
25000-50000	58	
50001-75000	91	
75001-100000	59	
>100000	45	

Table 2 shows that 68.7% respondents were pre obese and 14.5% were overweight.

Table 2: Nutritional status of the respondents (n=83)

(Respondents who did not have oedema were assessed for nutritional status by BMI) (As oedema increases the body weight and also BMI, only non-oedematous patients were assessed for the study, where sample size was 83)

Nutritional status	Frequency	Percentage
Normal weight	6	7.2%
Overweight	12	14.5%
Pre obese	57	68.7%
Obese	8	9.6%

Table 3 showed that 85.4% of the respondents took three major meals per day for the last 7 days. 54.2% ate snacks between breakfast and lunch, and 95.7%

ate snacks between lunch and dinner. 22.5% skipped any major meal. Most of the respondents (20.1%) skipped breakfast.

Table 3 Dietary pattern as physician advices to follow a healthy dietary pattern for CKD patients) of the respondents for the last 7 days (n = 253)

Characteristics	Frequency	Percentage
Major meal per day		
2 meals	37	14.6
3 meals	216	85.4
Light meal		
Yes (At midmorning)	137	54.2
No (At midmorning)	116	45.8
Yes (At evening)	242	95.7
No (At evening)	11	4.3
Skipping any meal		
Yes	57	22.5
No	196	77.5
Name of skipped meal		
Breakfast	51	20.1
Dinner	6	2.4
Never skip a meal	196	77.5

Table-4: Distribution of the respondents according the food frequency questionnaire (for last 7 days, n=253)

Food name	Never frequency (percentage)	Once a day frequency (percentage)	2-3times per day frequency (percentage)	4/ more per day frequency (percentage)	Once a week frequency (percentage)	2-3 times per week frequency (percentage)	4/more per week frequency (percentage)
Rice	-	33(13%)	216(85.4%)	4(1.6%)	-	-	-
Roti	74(29.2%)	132(52.2%)	33(13%)	-	10(4%)	4(1.6) %	-
Bread	156(61.7%)	-	-	-	85(33.6%)	12(4.7%)	-
Milk & milk products	124(49%)	18 (7.1%)	-	-	39(15.4%)	49(19.4%)	23(9.1%)
Pulses	127(50.2%)	-	-	-	92(36.4%)	29(11.5%)	5(2%)
Egg	1(0.4%)	163(64.4%)	61(24.1%)	-	5(2%)	11(4.3%)	12(4.7%)
Chicken	68(26.9%)	93(36.8%)	20(7.9%)	-	34(13.4%)	37 (14.6%)	1(0.4%)
Fish	14(5.5%)	131(51.8%)	40(15.8%)	-	8(3.2%)	49(19.4%)	11(4.3%)
Mutton	234(92.5%)	1(0.4%)	-	-	17(6.7%)	1(0.4%)	-
Beef	225(88.9%)	9(3.6%)	-	-	18(7.1%)	1(0.4%)	-
Fruits	42(16.6%)	112(44.3%)	-	-	44(17.4%)	30(11.9%)	25(9.9%)
Vegetables	-	46(18.2%)	176(69.6%)	13(5.1%)	4(1.6%)	14(5.5%)	-
Nuts	246(97.2%)	-	-	-	3(1.2%)	4(1.6%)	-
Sweet foods like sugar, chocolate, bakery etc.	127(50.2%)	35(13.8%)	-	-	67(26.5%)	20(7.9%)	4(1.6%)
Fatty foods like oil, butter, margarine	-	10(4%)	243(96%)	-	-	-	-

Table 5 showed that majority of the respondents (53.3%) took 1.5 litres of water daily. 31.2% of the respondents took extra salt during meals and 5.9% ate nuts, beans, legumes, pulses. Majority of the

respondents (62%) did not strain vegetables prior cooking. 34.4% of the respondents took fruits that are allowed in CKD.

Table 5: Dietary restrictions (According to the physician advice for CKD patients) of the respondents (n = 253)

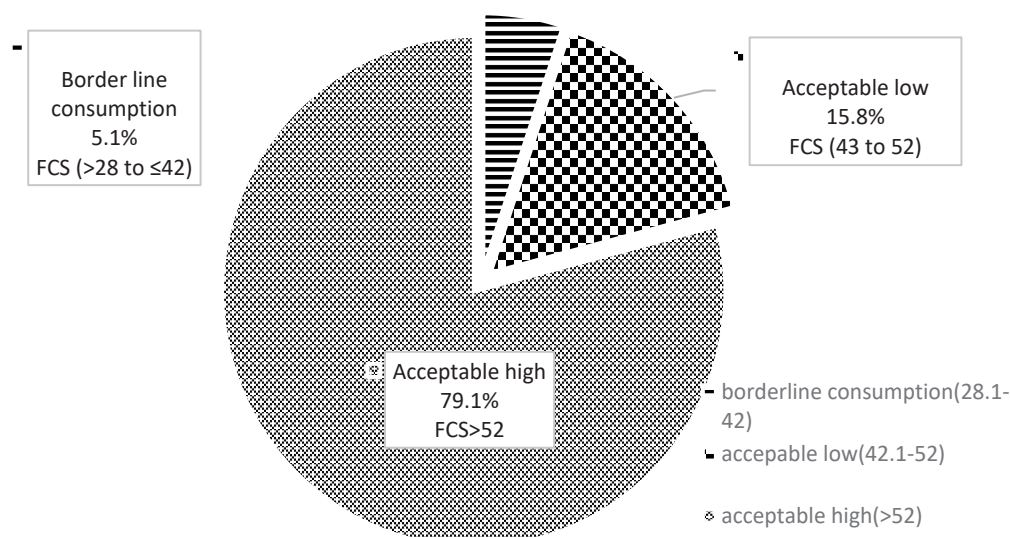
Characteristics	Frequency	Percentage
Daily water intake		
1 Litre	3	1.2
1.5 Litres	135	53.5
2 Litres	115	45.5
Extra salt intake during meal		
Yes	79	31.2
No	174	68.8
Intake of nut, beans, legumes, pulses		
Yes	15	5.9
No	106	41.9
Sometimes	32	52.2
Straining of vegetables in boiling water prior cooking		
Yes	91	36
No	157	62
Sometimes	5	2
Intake of fruits		

Fruits that are allowed to eat in CKD (apple, guava, papaya, pineapple, pear)	87	34.4
All types of fruits-allowed & not allowed	124	49
Never took fruits	42	16.6

The figure 1 shows the majority of the respondents (79.1%) had acceptable high FCS, 15.8% of them

Acceptable low consumption. None of the respondents had poor consumption (≤ 28).

Figure-1: Respondents according the Food Consumption Score **in Bangladesh. (n=253)



[**The Food Consumption Score (FCS) in Bangladesh measures household dietary diversity and quality, categorizing food security into Poor (≤ 28), Table - 6 shows CKD patients of higher age group (>45 years) showed higher proportion of obesity than

Borderline (>28 and ≤ 42), and Acceptable low (43-52), Acceptable high (>52) with weights adjusted for local staples like rice, fish, and oil].

younger age group (18-45 years) and the difference was significant ($p < 0.05$).

Table-6: Association of different variables with nutritional status (n=253)

Characteristics		Nutritional status ^a				p-value
		Normal	Over Weight	Pre Obese	Obese	
Dietary pattern (Major meal intake per day)	2 meals (n=37)	1 (2.7%)	6 (16.2%)	22 (59.5%)	8 (21.6%)	(0.471)
	3 meals (n=216)	13 (6%)	20 (9.3%)	124 (57.4%)	59 (27.3%)	
Dietary pattern (Skipped meal)	Yes (n=57)	4 (7%)	6 (10%)	33 (58%)	14 (25%)	(.940)
	No (n=196)	10 (5%)	20 (10%)	113 (58%)	53 (27%)	
Age (years)	18-45 (n=87)	7 (8%)	16 (18.4%)	58 (66.7%)	6 (6.9%)	(0.000)
	>45 (n=166)	7 (4.2%)	10 (6%)	88 (53%)	61 (36.7%)	
Sex	Male (n=130)	5 (3.8%)	14 (10.8%)	82 (63.1%)	29 (22.3%)	(0.209)
	Female (n=123)	9 (7.3%)	12 (9.8%)	64 (52%)	38 (30%)	
Educational	Secondary	6	9	57	30	

Status	and below (n=102)	(5.9%)	(8.8%)	(55.9%)	(29.4%)	(0.791)
	Higher secondary and above (n=151)	8 (5.3%)	17 (11.3%)	89 (58.9%)	37 (24.5%)	

DISCUSSION

This cross-sectional study was conducted to assess the dietary pattern and nutritional status of chronic kidney disease patients. Among 253 respondents, majority belonged to age group 46-55 years where the mean ($\pm$ SD) of age was 52.25 ($\pm$ 13.76) years. 51.4% of the respondents were male, rest of them were female (48.6%). 38.3% of them passed college, majority of the respondents were housewives (42.3%), 20.9% were businessman and most of the respondents were married (78.7%), 13% of them were widowed.

A study conducted in Bangladesh where the mean ($\pm$ SD) of age was 48.2 ($\pm$ 16.4) years, 56.2% of the respondents were female, 36.2% were illiterate, 79% of the respondents were married, 49% were housewives [18]. In a study, the mean BMI was 28.5, mean weight was 68.5 kg [19].

