



Research Article

Changes in Livelihoods of Rural Women Working in the Fish Processing Industry

Shamme Akter, Md. Zulfikar Rahman, Saifur Rahman[✉], Sharmin Akter and Mohammed Nasir Uddin

Department of Agricultural Extension Education, Bangladesh Agricultural University, Bangladesh

ARTICLE INFO	ABSTRACT
<p>Article history Received: 24 Dec 2022 Accepted: 09 Mar 2023 Published: 31 Mar 2023</p> <p>Keywords Livelihood, Rural women, Fish processing, Problems, Bangladesh</p> <p>Correspondence Saifur Rahman ✉: saifur.agext@bau.edu.bd</p> <p> OPEN ACCESS</p>	<p>Rural women of Bangladesh are getting involved in different income-generating activities, including fish processing. Through these activities, rural women contribute to the family income and ensure a better life for the family members. In this perspective, the current study was conducted to assess the livelihood changes of the rural women working in the fish processing plant, identifying the factors affecting the livelihood change and to identify the problems faced by the rural women worker while working in the fish processing industry. The study was conducted in the Trishal Upazila of Mymensingh district. The population size was 140; out of them, 70 were selected randomly. A pre-tested questionnaire was used to collect data through a face-to-face interview. Then, regression analysis was done to identify associated factors. The majority of the women (68%) had a medium change in livelihood. Household size, annual family income, training, and extension media contact were the most crucial variables explaining the respondents' livelihood change. Moreover, most (60%) of the women faced low problems in fish processing activities. However, among the identified problems, the major concerns were lack of technical knowledge, lack of transportation facilities to reach the workplace and poor salary. Therefore, in order to overcome these obstacles, efforts must be made to increase the human capital of rural women, such as their technical expertise and skills in fish processing, through training and extension communication. In addition, it is necessary to ensure sufficient salary, which will also positively impact the rural women's family income.</p>
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Introduction

Capture fisheries and aquaculture have great potential in Bangladesh due to the country's abundant inland lakes and river systems. Bangladesh's prime location brings with it an abundance of aquatic species and ample resources to sustain the country's developing fishing industry (Shamsuzzaman et al., 2017).

According to the Bangladesh Economic Review (2020), this high-growth sector contributed around 3.52% to the GDP in the Fiscal Year (FY) 2019-20. The livelihood of approximately 6.7 million people in the country relies on the fishing sector directly or indirectly (Haque et al., 2016). According to the Poverty Reduction Strategy Paper and the National Fisheries Strategy, the fisheries industry offers rural people the most promising income-generating prospects (Planning Commission, 2005).

It has previously been reported in the study of other regions that women and youngsters were involved in fish feeding and harvesting as an extension of their domestic task (Williams et al., 2005; Napati et al., 2016, Bosma et

al., 2019), and to contribute in a household income-generating activity. Women also took the lead in aquaculture in ponds, pens, cages, and around shores (Bosma et al., 2019). Similarly, in Bangladesh, women play various roles in fish farming, strongly emphasizing small-scale fishing and aquaculture productivity (Halim & Ahmed, 2006). Around 43% of rural women in Bangladesh devote their time to agricultural, aquaculture, and fisheries operations in addition to their home obligations (Ahmed et al., 2012). Example of these includes pond stocking, feeding, pond management, fertilizing, liming, fish harvesting, and selling, as well as isolated instances of fishnet weaving (Shirajee et al., 2010), as well as drying, curing, and marketing fish to a considerable degree as hawkers and stall keepers in permanent markets and weekly bazaars (Rashid et al., 2012).

Although women play a diversified role in fish farming, such as manufacturing fishnets and gear, preparing fish feed, processing fish, excavating ponds, sorting fingerlings, catching, and selling, except harvesting,

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liming, stocking, and fertilizing (Halim & Ahmed, 2006) as well in post-harvest industry, from landing through processing and marketing (Nauen, 1989), however, many people consider that fish farming is a masculine activity where women only confined for processing and marketing activities only. (Bosma et al., 2019).