According to this study, 85.4% of the respondents took three meals a day and 14.6% of the respondents took two meals a day. This study also revealed that 54.2% of the respondents took light meat at midmorning and 95.7% of them took light meat at evening. A study showed healthy dietary patterns typically encouraged higher intakes of whole grains, vegetables, fish and low-fat dairy, and lower intakes of fruit, legumes, nuts, red and processed meats, sodium, and sugar-sweetened beverages. A healthy dietary pattern reduced the risk of CKD [20]. The study also observed there was no significant association between major meal intake and nutritional status of the respondents. A study showed that there was significant association between sex and nutritional status, height and nutritional status, weight and nutritional status of CKD patients, but there was no significant association between other socio demographic characteristics and nutritional status of CKD patients [2].

CONCLUSION

The study was conducted to assess the dietary pattern and nutritional status of CKD patients. Here most of the respondents found pre obese, obese and overweight. Most of them took three meals a day. More than half of the respondents took light meal at midmorning and most of them took light meal at evening. Regular dietary and nutritional follow up of

the CKD patients should be done for improvement of their quality.

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Original Article

PREVALENCE AND FACTORS ASSOCIATED WITH CONTRACEPTIVE USE AMONG MARRIED FEMALE GARMENT WORKERS IN DHAKA, BANGLADESH

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ABSTRACT

Background: Contraceptive use is an effective measure for fertility control and unwanted pregnancy reduction, thus improving the reproductive health of women. This study was conducted among married reproductive-aged female garment workers to assess the prevalence of contraceptive use among them and the factors associated with it.

Method: This cross-sectional study was conducted in four randomly selected garment factories in Dhaka city, from March to April, 2020. A structured questionnaire was used to collect data from 277 participants selected by simple random sampling method. Only married and within reproductive age female garment workers were included. Pregnant women, women who were trying to conceive at the time of the interview, who were not sexually active: widows, separated from husband or husband living away for more than 1 year, and women with a history of Hysterectomy were excluded from this study.

Result: Descriptive statistics were described for the dependent and independent variables. Chi-square test and logistic regression were used to find out the association between dependent and independent variables. The results showed the prevalence of contraceptive use was 74.7% among married reproductive-aged female garment workers in Dhaka city, Bangladesh. This study found a significant association between age, education, duration of marriage, number of living children, desire for additional children, Knowledge on contraception, reproductive autonomy, husband's education level, husbands' participation, family income, Influence of family member, availability and accessibility to Reproductive Healthcare facility, workplace rules and regulation, social belief, access to mass media, perception on national policy and contraceptive use (p-value < 0.05).

Conclusion: This study show, that the prevalence of contraceptive use among the target group can be increased by improving knowledge on contraception, enhancing reproductive autonomy, and utilizing mass media effectively.

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Keywords: Contraceptive use, married women, reproductive age, garment workers, unmet need, cross-sectional study, Bangladesh.

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INTRODUCTION

A high population growth rate is one of the leading problems experienced by the developing world, as it is responsible for increasing the level of poverty and decreasing life expectancy. Bangladesh is the 8th most populous country in the world with a total population of more than 170 million. The contraceptive prevalence rate is 64% according to

BDHS 2022, which means 38% of females of the reproductive age group do not use any method of contraception (1). Unwanted pregnancy and teenage pregnancy can lead to maternal mortality, which is a consequence of not using contraception. In Bangladesh, 24% of females start childbearing in their teenage years (15–19 years) (1). Unintended pregnancy is 25.4% to 35.8% among different groups

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of women in Bangladesh. Bangladesh has a higher maternal mortality ratio (MMR), which is 172/100,000 live births at present (2). Contraception can be an effective medical intervention for reducing teenage pregnancy, and unintended pregnancy, thus reducing MMR which helps improve female reproductive health and maternal and child health. One of the 4th HPNSP's (Health, Population and Nutrition Sector Program) objectives regarding teenage pregnancy is to reduce the number of childbearing teenagers to 25% by 2022. The target of SDG regarding MMR is to reduce the maternal mortality ratio to less than 70/100,000 live births. To meet all these targets, one common possible approach can be to increase the use of contraceptive methods. One of the 4th HPNSP's (Health, Population and Nutrition Sector Program) objectives regarding teenage pregnancy is to reduce the number of childbearing teenagers to 25% by 2022 (1). The target of SDG regarding MMR is to reduce the maternal mortality ratio to less than 70/100,000 live births (2). To meet all these targets, one common possible approach can be to increase the use of contraceptive methods. According to the National Institute of Population Research and Training, this country has made substantial progress in contraceptive use from 8% in 1975 to 62% in 2018 among married women of reproductive age (3). But still, the issue demands importance.

At present, Bangladesh is moving fast towards an industrialized economy in which the garment sector is playing an important role occupying a unique position in overall economic development. This industry has become the largest export-earning source of Bangladesh as well as it is considered the backbone of the country's economy. Over 4.2 million workers from lower socioeconomic conditions and having no or minimal formal education are employed in more than 4500 garment factories. Of these large numbers of workers, 80% are female (4). Although we do not have an exact record regarding the age group and marital status of female garment workers, but in Bangladesh, 55.1% of females belong to the reproductive age group, and 63.6% are married among a total 82.2 million female population (5). The workers in this sector have very low incomes which make it difficult to maintain minimum health care, medical services, hygienic accommodation and other basic needs. As a result, they have to suffer from various health-related problems especially women who are vulnerable where married female workers are very much prone to health problems due to practicing wrong as well as non-practicing family planning methods (6). The rate of miscarriage among garment workers is very high and most of them

experience abortion more than once. Only 31% of female reproductive-aged workers are using contraception (7). Most of the previous studies have revealed an association of different factors with contraceptive use among married women of reproductive age in different settings (8, 9), but little attention is given to the contraceptive use pattern of this large vulnerable female population working in garment factories.

As individual behavior both affects and is affected by multiple levels of influence through interacting with physical as well as socio-cultural environments, the Ecological model can explain different factors that affect contraceptive use among the target group of this study (10). A study of contraceptive use patterns and factors affecting the use of contraception among married reproductive-aged female garment workers is needed to improve their reproductive health, control population, as well as economic development of Bangladesh.

This study aimed to assess the prevalence of contraceptive use among married reproductive-aged female garment workers and the association of factors such as intrapersonal, interpersonal, institutional or organizational factors, community factors, and public policy with it.

METHODS

It was a cross-sectional study on married reproductive-aged female garment workers. This study was based on the ecological model. Intrapersonal factors such as age, education, religion, duration of marriage, number of living children, desire for additional children, son preference, knowledge on contraception, and reproductive autonomy, interpersonal factors such as husband's education level, husband's occupation, husband's participation, family income, influence of family members, institutional or organizational factors like availability and accessibility to reproductive healthcare facility, workplace rules and regulation, community factors such as social belief, access to mass media, public policy (perception on national policy) was described for association with contraceptive use in this study.

Sample size calculation: The Target population of this study was married, reproductive-aged female garment workers working in a garment factory in Dhaka city. According to the data of the Bangladesh Health and Demographic Survey 2017-2018, overall, 62% of the currently married women aged 15–49 years are currently using any method of

contraception. This prevalence was used to calculate the sample size in this study.

The following formula of sample size calculation was used:

$$n = \frac{z^2 P (1-P)}{d^2}$$

Where,

n = estimated sample size

z = value from normal distribution at 95 % confidence interval= 1.96

d = error = 0.06

P = the proportion in the population possessing the characteristic of interest = 62% (CPR is 62%, Bangladesh Health and Demographic Survey 2017-2018)

$$n = \frac{(1.96)^2 (0.62)(1-0.62)}{(0.06)^2}$$
$$= 251$$

To prevent attrition, 10% minimal sample size was added to sample size and thus total sample size of the study was 276.1 ~ 277.

Study population was married, reproductive-aged female garment workers.

Inclusion criteria were: a. Married women, b. Reproductive aged (15 to 49 years old) c. Working in a garment factory, d. Willing to participate.

Exclusion criteria were: a. Pregnant women, b. Women who are trying to conceive at the time of the interview, c. Who are not sexually active: widow, separated from husband, Husband living away more than 1 year, d. Women with a history of Hysterectomy e. Women who are not present at the day of data collection.

Stratified random sampling was done to select the respondents among the study population and followed by three steps-

Step 1: By studying the available list of garment factories in Dhaka city, it was seen that garment factories are situated randomly in and around Dhaka city (11). They were located in different areas in the central zone of Dhaka city (Mirpur, Uttara, Pallabi, Rampura, Double mooring) as well as in the peripheral zone of Dhaka city (Savar, Ashulia, Gazipur). These areas with different names were very small in size and located adjacent to each other. According to the location of garment factories, for this study purpose, they were categorized into two groups: a) factories located in the Central zone and b) factories located in the peripheral zone. There were 890 factories in the central zone and 869 factories in peripheral zone (12).

Step 2: 2 areas from each zone were selected by simple random sampling. Total 4 areas were there- area 1, area 2, area 3, area 4.

Step 3: 1 garment factory was selected from each area by simple random sampling. Total 4 garment factories were there- factory 1, factory 2, factory 3, factory 4.

Step 4: Participants from each factory were selected by simple random sampling method.

Sample size in each factory was calculated according to this formula: $n_i = n \times N_i / N$

Where, n_i = Number of participants taken from one garment factory, $i = 1, 2, 3, 4$.

n = Estimated sample size (n= 277)

N_i = Total number of female workers in that garment factory

N = Total number of female workers in the selected 4 garment factories.

The total number of female married reproductive-aged workers in the randomly selected 4 garment factories were 80, 152, 110 and 93, respectively. Following the formula, 51, 97, 70 and 59 participants were selected from the four garment factories, respectively, by simple random sampling.

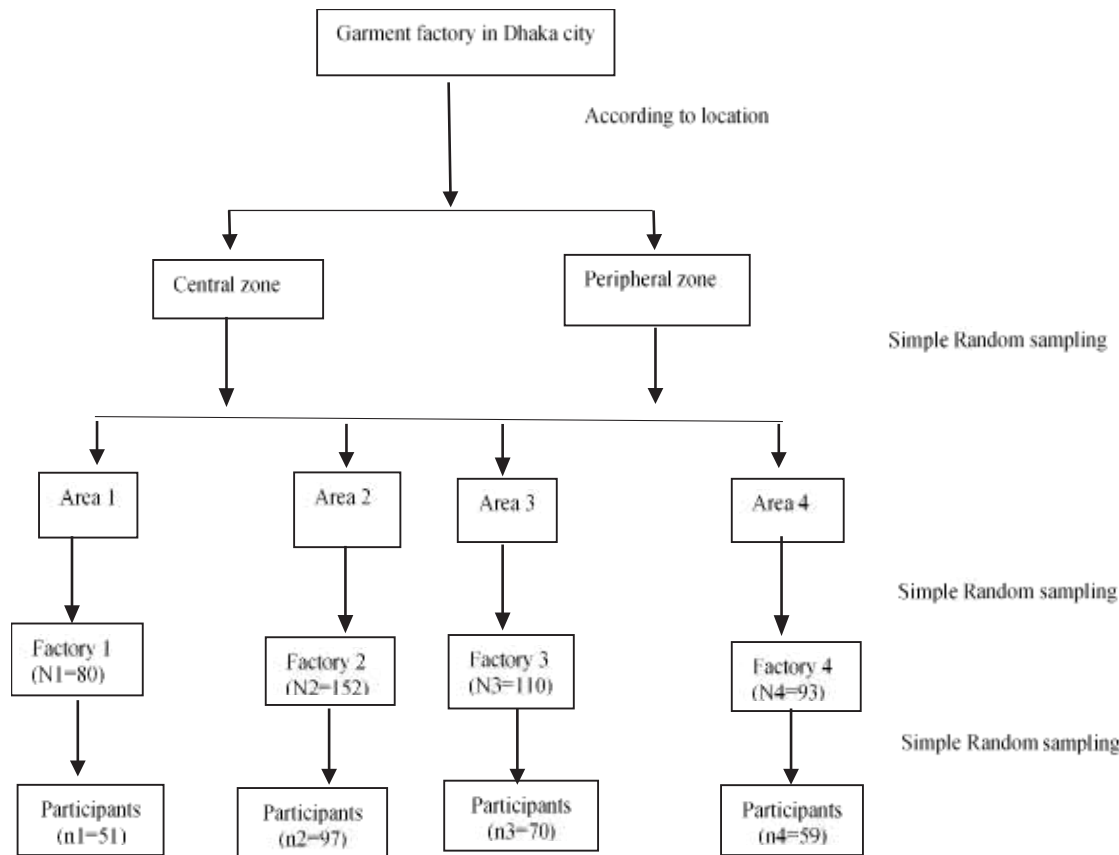


Figure: Sampling procedure

Data collection was conducted within a time frame. It was started in March, 2020 and ended in April, 2020. To collect data, two research assistants were assigned and whole methodology was explained to them. Before data collection, the whole procedure, aim of this study, detailed questionnaire were explained to the authorities of that four selected garment factories and they were requested for approval to conduct this study on respective factory. Before interview, every part of questionnaire was explained to participants and informed consent was taken from every participant by assistants. Interview lasted about 20 minutes. A structured questionnaire was used having 9 parts with a total of 89 questions related to intra-personal factors including age, education, religion, duration of marriage, number of living children, desire of additional children, son preference, knowledge on contraception, and reproductive autonomy. About reproductive characteristics, age at marriage, age at 1st pregnancy, number of conceptions, number of unwanted pregnancies, number of abortions, taking reproductive healthcare services etc. were included. Knowledge scores were categorized using a modified Bloom's cut-off point commonly used in KAP studies: 1) Well knowledge: more than or equal to 80% of the total score, 2)

Average knowledge: 60-79% of total score, 3) Poor knowledge: less than 60 % of the total score (13). Regarding reproductive autonomy, questions about decision-making about methods to be used to prevent pregnancy, about planning for a baby, decisions about unplanned baby were asked and scoring was done by following 'Development and Validation of a Reproductive Autonomy Scale' by Ushma D. Upadhyay (14). During Data analysis, Mean, median, standard deviation, minimum, maximum, and percentage values were described for the dependent and independent variables for descriptive statistics.

Regarding Inferential statistics, the chi-square test and logistic regression were used to find out the association between dependent and independent variables with a significance level of 5% by using SPSS (Statistical Package for Social Science) version 18.

Ethical implication: Before starting the study, ethical clearance was taken from the Ethical Review Committee for Human Research, Faculty of Public Health, Mahidol University (COA. No. MUPH 2020-038, Protocol No. 32/2563). Written permissions were taken from the administrative authority of selected garment factories. Throughout the study,

neither an invasive procedure nor any intervention was done. Before the initiation of the interview, a brief introduction about aims, objectives and way of interviewing was described to the participant. Also, the right to participate or refuse was given to them. Their confidentiality was assured. After taking informed written consent the interview was started and proper privacy was maintained.

RESULTS

Descriptive statistics

The results showed the age distribution of the total participants (n=277) where 39% of the participants were 26 to 30 years old and 67.5% of participants got married at 17 to 19 years old and 12.6% got married at less than 16 years old. This data showed about 80% of participants got married at less than 20 years of age while the minimum age of being married was 15 years old. More than 61% of participant became pregnant at 17 to 19 years of age while the minimum age of being pregnant was 16 years old. The study revealed that more than 49% participants had primary level education and more than 23% below primary

level, which reveals very low level of education among female garment workers. Among the participants, more than 90% are Muslims and remaining are from religion other than Muslim. 45% of the participants are married for 6 to 10 years, with mean 10.44 years of married life. Among participants, 42.3% had one child, 37.9% had two, 16.2% had three and 3.6% had four children. Regarding sex of the child, 34.3% had only male child, 20.6% had only female child and 45.1% had both male and female child. Among participants, 35% had desire for additional children, among them (n=97) and 37% had desire for additional child due to having son as further child which is son preference. This study revealed, 27.4% participant had conceived for once, 38.3% for twice, 16.6% for thrice, 12.3% for four times and 5.4% for more than four times. About 32% had history of unwanted pregnancy where more than 26% had experience of unwanted pregnancy at least once. 45% of the participant had history of abortion and among them (n=125) more than 86% experience of abortion at least once in life. Also the data revealed that 32.4% of the total abortion cases occurred intentionally.

Table 1: Frequencies and percent distribution of general characteristics of the participants (n=277)

Variables	Frequencies	Percentage (%)
Age group of the participants		
≤ 20 years	3	1.1
21 to 25 years	79	28.5
26 to 30 years	108	39.0
31 to 35 years	61	22.0
36 to 40 years	22	7.9
41 to 45 years	3	1.1
≥46 years	1	0.4
Mean:28.56 ± S.D. 4.858, Minimum:17, Maximum:46		
Participants age at marriage		
≤16 years	35	12.6
17 to 19 years	187	67.5
20 to 22 years	50	18.1
23 to 25 years	5	1.8
Mean 18.08 ± S.D. 1.592, Minimum:15, Maximum :25		
Participants age at 1st pregnancy		
≤16 years	4	1.4
17 to 19 years	170	61.4
20 to 22 years	90	32.5
23 to 25 years	11	4.0
≥26	2	0.7
Mean 19.25 ± S.D. 1.826, Minimum:16, Maximum:29		
Participants education level		
Less than primary	65	23.5
Primary	137	49.4
Secondary	74	26.7
Higher secondary	1	0.4

Religion		
Muslim	250	90.3
Other than Muslim	27	9.7
Duration of marriage		
Less than 5 years	37	13.4
6 to 10 years	126	45.5
11 to 15 years	66	23.8
More than 15 years	48	17.3
Mean 10.44 ± S.D. 4.970, Minimum:2, Maximum:30		
Number of children:		
One	117	42.3
Two	105	37.9
Three	45	16.2
Four	10	3.6
Gender of existing children:		
Male	95	34.3
Female	57	20.6
Both	125	45.1
Desire for additional children:		
Yes	97	35.0
No	180	65.0
Cause of desire of more child (n=97):		
To have son	36	37.1
To have daughter	14	14.4
To have desired no. of child	47	48.5
Desire for additional child due to		
Son preference	36	37.1
Other than son preference	61	62.9
Number of conceptions:		
One	76	27.4
Two	106	38.3
Three	46	16.6
Four	34	12.3
More than four	15	5.4
Experience of unwanted pregnancy:		
Yes	88	31.8
No	189	68.2
Number of unwanted pregnancies (n=88):		
One	73	26.3
Two	14	5.1
Three	1	0.4
Experience of abortion in participants		
Yes	125	45.1
No	152	54.9
Number of abortions in participants (n=125):		
Once	108	86.4
Twice	17	13.6
Mode of abortion (among total 142 abortion cases):		
Naturally occurred	96	67.6
Done intentionally	46	32.4

The level of knowledge on contraception was measured by the cumulative score of the participants answer of 12 items about information on

contraceptive use. The minimum score among the participants was 1, maximum was 9 with a mean score of 5.556.