Studies conducted in the Gaibandha, Sherpur, and Kishoreganj districts reveal women's participation in aquaculture-related economic activities was very limited (Hoque & Itohara, 2008; Rahman & Naoroze, 2007). However, studies in Mymensingh, Norshingdi, Tangail, Cox's Bazar, Netrokona, and Panchagarh districts reported contradictory results where they mentioned more involvement of women in aquaculture production (Shirajee et al., 2010, Halim & Ahmed, 2006). Therefore, these results imply that social, cultural, and religious norms strongly affect women's participation in different aquaculture activities (Shirajee et al., 2010).

At the same time, several authors have signaled the importance of involving women in fish farming to avoid the problem of labor shortage (Jahan et al., 2015; Faruque, 2007). Others have signaled the importance of involving poor farmers in small-scale aquaculture to improve their livelihood, including rural women (Kabir et al., 2012; Ahmed et al., 2012; Adhikary et al., 2018). In response to this, several researchers have studied the economic contribution of fish farming and trading (Shamshuzzaman et al., 2020), the participation of women in aquaculture (Ahmed et al., 2012), to improve the livelihood of haor people in Bangladesh (Sheheli et al., 2014). Although several authors make a plea to investigate the role of fish farming in improving livelihood (Sheheli et al., 2014), very little research has been conducted in Bangladesh to examine the livelihood change of rural women due to their involvement in fish processing activity.

In light of the above problem statement, this paper aims to fill this gap by investigating the extent of changes in the livelihood outcome of rural women while working in the fish processing industry. The purpose of this study is to assess the livelihood changes of the rural women working in the fish processing industry to identify the factors affecting the livelihood change and to find out the problems as well as their extent faced by the rural women worker for fish processing.

Women's participation in income-generating activities

Livelihood is best defined as the ways and means of making a living in the world. The concept revolves around resources such as land/property, crops, finances, food, social relationships, knowledge, and their interconnected relationship with an individual community's economic, political, and sociocultural

characteristics. A livelihood comprises the skills, assets, and activities required to make a living (Islam et al., 2016). It appears that only a land-based production system is insufficient for improving people's living conditions as people living in developing countries generally rely on agro-based livelihoods, which are vulnerable to climate catastrophes. (Rahman et al., 2015; World Bank, 2017). Understanding the assets of the poor in terms of their human, physical, natural, social capitals, and financial, as well as their coping mechanisms for trends, shocks, and seasonality (i.e., their context of vulnerability), as well as their institutional, commercial, and cultural structures and processes, can open up opportunities to more effectively target development strategies at the poor and assist them in achieving new livelihood outcomes (Ashley et al., 1999).

In Bangladesh, there is a significant gap in the livelihood pattern between urban people and the people of rural areas, primarily due to poverty (Imam et al., 2018). According to Khatun's (2015) research, poverty results from a lack of resources, including money, credit, and public infrastructure. Rahman (2015) looked at the variables influencing consumption and income inequality in rural Bangladesh. Now, to cope with the poverty issue, the rural women of Bangladesh are getting involved in different activities. In Bangladesh, over time, there has been a slight decrease in the wage gap between men and women who labor. A study by Kabir et al. (2019) reveals that female labor participation compared to male labor has increased in the agricultural sector from 1999-2017.

Despite this, national statistics show that women's contributions are underappreciated and underreported (Shelly & Costa, 2001; Ahmed et al., 2012; Halim & Ahmed, 2006). The extant research paints an inconclusive picture of the scope and character of women's participation in aquaculture. According to one of the few studies on the amount of women's involvement in fish aquaculture production, women contribute around 22 percent of total work for homestead ponds and 6 to 17 percent in gher-based technologies (Jahan et al., 2015). Khatun and Kabir (2004) investigated the topic of promoting women's empowerment through business in Bangladesh. They argued that women's social, political, and economic circumstances are extremely precarious. Women who are not allowed to leave their houses can manage their own businesses by baking, tailoring, gardening, poultry, fishing in their family ponds, and so on. Once more, the issue of women's participation in income generation has expanded worldwide and poses serious future concerns (Markovic et al., 2019).