Table 2: Frequencies and percent distribution of participants according to level of knowledge (n=277)

Knowledge level	Frequency	Percent
Poor Knowledge (<7)	190	68.6
Average Knowledge (7 -9)	87	31.4
Well Knowledge (≥10)	0	0

Mean 5.55 ± S.D. 1.78, Minimum: 1, Maximum: 9

More than 80% of the participants knew that using contraception can prevent unplanned pregnancy while 76.9% knew about minor side effects of oral

pill. However, they had poor knowledge on IUD, sterilization and calendar method of contraception.

Table 3: Frequencies and percent distribution of participants by correct score of knowledge items(n=277)

Statement	Correct answer	
	Frequency	Percentage
• Using contraceptive method can prevent unplanned pregnancy	224	80.9
• Oral pill has minor side effects (for example, Nausea, vomiting, dizziness) for some women	213	76.9
• Birth spacing is important for mothers' health	209	75.5
• Injection is taken once in three months	201	72.6
• If you forget to take oral pills, you should continue to take according to instruction of oral pill pack.	192	69.3
• Implant can prevent pregnancy up to 3 years	151	54.5
• Women can conceive after IUD removal	110	39.7
• Breast feeding can act as contraception	87	31.4
• Condom prevents pregnancy and STD	71	25.6
• IUD can cause heavy menstrual bleeding for some months after insertion	42	15.2
• After completing family, sterilization can be used	35	12.6
• To maintain calendar method, it is needed to have regular menstrual cycle	4	1.4

Regarding the level of reproductive autonomy, the minimum score among the participants was -9, maximum was 30 with a mean score of 16.0469.

According to the result, 44% of the participants had poor autonomy. 17% and 39% of the participants had average and well autonomy respectively.

Table 4: Frequencies and percent distribution of Reproductive Autonomy level of participants (n=277)

Level of Reproductive Autonomy	Frequency	Percent
Poor (≤16)	122	44.0
Average (17-18)	47	17.0
Well (>18)	108	39.0

Mean 16.04 ± S.D. 6.92, Minimum: -9, Maximum:30

Interpersonal factors showed the occupation of the participants husband. These are 1.8%, 19.1%, 22.4%, 24.5%, 3.6% and 28.6% for Unemployed, Factory worker, Driver, Business, Govt. job and Others categories respectively. For the education level of

participants husband, the data revealed that more than half about 54.2% of them had education up to a secondary level. In case of less than primary, primary and higher secondary level the percentage is 2.2%, 20.9% and 22.7% respectively. Among the

participants husbands, more than 75% of husbands participated in decision making about using contraception and 24.9% did not. On the other hand, 82.3% of participants husbands participated in decision making about the number of children in the family whereas the remaining 17.7% did not. Regarding total family income, 48.4% of participants had a total family income of more than 26,000 BDT. 20.9% and 30.7% of participants had a total family income of less than 20,000 and in the range of 21,000 to 25,000 BDT. The mean of their family income was 24129.96 BDT where the minimum was 14000 BDT and the maximum was 30000 BDT. Among the participants 70.8 % thought that their total family income was adequate, whereas 19.9% and 9.3% of participants total family income was inadequate without debt and inadequate with debt respectively. It was found that 22% of the participants had the influence of family members on the decision making of having a baby in their life and 78% had no such influence.

Analysis of the **institutional or organizational factors** showed that more than half of the participants went to government hospitals for reproductive healthcare services. Then 31% of participants went to different healthcare centers affiliated with NGO. 12.3%, 2.2%, and 0.7% of participants usually went to drug stores, private clinics and private hospitals respectively. More than 79% of participants were satisfied with the service of the healthcare center. Regarding mode of transport, 47.3% used tricycle rickshaw, 40.3% went by walking, remaining 6.1%, 5.1%, and 1.1% went by bus, car and motorcycle respectively. Among all participants, 88.4% usually took less than 30 minutes to go to the reproductive healthcare center while the remaining took more than 30 minutes. Here, the minimum was 5 minutes, Maximum was 60 minutes with a mean of 22.22 minutes. It was found convenient to go to a healthcare center for reproductive healthcare service by 67.1% of participants, while the remaining found it inconvenient. It was found that 57.8% of participants usually had to wait less than 30 minutes at the reproductive healthcare center for required service, while the remaining had to wait more than 30 minutes. Here, the minimum was 1 minute, Maximum was 60 minutes with a mean of 31.84 minutes. More than half, 53.8% of the participants said, there were available free healthcare facilities in government hospitals as well as in some private healthcare facilities, while the remaining said that free service was not available. Among those, who said free service was available, 22.1% found it expensive even after being free of cost due to transportation and medicine expenses. Only 16.6% of

the participants had home visits of family planning workers but most of them were before more than six months. It is revealed by 25.3 % of participants that there was rule in the factory that goes against pregnancy. Most of them said that they had to discontinue jobs if pregnant. Others said about the discontinuation of the job if sick due to pregnancy, absence of leave during pregnancy, lack of rest time for pregnant ladies and pregnant women are not eligible to be recruited for the job.

In **community factors**, participants showed a high level of social belief on contraception where 82.3% had low belief against contraception with a minimum score of 13.00, maximum score of 37.00 and mean score of 23.9314. Among all participants 13.4% had an average belief against contraception and 4.3% had a high belief against contraception. The study showed participants perceptions of different social beliefs against contraception. 41.2% of participants disagreed with the statement that contraception is against nature while 25.3% agreed. Similarly, 46.6% of participants disagreed with the statement that Contraception can make one sterile while 29.5% agreed. Moreover, 36.5% of participants agreed with the statement that Contraception can cause serious disease while 53.1% disagreed. 66.1% of participants disagreed with the statement that More children can make the family stronger while 19.8% agreed. For the statement Contraception is forbidden in Islam, 62.1% disagreed. Similarly, the majority group disagreed with the statement that the Pill can cause fetal abnormality, long-acting methods for females can cause harm to their husbands and Contraception can weaken the bond between spouses. Different opinions were found on the statement that Contraception causes weight gain and Pill can be accumulated within the body, where the majority agreed with that statement with 67.5% and 52.7% respectively. The study also showed more than 76% of the participants had access to mass media. Among them 74% had access to Television and only 24.1% of them had any information regarding contraception. When asked further, most of them got information about where to get reproductive healthcare services and then the name of NGO they had known from mass media.

Among participants 67.9 % had a low perception of **national policy** where the minimum score was 5.00 and the maximum score was 10.00 with a mean score of 6.94. 67.9% of the participants knew that free healthcare services were available in all government or some private hospitals, while 32.1% did not know about this free service. On the other hand, only 22.4% of participants knew that there was 24-hour available service in all government healthcare

facilities, while the majority did not know about that. Similarly, only 15.9% of participants knew about national policy. Regarding the popular slogan of national policy, 52.7% knew about it, among them three fifth (3/5) followed the slogan of national policy.

Collected data revealed that among the participants, the prevalence of contraceptive use was 74.7%, while 25.3% of participants did not use any contraceptive method currently. Among the participants who were not using contraceptive methods, 54.3% had done it willingly, 35.7% due to side effects and 10% due to husbands' demand. Among current contraceptive users, 49.3% were using oral pills. After that Depo injection, Copper T, Condom, Implant and Sterilization were used by 19.3%, 16.9%, 6.8%, 6.3% and 1.4% of participants respectively. The most preferred method of contraception among participants was oral pill (36.7%) and after that Condoms, Depo injection, Copper T, Implant and Natural method came with 20.8%, 19.8%, 14.5%, 6.3% and 1.9% respectively. 71.8% of participants had ever changed contraceptive methods and among them 43.7% had changed due to side effects.

Inferential statistics

The **age** of the participants had a significant association with contraceptive use (p-value <0.001). Participants aged 30 years or below were 5 times (OR=4.948, 95% CI: 2.777 - 8.816) more likely to use contraception than those aged above 30 years. 84.7% of the participants of the age group 30 years or below used contraceptives. Participants **age at marriage** had a significant association with contraceptive use (p-value 0.002). Participants who got married at 19 years or above age were 2.7 times (OR=2.667, 95% CI: 1.4 - 5.120) more likely to use contraception than those who got married at 18 years or below age. More than 85% of the participants of the age group 19 years or above had found using contraceptives. Participants **age at 1st pregnancy** had a significant association with contraceptive use (p-value 0.001). Participants who had 1st pregnancy at 20 years or above age were 3 times (OR=3.017, 95% CI: 1.580 - 5.762) more likely to use contraception than those who had 1st pregnancy at 19 years or below age. Contraceptive was used by 86.4% of participants among those who had 1st pregnancy at 20 years or more age. Participants **level of education** was found significantly associated with

contraceptive use (p-value 0.005). Participants with an education level more than primary were 3 times (OR=2.746, 95% CI: 1.322 - 5.705) more likely to use contraception than those with an education level primary or less. Contraceptive was used by 86.7% of participants among those whose education level was more than primary. The **duration of marriage** of the participants had a significant association with contraceptive use (p-value <0.001). Participants with duration of marriage less than 10 years were 11 times (OR=10.690, 95% CI: 4.869 - 23.467) more likely to use contraception than those with duration of marriage 10 years or more. Among participants with a duration of marriage less than 10 years, 93.8% were using contraceptives. Several **living children** had a significant association with contraceptive use (p-value <0.001). Participants with two or fewer children were 6 times (OR=6.061, 95% CI: 3.211 - 11.439) more likely to use contraception than those with more than two children. Among participants with two or fewer children 82.4% were using the contraceptive method. **Experience of abortion** had a significant association with contraceptive use (p-value <0.001). Participants without experience of abortion were 3 times (OR=3.105, 95% CI: 1.760 - 5.478) more likely to use contraception than those with experience of abortion. Among participants without experience of abortion, 84.2% were using contraceptive methods. The **desire for additional children** was also found significantly associated with contraceptive use (p-value <0.001). Participants who want more children in the future after at least one year were 7 times (OR=6.923, 95% CI: 3.025 - 15.842) more likely to use contraception than those who don't want more children in the future. Among participants who want more children, 92.8% were using contraceptive methods. **Experience of unwanted pregnancy** had a significant association with contraceptive use (p-value <0.001). Participants without experience of unwanted pregnancy were 4 times (OR=4.057, 95% CI: 2.294 - 7.175) more likely to use contraception than those with experience of unwanted pregnancy. Among participants without experience of unwanted pregnancy, 83.6% were using contraceptive methods. The desire for additional child due to **son preference** and participants' **religion** were found not significantly associated with contraceptive use. Significant association between **level of knowledge** on contraception of the participants and contraceptive use is shown in Table 2.

Table 5: Association between level of knowledge on contraception of the participants and contraceptive use (n=277)

Variables	Contraceptive use		OR	95% CI	p-value
	Yes n (%)	No n (%)			
Knowledge on Contraception					
Average Knowledge	81 (93.1%)	6 (6.9%)	6.857	2.838-16.567	<0.001
Poor Knowledge	126 (66.3%)	64 (33.7%)	1		
Significant p-value <0.05					

Significant p-value <0.05

Significant association between level of reproductive autonomy of the participants and contraceptive use is shown in table 3.

Table 6: Association between level of reproductive autonomy of the participants and contraceptive use (n=277)

Variables	Contraceptive use		OR	95% CI	p-value
	Yes n (%)	No n (%)			
Reproductive Autonomy					
Well	95 (88%)	13 (12%)	4.217	2.150-8.484	0.164
Average	35 (74.5%)	12 (25.5%)	1.705	0.804-3.615	<0.001
Poor	77 (63.1%)	45 (36.9%)	1		

Significant p-value <0.05

Participants' **husband's level of education** was found significantly associated with contraceptive use (p-value 0.001). Participants with husbands' education level more than primary were 2 times (OR=2.628, 95% CI: 1.444 - 4.784) more likely to use contraception than those with husband's education level primary or less. Contraceptive was used by 79.3% of participants among those whose husband's education level was more than primary. Regarding the **husband's occupation**, there was no significant association between participants' husband's occupation and contraception use (p-value 0.851). Participants' **husband's participation in contraceptive use** was found significantly associated with contraceptive use (p-value <0.001). Participants with husbands participating in decision making regarding contraceptive use were 5 times (OR=5.088, 95% CI: 2.805 - 9.230) more likely to use contraception than those with non-participating husbands. The contraceptive was used by 83.2% of participants among those with husbands participating in decision making regarding contraceptive use. Similarly, participants' **husband's participation in decision making** about several children in the family was found significantly associated with contraceptive use (p-value <0.001). Participants with husbands participating in decision making regarding the number of children in the family were 6 times (OR=5.905, 95% CI: 3.060 - 11.395) more likely to use contraception than those with non-participating husbands. The contraceptive was used by 81.6% of

participants among those with husbands participating in decision making regarding the number of children in the family.

Total **family income** was not significantly associated with contraceptive use (p-value 0.907). However, participants' perception of the adequacy of family income had a significant association with it (p-value <0.001). Participants with adequate family income were 5 times (OR=5.398, 95% CI: 3.011 - 9.679) more likely to use contraception than those with inadequate income. Among those with adequate family income 84.7% of participants used contraception. The **influence of family members** on decision making about having a baby was found significantly associated with contraceptive use (p-value 0.005). Participants with such influence were 3 times (OR=3.176, 95% CI: 1.371 - 7.360) more likely to use contraception than those without such influence. The contraceptive was used by 88.5% of participants among those with the influence of family on decision making about having a baby. **Availability of free healthcare services** was found significantly associated with contraceptive use (p-value 0.197).

Expenses of transportation and medicine while healthcare service free (n=149) were found significantly associated with contraceptive use (p-value <0.001). Participants who found it not expensive were 12 times (OR=12.18, 95% CI: 4.92 - 30.15) more likely to use contraception than those

who found it expensive. Contraceptive was used by 88.8% of participants among those who found it not expensive. The time required to go to the healthcare center was found significantly associated with contraceptive use (p-value <0.001). Participants taking less than 30 minutes were 5 times (OR=5.560, 95% CI: 2.574 - 12.007) more likely to use contraception than those taking more than 30 minutes. The contraceptive was used by 79.2% of participants among those taking less than 30 minutes to go to the healthcare center. Similarly, **waiting time** at healthcare centers was found significantly associated with contraceptive use (p-value 0.001). Participants waiting for less than 30 minutes were 2 times (OR=2.437, 95% CI: 1.401 - 4.237) more likely to use contraception than those waiting for more than 30 minutes. The contraceptive was used by 81.9% of participants among those waiting for less than 30 minutes at the healthcare center. Participants who considered it was convenient to go to a healthcare center were found 3 times (OR=3.177, 95% CI: 1.810 - 5.576) more likely to use contraception than those considering it inconvenient. This relation showed a significant association at p-value <0.001. Similarly, satisfaction with service was found to be a significant association at the same p-value. Contraceptive use was 5 times more likely among participants who were satisfied with healthcare service. Home visit by family planning workers was found significantly associated with contraceptive use (p-value 0.001). Participants who had home visits by family planning workers were 6 times (OR=5.856, 95% CI: 1.756 - 19.527) more likely to use contraception than those who had not. The contraceptive was used by 93.5% of participants among those who had home visits by a family planning worker. The presence of factory rules against pregnancy was found significantly associated with contraceptive use (p-value <0.001). Participants working in a garment factory with rules against pregnancy were 34 times (OR=34.500, 95% CI: 4.692 - 253.690) more likely to use contraception than those working in a garment factory without such rule. The contraceptive was used by 98.6% of participants among those working in a garment factory with rules against pregnancy. Social belief in contraception was found significantly associated with contraceptive use (p-value <0.001). Participants who had a social belief not against contraception were 15 times (OR=15.801, 95% CI: 7.60 - 32.83) more likely to use contraception than those who had a social belief against contraception. Contraceptive was used by 85.1% of participants among those who had social belief not against contraception. Access to mass media was found significantly associated with contraceptive use (p-value <0.001). Participants who had access to mass media were 4 times (OR=3.686,

95% CI: 2.029 - 6.694) more likely to use contraception than those who had no access to mass media. Contraceptive was used by 81.1% of participants among those who had access to mass media. Acknowledgment of free healthcare service was not significantly associated with contraceptive use (p-value 0.655). On the other hand, acknowledgment of the 24-hour availability of healthcare service was found significantly associated with contraceptive use (p-value <0.001). Participants who knew about the availability of healthcare services for 24 hours in government facilities were 5 times (OR=4.940, 95% CI: 1.893 - 12.894) more likely to use contraception than those who did not know. Contraceptive was used by 91.9% of participants among those who acknowledged about availability of healthcare services for 24 hours in government facilities. Acknowledgment of national policy about family planning was found significantly associated with contraceptive use (p-value 0.007). Participants who knew about the national policy about family planning were 4 times (OR=3.952, 95% CI: 1.360 - 11.483) more likely to use contraception than those who didn't know. The contraceptive was used by 90.9% of participants among those who acknowledged about the national policy about family planning. Acknowledgment of the slogan of national policy about family planning was found significantly associated with contraceptive use (p-value 0.014). Participants who knew about the slogan of national policy about family planning were 2 times (OR=1.989, 95% CI: 1.145 - 3.453) more likely to use contraception than those who did not know. Contraceptive was used by 80.8% of participants among those who acknowledged about slogan of national policy about family planning. Among the participants, who had acknowledged of slogan of national policy about family planning (n=146) there was a significant association between following the slogan and contraceptive use (p-value <0.001). Participants who followed the slogan of national policy about family planning were 8 times (OR=8.036, 95% CI: 3.192 - 20.227) more likely to use contraception than those who did not follow. Contraceptive was used by 91.8% of participants among those who followed the slogan of national policy about family planning. At last, participants' perception of national policy was significantly associated with contraceptive use (p-value <0.001). Participants with a high perception of national policy were 15 times more likely to use contraception (OR=15.873, 95% CI: 4.83 - 52.13) than participants with a low perception.

DISCUSSION

According to the study, the prevalence of contraceptive use was 74.7% among married reproductive aged female garment workers in Dhaka City, Bangladesh. In this study, the most frequently used method of contraception was the oral pill (49.3%). After that Depo injection, Copper T, Condom, Implant and Sterilization were used by 19.3%, 16.9%, 6.8%, 6.3% and 1.4% of participants respectively. Regarding not using contraceptive methods, 54.3% had done it willingly, 35.7% due to side effects, and 10% due to husbands' demand. Intrapersonal factors such as age, education, duration of marriage, number of living children, desire for additional children, Knowledge on contraception, and reproductive autonomy were found significant associations with contraceptive use. Previous study in Bangladesh and Indonesia also showed similar findings (15, 16).