Additionally, Bangladesh has approved the most significant budgetary expenditure in the 2018–2019

fiscal year to achieve the objectives set forth by the government for the advancement of women. Bangladesh views women's engagement as a crucial component of women's empowerment and as one of the key factors in moving the nation from a low-income to middle-income position. The ability of Bangladesh to attract more women to the labor market by giving them more lucrative and productive employment opportunities will be crucial to meeting the goals outlined in the country's Vision 2021 document, which aims to accelerate GDP growth and make Bangladesh a developed nation by 2041.

Conceptual Framework of the Study

The livelihood of women workers for fish processing may be affected by interacting forces of many characteristics and social propaganda in their surroundings. Still, it is

impossible to investigate all the attributes in a single study.

Therefore, given the prevalence of livelihood changes in terms of three selected indicators of rural women working in the fish processing industry, the study explored to what extent certain characteristics of the rural women such as age, education, family size, income, family asset, farm size, credit received, organizational participation, the capacity to work, and training on working in fish processing influence the livelihood changes of rural women.

Based on the above discussion and literature review, the conceptual framework of this study has been structured, as shown in Figure 1.

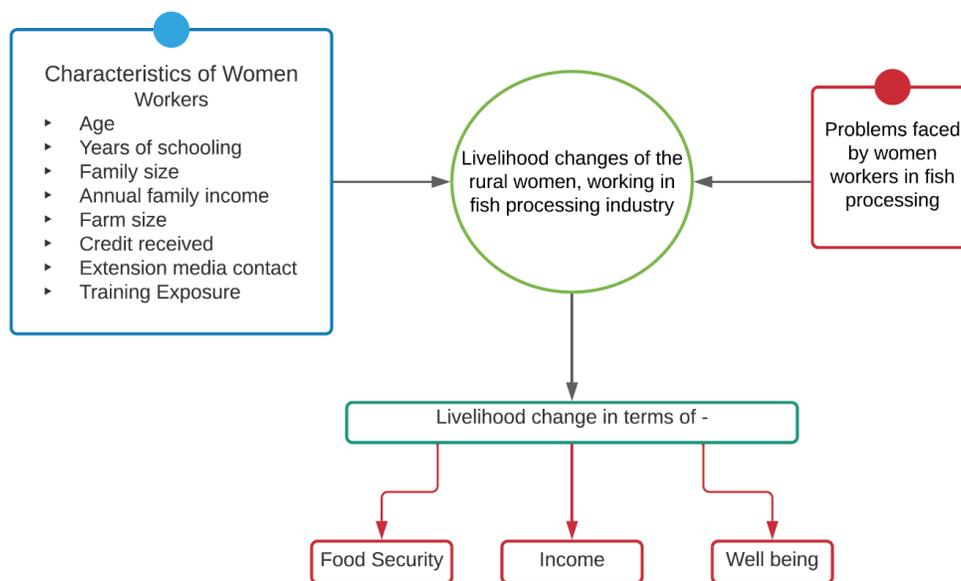


Figure 1. Conceptual framework of the study

Methodology

Study Area

The study was conducted in Trishal Upazila of Mymensingh district of Bangladesh (Figure 2). This Upazila is well known for fish production due to the availability of fish fry, favorable resources, and climatic conditions like, the availability of ponds, low-lying agricultural land, and warm climate. Most people in this area are directly or indirectly involved in fish-related activities due to the above-mentioned reasons (Sheheli et al., 2014). Since fish is part and parcel of the life of people here, women are also involved in fisheries-based jobs, especially in fish processing. Thus, Trishal upazila was selected purposively to get information from rural women engaged in these activities.

Population and Sampling

The selection of respondents was intended to sample the rural women who work in the fish processing industry to contribute to their family income. A list of rural women working in the fish processing industry was prepared with the help of the study area's local leader and local-level extension workers. A total of 140 women (target population) were found in the working fish procession plant. This list was used as a sampling frame to finalize the study participants. Using a random sampling technique, 50% of the population was selected as a sample from the target population (140). Thus, 70 rural women working in the fish processing industry were selected as a study sample. Choosing this sample number (70) was arbitrary as the actual population size was high (Cochran, 1977). The research budget, time, and data quality were also considered in drawing the sample size (Lynn, 1996).