Interestingly number of living children had significant association with contraceptive use (p -value < 0.001) where participants with two or less child were 6 times ($OR=6.061$, 95% $CI: 3.211 - 11.439$) more likely to use contraception than those with more than two children. It could be explained that perception among women that fertility decreases after birth of several children and also with age could discourage women who had more than two children to use contraceptive. This finding is similar with a study conducted in Bangladesh (15). But several studies conducted previously in Bangladesh, Pakistan, Afghanistan, Indonesia showed different result saying number of living children increases contraceptive use (16, 17, 18, 19).

Another interesting finding was Desire for additional children variable found significantly associated with contraceptive use (p -value < 0.001) and revealed that participants who want more child in future after at least one year were 7 times ($OR=6.923$, 95% $CI: 3.025 - 15.842$) more likely to use contraception than those who does not want more child in future. But several studies conducted previously in Bangladesh, Pakistan, Indonesia showed different result showing that woman who had no desire for more children was much more likely to use contraception (16, 19, 20).

Interpersonal factors such as the husband's education level, husband's participation, family income, and Influence of family members were significantly associated with contraceptive use. These findings are consistent with those reported in previous studies (18, 21). In Institutional/organizational factors, availability and accessibility to Reproductive Healthcare facility, workplace rules and regulation found significant associations with contraceptive use.

Similar associations have been documented in other studies (15, 16). For community and public policy factors, social belief, and access to mass media, some factors related to the perception of national policy were found significant association with contraceptive use supported by previous research conducted in Bangladesh and elsewhere (15, 21). On the other hand, no association is found between religion, son preference, husband's occupation and contraceptive use. Factors having significant association create a further workspace to march forward.

Limitation of the study: This study was conducted during COVID-19 pandemic. Data collector had to face difficulties to collect data while maintaining personal protective equipment and physical distance. The study was a cross-sectional study among married reproductive aged female garment workers in Dhaka city, the capital city of Bangladesh. So, the result is not possible to be generalized among garment workers outside Dhaka city due to obvious differences in social, economic, and cultural context between inside and outside of the town. As the questions about contraception, reproductive autonomy, the cause of not using contraception, abortion etc. are sensitive issues for some participants due to the social and cultural context of Bangladesh, sometimes answers to these items can be biased. This research was based on ecological model. Some individual and intrapersonal factors such as participants reproductive characteristics, abortion, and unwanted pregnancy could not be explored due to the limitation of time which need further investigation.

CONCLUSION

The results showed the prevalence of contraceptive use was 74.7% among married reproductive-aged female garment workers in Dhaka city, Bangladesh. This study found a significant association between age, education, duration of marriage, number of living children, desire for additional children, Knowledge on contraception, reproductive autonomy, husband's education level, husbands' participation, family income, Influence of family member, availability and accessibility to Reproductive Healthcare facility, workplace rules and regulation, social belief, access to mass media, perception on national policy and contraceptive use (p -value < 0.05). On the other hand, no association is found between religion, son preference, husband's occupation and contraceptive use.

RECOMMENDATIONS

According to the study more than 68% of the participants had poor knowledge on contraception. Improvement of knowledge can directly increase contraception use as well as indirectly decrease unwanted pregnancy and abortion which can be done using appropriate information education communication (IEC) material that is suitable for the target population with minimum or without any formal education. Thus, it contributes to maintaining the well-being of reproductive health. To enhance reproductive autonomy, sharing thoughts during decision making, proper communication and a supportive mentality are crucial which can be achieved by different methods like couple counseling sessions or post-marital counseling. Government and non-government organizations should work in collaboration to make such policies, implementing and monitoring.

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Original Article

WOMEN EMPOWERMENT AND SAFE MOTHERHOOD PRACTICES AMONG RURAL WOMEN

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ABSTRACT

Background: Women's empowerment is increasingly recognized as a determinant of maternal healthcare utilization, yet evidence from rural Bangladesh remains limited. This study examined the association between women's empowerment and safe motherhood practices among rural mothers.

Methods: A descriptive cross-sectional survey was conducted with 400 rural mothers in five villages of Kolakopa union, Nawabganj upazila. Data were collected via semi-structured questionnaires through face-to-face interviews using purposive sampling technique and analyzed using IBM SPSS 26 version with results presented through frequencies, percentages, charts, and tests.

Results: The women in the study had a mean age of 28.61 years (± 5.763 SD). Most respondents were housewives (98.3%) with secondary-level education (42.5%) and small family size (82.5%). Nearly two-thirds (63.5%) of the women had low empowerment, while only 12.8% were highly empowered. Key safe motherhood indicators showed that less than half (43.5%) completed four or more ANC visits, although over two-thirds delivered in (74.3%) health facilities with skilled birth attendants (74.5%) and received postnatal care within 48 hours (70.3%). Women's empowerment was significantly associated with the use of antenatal care, institutional delivery, skilled birth attendance, and timely postnatal care (all $p < 0.001$). Sociodemographic factors—particularly education, household income, and age at marriage—were also strongly associated with both empowerment and maternal healthcare use. ($p < 0.001$)

Conclusion: Findings of the study shows that Higher women's empowerment is linked to greater use of safe motherhood services among rural women. Improving women's education, economic participation, and decision-making can help reduce preventable maternal deaths.

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INTRODUCTION

Maternal and neonatal mortality remain major challenges in LMICs despite global efforts. Now, the burden of maternal mortality is the highest in South Asia and Sub-Saharan Africa. In these regions, many women still don't receive adequate care during

pregnancy, childbirth, or the postnatal period ^{1,2}. Several factors contribute to this problem: a shortage of skilled birth attendants, limited access to institutional deliveries, widespread poverty and illiteracy, persistent gender inequality, and overall weak health systems ^{3, 4}. To address this global

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challenge, initiatives have been launched over the years. Starting with the Safe Motherhood Conference in 1987, followed by the Millennium Development Goals, and more recently the Sustainable Development Goals—all of these highlight maternal health as a major public health priority³.

Proven interventions: ANC, skilled delivery, PNC—reduce morbidity/mortality and promote women's reproductive rights³⁻⁵. Women's empowerment is multidimensional. Factors such as Education, Economic Participation, decision making autonomy and freedom of mobility directly shape Whether the women are able to use maternal health services⁶.

This study explores how women's empowerment influences the use of maternal health services and maternal health outcomes among rural women. It focuses on both external factors, such as education and access to resources, and internal factors, such as decision-making autonomy. Rural women are emphasized because they face greater barriers to maternal healthcare, making this group critical for reducing maternal mortality. Ultimately, this research seeks to contribute to the ongoing efforts to achieve the Sustainable Development Goal (SDG) target of reducing maternal mortality to below 70 per 100,000 live births by 2030.

METHODS

Study design, settings and period

A descriptive cross-sectional study was conducted to evaluate the association between women's empowerment and safe motherhood practices among rural women. The study was carried out over a period of one year, from July 2024 to June 2025, following a structured timeline that included protocol development, approval, ethical clearance, questionnaire preparation, data collection, analysis, and report writing. The study was conducted in five selected villages—Kashimpur, Purba Shamshabad, Pashchim Shamshabad, Panail, and Nobabganj—of Kolakopa Union under Nawabganj Upazila, Dhaka District.

Study population, sample size & sampling technique : The study population comprised married women aged 18–45 years who had children under two years of age, using a two-year recall period to minimize recall bias. A sample size of 400 respondents was determined based on the formula $n = \frac{Z^2pq}{d^2}$, considering relevant BDHS (2022) indicators and a 10% non-response adjustment. Respondents were selected through purposive

sampling using house-to-house visits based on inclusion criteria.

Data collection: Data were collected using a pre-tested semi-structured questionnaire through face-to-face interviews conducted in Bengali after obtaining informed written consent. The questionnaire focused on sociodemographic characteristics; variables related to safe motherhood practices and different dimensions of women empowerment and developed through multiple literature reviews. In this study, safe motherhood practices denote the utilization of essential maternal health services during pregnancy, childbirth, and the postpartum period, including antenatal, delivery, and postnatal care, to reduce maternal and neonatal risks³. Women's empowerment is measured using a Women Empowerment Index (WEI) constructed from three domestic dimensions—economic decision-making power, household decision-making authority, and freedom of physical movement—following the framework of Mason and Smith (2003). For each dimension, indicators are standardized on a scale of 0 to 1 using the Human Development Index formula: $(\text{Actual score} - \text{Minimum score}) / (\text{Maximum score} - \text{Minimum score})$, and the overall WEI is calculated as the simple average of the three-dimension indices⁷⁻⁸ (UNDP, 2005). Consistent with UNDP (HDI, 2005), the WEI is categorized into low (0.00–0.49), medium (0.50–0.79), and high (0.80–1.00) levels of empowerment⁸.

Data analysis: After collection data were checked, coded, cleaned, and analyzed using SPSS version 26. Descriptive statistics (frequency, percentage, mean, and standard deviation) were used to summarize socio-demographic characteristics, empowerment indicators, and maternal healthcare practices. Inferential statistics (chi square tests, Mann Whitney Kruskal Wallis's) were performed to assess associations between empowerment and safe motherhood indicators.

Ethical considerations: Quality control was ensured at every stage, including protocol development, pretesting, translation, and data verification. Ethical approval was obtained from the Institutional Review Board (IRB) of NIPSOM, and all participants were assured of voluntary participation, confidentiality, and the right to withdraw at any stage without harm.

RESULTS

Table 1 shows that A total of 400 married rural women participated in the study. Most respondents were aged 18–28 years, with a mean age of 28.6 years. Nearly half had secondary-level education,

while only 5.5% had no formal education. Similar patterns were observed for husbands' education. Almost all women (98%) were housewives, and most families (43.3%) had monthly incomes between 20,001–30,000 BDT. A majority (57.5%) lived in nuclear families, and 82.5% had 2 or less children. Early marriage was highly prevalent (78.5% married at ≤ 18 years).