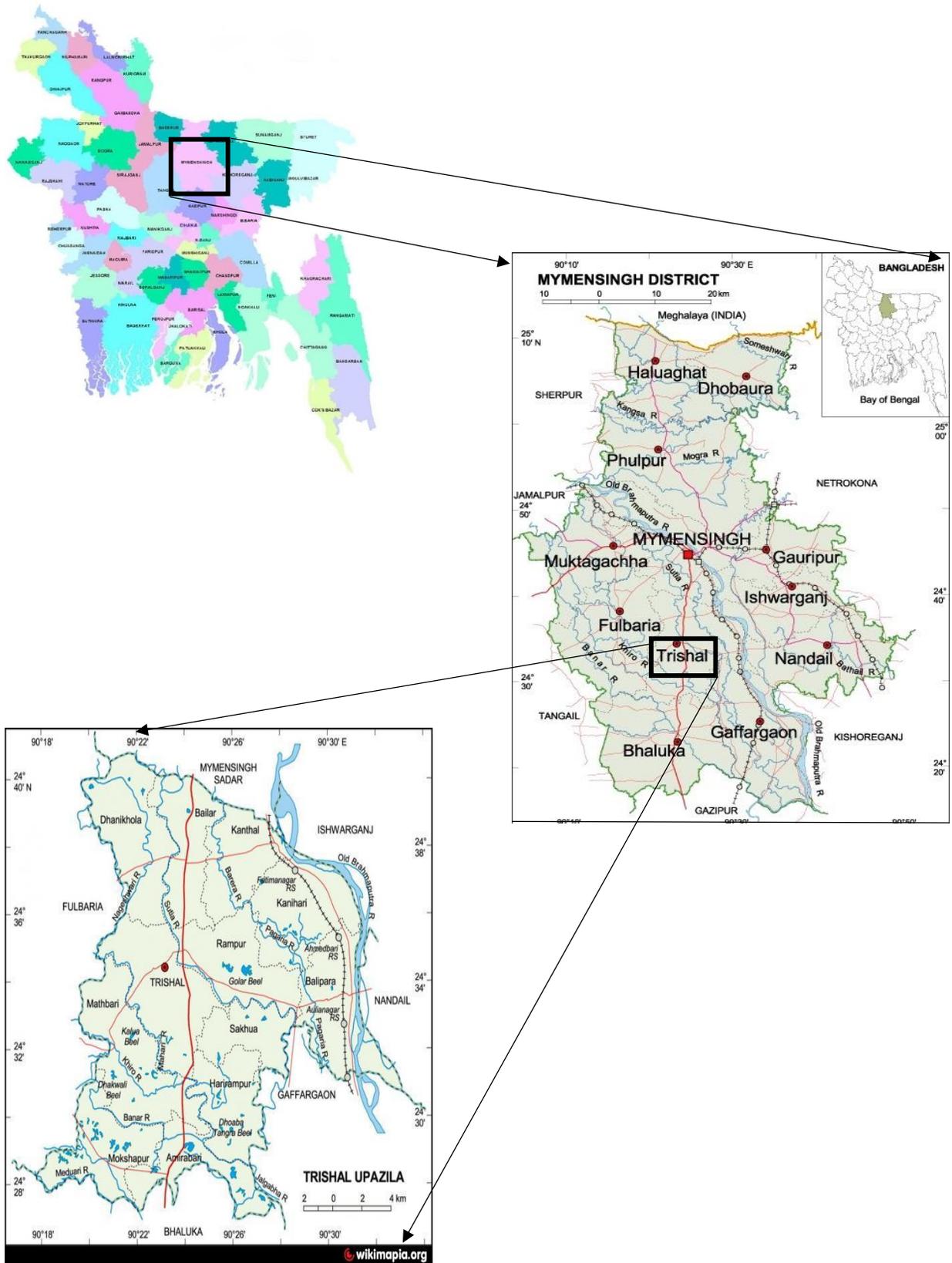


Figure 2. Map of the Research Area

Method of Data Collection

Field work for this research was undertaken from 1st October to 30th October 2019. In the first week of October, data collection started with exploratory work at the village level through conducting focus group discussion (FGD) Semi-structured questionnaires were carefully prepared for the FGD with ten rural women who work in a fish processing industry in order to get an insight into their activities and what changes in livelihood outcomes are due to their involvement in fish processing. The exploration also included observing women's activities in the fish processing plant. This helped us to understand which questions and information need to be asked. After the exploratory work, the interview schedule (structured questionnaires) was prepared to collect relevant data for the study in light of the objectives set forth in the study. The interviews were conducted with 70 respondents at the fish processing plant. The collected primary data were coded, categorized, tabulated, and analyzed scientifically. The local units were converted into standard units. The qualitative data were transferred into quantitative data by appropriate scoring techniques. In most cases, percentage, mean, standard deviation (SD), rank order, multiple linear regression analysis, and step-wise multiple regression analysis were used to analyze and interpret the data.

Measurement of the variables and analysis of data

Livelihood changes of rural women were measured based on three selected indicators of livelihood outcomes from a review of the relevant literature. Three indicators of livelihood outcomes, including food security, income, and well-being, were selected to measure the change in the livelihoods of rural women.

The measuring procedure of the livelihood outcomes indicators and the focus variable's total score is described below:

Food security: This refers to rural women's perception on the availability of necessary food over to previous year recall period of twelve months after working in the fish processing industry. The respondent was asked to recall the availability of necessary food for twelve months. A three-point rating scale measured the extent of the food security score (0 - 3), where 0 stands for 'decreased', 1 for 'unchanged', and 2 for 'improved'. The extent of total food security was computed by adding all scores obtained from the availability of necessary food over to the previous year's recall period of twelve months after working in the fish processing industry. Thus, the food security score could vary from 0 to 24, while 0 indicates the lowest and 24 shows the highest level of food security.