Table 2.1 shows that Antenatal care uptake was moderately high: 43.5% received ≥ 4 ANC visits, and 41.8% initiated ANC in the first trimester. TT vaccination coverage was 84.5%, but only 11.5% were aware of pregnancy danger signs. **Table 2.2** demonstrates that Institutional delivery occurred among 74.3% of respondents, with 74.8% attended by skilled birth attendants. **Table 2.3** shows that Postnatal care within 48 hours was received by 70.3%, although only 10.5% received PNC within 42 days. Newborn care practices such as colostrum feeding (98.5%), skin-to-skin contact (98.3%), and complete infant vaccination (94.5%) were high.

Table 3 shows that Women's empowerment was generally low, with 63.5% classified as low empowerment (WEI mean = 0.44). Economic decision-making was largely dominated by husbands, while women had greater involvement in household decisions. Mobility remained highly restricted.

Table 4 shows that Bivariate analysis shows that women's education, husbands' education, family income, age at marriage, and number of children were significantly associated with ANC use, institutional delivery, skilled attendance, and PNC ($p < 0.001$). Occupation and age showed no significant associations. Similar determinants—education, income, expenditure, family size, occupation, age, and age at marriage—were significantly related to empowerment ($p < 0.001$). (Table 5)

Table 6 shows that Women's empowerment demonstrated a strong positive relationship with safe motherhood practices. Higher empowerment significantly increased the likelihood of adequate ANC, facility delivery, skilled attendance, and timely postnatal care ($p < 0.001$).

Table 1: Distribution of the respondents according to their socio-demographic characteristics:

Characteristics	Frequency(f)	Percentage (%)
Age group (In years)		
18-24	112	28.0
25-33	191	47.8
34-45	97	24.3
Mean=28.61, St. Deviation ± 5.763		
Educational level of the respondents		
No formal education	22	5.5
Primary (1-5)	82	20.5
Secondary (6-10)	170	42.5
Higher secondary	76	19.0
Graduation	32	8.0
Masters	18	4.5
Educational level of the respondents' husbands		
No formal education	35	8.8
Primary (1-5)	81	20.3
Secondary (6-10)	144	36.0
Higher secondary	60	15.0
Graduation	48	12.0
Masters	32	8.0
Occupation of the respondents		
Housewife	393	98
Teacher	4	1.0
Service holder	2	0.5
Doctor/nurse	1	0.3
Occupation of the respondents' husbands		
Day labourer	55	13.8
Farmer	26	6.5

Rickshaw/ vanpooler/Auto driver	17	4.3
Service holder	96	24
Businessman	102	25.5
Teacher	11	2.8
Others (extricate worker)	93	23.3
Monthly family income (BDT)		
10,000-20,000	145	36.3
20,001-30,000	173	43.3
30,001-50,000	82	20.5
Mean=26,265, St. Deviation±8608.137		
Monthly family expenditure (BDT)		
8000-18000	128	32.0
18,001-27,750	172	43.0
27,751-47,000	100	25.0
Mean=2920.0, St. Deviation±7806.469		
Type of Family		
Nuclear	230	57.5
Joint	170	42.5
Number of family members		
≤5	269	67.3
Above 5	131	32.8
Mean=5.08, St. Deviation±1.837		
Age at marriage (In years)		
≤18	314	78.5
Above 18	86	21.5
Mean=17.07, St. Deviation±2.627		
Number of children		
≤2	330	82.5
More than 2	70	17.5
Mean=1.86, St. Deviation±.755		
Total	400	100.0

Table 2: Distribution of the respondents according to safe motherhood practices:

Table 2.1: Antenatal care practices

Attributes	Frequency (f)	Percentage (%)
Number of ANC visits		
No visit	74	18.5
1-3 visits	152	38.0
4 or more visits	174	43.5
1st antenatal visit within first 3 months		
No	233	58.3
Yes	167	41.8
Comprehensive ANC examinations		
No comprehensive examinations	87	21.8
Basic/occasional ANC examinations	148	37.0
Comprehensive ANC examinations	165	41.3
Healthy or nutritious diet during pregnancy		
Never	108	27.0
Sometimes	188	47.0
Always	104	26.0
Nutritional supplements intake		
Never	131	32.8
Sometimes	127	31.8
Regular	142	35.5

TT vaccination		
No vaccination	51	12.8
Incomplete vaccination	11	2.8
Complete vaccination	338	84.5
Proper rest/sleep		
Never	170	42.5
Sometimes	186	46.5
Always	44	11.0
Recommended screening tests		
No tests done	86	23.8
Some tests done	117	29.3
All tests done	197	49.3
Awareness about danger signs of pregnancy		
Not aware	241	60.3
Partially aware	113	28.2
Well aware	46	11.5
Preparedness for emergency and delivery		
Not prepared	95	23.8
Well prepared	305	76.3
Total	400	100.0

Table 2.2: Intranatal care practices (n=400)

Attributes	Frequency (f)	Percentage (%)
Delivery in health facility		
No	103	25.8
Yes	297	74.3
Delivery by skilled birth attendants		
No	101	25.3
Yes	299	74.8
Vitals checking during labour		
No	98	24.5
Yes	302	75.5
Progress of labour monitoring		
Not at all monitored	84	21.0
Infrequently monitored	32	8.0
Frequently monitored	284	71.0
Hygiene of delivery place		
No	93	23.3
Yes	307	76.8
Cord cut with sterile instruments		
No	67	16.8
Yes	333	83.3
Skin-to-skin-contact		
No	7	1.8
Yes	393	98.3
Colostrum feeding within first hour after birth		
No	6	1.5
Yes	394	98.5
Emergency transport for facility delivery		
No	92	23.0
Yes	308	77.0
Total	400	100.0

Table 2.3: Postnatal care practices (n=400)

Attributes	Frequency (f)	Percentage (%)
Observation for postpartum complications		
Not at all monitored	90	22.5
Briefly monitored	34	8.5
Closely monitored	276	69.0
Postnatal check-up within 48 hours after delivery		
No postnatal check -up	99	24.8
Brief postnatal check-up	16	4.0
Detailed postnatal check-up	285	70.3
Postnatal check-up within 42 days after delivery		
Not at all	288	72.0
At least 1	70	17.5
2 or more	42	10.5
Maintenance of postpartum hygiene		
Not at all maintained	52	13.0
Fairly maintained	241	60.3
Very properly maintained	107	26.8
Nutritious diet/rest during postpartum period		
Never	191	47.8
Sometimes	181	45.3
Always	28	7.0
Exclusive breastfeeding for first 6 months		
Never	55	13.8
Sometimes (mixed)	57	14.2
Always	288	72.0
Postnatal family planning method		
No	102	25.5
Yes	298	74.5
Baby follow-up		
Never	187	46.8
Sometimes	116	29.0
Always	97	24.3
Counsel on baby danger signs		
No counselling	234	58.5
Partial counselling	121	30.3
Proper counselling	45	11.3
Baby vaccinations		
No vaccination	18	4.5
Incomplete vaccination	4	1.0
Complete vaccination	378	94.5
Total	400	100.0

Table 3: Distribution of the respondents according to Women Empowerment Index and categorization (n=400):

Dimensions of Women Empowerment	Category	
	Involving women f (%)	Not involving women f (%)
Economic decision making		
Decision on spending money	84(21)	316(79)
Decision on large household purchase	93(23.3)	307(76.8)
Decision on daily household purchase	243(60.8)	157(39.3)
Household decision making		
Decision on own healthcare	289(72.3)	111(27.8)
Decision on child healthcare	273(68.3)	127(31.8)
Decision on food to be cooked daily	325(81.3)	75(18.8)
Decision on family planning	174(43.5)	226(56.5)
Physical movement		
	Alone f (%)	With others f (%)
Movement outside village	19(4.8)	381(95.3)
Going to hospital	106(26.5)	294(73.5)
Going to shopping	49(12.3)	351(87.8)
Women Empowerment Level		
	Frequency (f)	Percentage (%)
Low Empowerment (0.00-0.49)	254	63.5
Medium Empowerment (0.50-0.79)	95	23.8
High empowerment (0.80-1.00)	51	12.8
Mean=0.4388, St. Deviation=0.253		
Total	400	100

Table 4: Association Between sociodemographic characteristics and safe motherhood practices

Association variables	Attributes	Chi-square test statistic/Fisher's Exact value	P value
Age	≤28 years Vs. >28 years	$\chi^2 = 1.277$	.536
Education	Up to secondary Vs. Above secondary	$\chi^2 = 121.97$	<0.0001**
Husbands' Education	Up to secondary Vs. Above secondary	$\chi^2 = 105.33$	<0.0001**
Occupation	Housewife Vs. working women	$\chi^2 = 4.056$	.095
Monthly family income	≤25,000 Vs. >25,000	$\chi^2 = 107.219$	<0.0001**
Monthly family expenditure	≤25,000 Vs. >25,000	$\chi^2 = 77.757$	<0.0001**
Number of family members	≤5 Vs. >5	$\chi^2 = 7.415$	.025*
Age at marriage	≤18 Vs. >18	$\chi^2 = 81.133$	<0.0001**
Number of children	≤2 Vs. >2	$\chi^2 = 24.764$	<0.0001**
Age	≤28 years Vs. >28 years	$\chi^2 = 0.390$	0.424
Education	Up to secondary Vs. Above secondary	$\chi^2 = 49.032$	<0.0001**
Husbands' Education	Up to secondary Vs. Above secondary	$\chi^2 = 48.504$	<0.0001**
Occupation	Housewife Vs. working women	$\chi^2 = 0.390$	0.424
Monthly family income	≤25,000 Vs. >25,000	$\chi^2 = 57.254$	<0.0001**
Monthly family expenditure	≤25,000 Vs. >25,000	$\chi^2 = 35.705$	<0.0001**
Number of family members	≤5 Vs. >5	$\chi^2 = 0.095$	0.757

Age at marriage	≤18 Vs. >18	$\chi^2 = 25.508$	<0.0001**
Number of children	≤2 Vs. >2	$\chi^2 = 17.688$	<0.0001**
Age	≤28 years Vs. >28 years	$\chi^2 = 0.746$	0.388
Education	Up to secondary Vs. Above secondary	$\chi^2 = 47.492$	<0.0001**
Husbands' Education	Up to secondary Vs. Above secondary	$\chi^2 = 46.794$	<0.0001**
Occupation	Housewife Vs. working women	$\chi^2 = 0.454$	0.685
Monthly family income	≤25,000 Vs. >25,000	$\chi^2 = 54.962$	<0.0001**
Monthly family expenditure	≤25,000 Vs. >25,000	$\chi^2 = 34.273$	<0.0001**
Number of family members	≤5 Vs. >5	$\chi^2 = 0.222$	0.713
Age at marriage	≤18 Vs. >18	$\chi^2 = 24.629$	<0.0001**
Number of children	≤2 Vs. >2	$\chi^2 = 16.290$	<0.0001**
Age	≤28 years Vs. >28 years	$\chi^2 = 2.496$	0.287
Education	Up to secondary Vs. Above secondary	$\chi^2 = 49.508$	<0.0001**
Husbands' Education	Up to secondary Vs. Above secondary	$\chi^2 = 51.261$	<0.0001**
Occupation	Housewife Vs. working women	Fisher's Exact value=2.211	0.399
Monthly family income	≤25,000 Vs. >25,000	$\chi^2 = 61.695$	<0.0001**
Monthly family expenditure	≤25,000 Vs. >25,000	$\chi^2 = 39.492$	<0.0001**
Number of family members	≤5 Vs. >5	$\chi^2 = 0.974$	0.615
Age at marriage	≤18 Vs. >18	Fisher's Exact value =81.133	<0.0001**
Number of children	≤2 Vs. >2	$\chi^2 = 15.286$	0.001*

*Significant at $p < 0.05$; **Significant at $p < 0.001$

Table 5: Association between socio-demographic variables and Women Empowerment:

Test Name	Variable comparison	Test Statistic	P value
Spearman Correlation	Age and WEI	Spearman's rho=0.136	0.006*
Mann Whitney U	Education (Up to Secondary Vs above Secondary) & WEI	U=30699.300	<0.0001**
Mann Whitney U	Husbands' Education (up to Secondary Vs. Above Secondary) & WEI	U=7870.500	<0.0001**
Mann Whitney U	Occupation (Housewife Vs. Working women)	U=61.500	<0.0001**
Mann Whitney U	Monthly family income (Up to 25000 Vs. above 25000) & WEI	U=8802.000	<0.0001**
Mann Whitney U	Monthly family expenditure (Up to 25000 Vs. above 25000) & WEI	U=9752.000	<0.0001**
Mann Whitney U	Number of family members (up to 5 Vs. Above 5) & WEI	U=11555.000	<0.0001**
Mann Whitney U	Age at marriage (up to 18 VS. above 18) & WEI	U=3330.500	<0.0001**
Mann Whitney U	Number of children (Up to 2 Vs. above 2) & WEI	U=8477.000	<0.0001**

**Significant at $p < 0.001$

Table 6: Association between Women Empowerment and safe motherhood practices:

Test Name	Variable comparison	Test statistic	P value
Chi-square	Category of women empowerment and number of antenatal visits	$\chi^2 = 4142.342$	<0.0001**
Chi-square	Category of women empowerment & delivery in health facility	$\chi^2 = 63.729$	<0.0001**
Mann-Whitney U test	WEI & delivery by Skilled birth attendant	U=25798.00	<0.0001**
Kruskal Walli's	WEI & PNC within 48 hours after delivery	H=2125.641	<0.0001**
Kruskal Walli's	WEI & PNC within 42 days after delivery	H=2136.713	<0.0001**

**Significant at $p < 0.001$

DISCUSSION

This study examined the association between women's empowerment and safe motherhood practices among rural women in Kolakopa Union, Nawabganj, revealing strong interlinkages between socio-demographic characteristics, empowerment dimensions, and maternal healthcare utilization. The majority of women were young, married early, and had modest education and income levels—factors that collectively limited healthcare access. Consistent with findings from Madhupur, Tangail⁴, Nepal⁹ and BDHS 2022¹⁰, higher educational attainment and better economic conditions were strongly associated with improved maternal healthcare utilization. Similar to Bangladesh¹¹ and Nepal³, maternal education emerged as a key determinant of ANC and PNC uptake. Despite progress in fertility reduction and increased family planning, the persistence of early marriage and limited education continues to reinforce vulnerabilities, highlighting the need for policies promoting girls' education, delayed marriage, and household-level economic strengthening¹.

Maternal healthcare utilization patterns reflected both progress and persisting challenges. While 74.3% of deliveries occurred in health facilities with skilled attendants^{4,12}, only 43.5% completed four or more ANC visits, and just 41.8% initiated care during the first trimester, echoing BDHS 2022. Postnatal care remained the weakest link, with only 10.5% completing two or more checkups within 42 days, consistent with BMMS 2010. These gaps were strongly influenced by educational level, income, family size, and age at marriage^{5,12-13}. Although institutional delivery and newborn care indicators such as clean cord care (83.3%) and colostrum feeding (98.5%) were encouraging¹⁴, persistent

inequities in ANC quality and postnatal follow-up mirror structural and cultural barriers also identified in studies from Nepal³, and Pakistan¹².

Women's empowerment was found to be a significant determinant of maternal healthcare utilization. The computed empowerment index (mean = 0.44, SD ± 0.253) showed that 63.5% of respondents fell in the low empowerment category, aligning with BDHS 2017–18 and SWPER findings². Empowerment was significantly higher among educated, employed, and economically stable women, as well as those with smaller families and delayed marriage^{5,11-12}. Highly empowered women demonstrated substantially better outcomes across all maternal health indicators—ANC attendance ($\chi^2 = 142.342$, $p = 0.000$), institutional delivery ($\chi^2 = 63.729$, $p = 0.000$), and timely PNC ($H = 125.641$, $p = 0.000$). These findings echo the assertions of, emphasizing empowerment's mediating role in enhancing care-seeking and maternal health outcomes⁶. However, persistent constraints in mobility and financial autonomy highlight the need for integrated empowerment strategies combining education, income generation, and gender-transformative programs to advance maternal and neonatal health in line with national targets and SDG commitments^{1,7,13}.

This study shows that women's empowerment plays a major role in whether rural Bangladeshi women receive essential maternal healthcare, and the pattern clearly matches findings from Nepal^{3,9}, Pakistan^{5,12} and Ethiopia¹⁴. Similar to BDHS 2022 and SWPER global studies, higher education, better income, delayed marriage, smaller family size, and greater decision-making power were strongly linked with completing ≥ 4 ANC visits, facility delivery with skilled care, and timely PNC¹⁵. Low empowerment

levels—especially limited mobility and financial control—also reflect challenges reported across South Asia and Sub-Saharan Africa^{1,13-14}.

These findings point to clear policy actions. Priority interventions include expanding girls' education, providing income-generating opportunities, and promoting financial inclusion, as these consistently improve maternal health across Bangladesh and other countries^{4, 6,10}. Programs that delay early marriage and support reproductive autonomy are essential for reducing high fertility pressure. Improving the quality of ANC, intrapartum monitoring, and postnatal follow-up—similar to recommendations in Ethiopia (Mini DHS 2023) and Nepal is also critical. Strengthening community outreach, counselling, and safe mobility options for rural women can further reduce social and cultural barriers. Together, these empowerment-focused strategies can help Bangladesh achieve equitable maternal healthcare and meet national and SDG targets^{1,14-16}.

These findings highlight critical policy implications. Improving female education and enhancing household economic capacity are essential for increasing institutional delivery and skilled birth utilization. Policies should also focus on delaying marriage age and promoting family planning to sustain these gains. However, gaps remain in addressing non-economic barriers, such as cultural norms and access disparities in rural areas. Future interventions should adopt integrated strategies that combine educational programs, economic empowerment, and culturally sensitive outreach to ensure equitable access to skilled maternal care, thereby advancing maternal and neonatal health outcomes in line with national targets and SDG commitments.

Limitations of the study: This study has several limitations. The introverted nature of many respondents made it challenging to obtain detailed interview responses. The relatively small sample size of 400 women limits the generalizability of the findings to larger populations. Women's empowerment is a multidimensional concept; however, this study examined only three dimensions due to data constraints and time limitations. Additionally, despite using a two-year recall period to reduce recall bias, some responses may still be affected by imperfect memory.

CONCLUSION

The findings show that improving women's empowerment is essential for better maternal health in rural Bangladesh. Key actions include giving girls and women more access to education, creating income-earning opportunities so they can be financially independent, supporting their right to make decisions about marriage and childbirth, and making rural health services easier to reach and afford. Focusing on these areas can help more women use maternal healthcare and reduce the risks of illness and death during pregnancy and childbirth.

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