Income: Income indicator of a respondent was considered one of the major outcomes of livelihood changes for rural women. Seven selected sources of income were identified through a literature review and FGDs. Each respondent was asked to choose one option against a three-point type scale, such as 'decreased=0', 'unchanged=1', and 'improved=2' for each source of income. Finally, the total income score of a respondent was measured based on adding the scores of seven selected sources of income while working in the fish processing industry. Thus, the income score could vary from 0 to 14, while 0 indicated the lowest and 14 indicated the highest income level.

Well-being: The well-being indicator of a respondent was considered as another major outcomes of livelihood changes. Eight selected well-being of fishermen were identified through a literature review and FGDs. The well-being score of a respondent was measured based on adding the values of eight selected items/aspects of well-being while working in the fish processing industry. A three-point Likert-type scale was used to measure the extent of well-being changes, where 0 stands for 'decreased', 1 for 'unchanged', and 2 for 'improved'. Thus, the well-being score could vary from 0 to 16, while 0 indicated the lowest and 16 indicated the highest level of well-being. A cumulative score of livelihoods changes was calculated by summing scores from three selected indicators of livelihood outcomes. Thus, the range of score varied from 0 to 54, where 0 indicate no livelihood changes and 54 indicate high livelihood changes. Eight selected characteristics of the rural women were considered to analyze the extent of livelihood changes. These were age, education, household size, farm size, annual family income, credit received, extension media contact, and training.

Factors affecting livelihood changes

The study's second objective was to identify factors associated with rural women's livelihood change, which was measured by regression analysis. Factors influencing the livelihood of rural women were age, education, household size, farm size, annual family income, credit received, extension media contact, and training. These factors were selected from a review of the relevant literature. Multiple regression analysis was used to determine the factors contributing to the livelihood change of rural women.

Step-wise regression analysis helps quantify the individual contribution of factor variables upon removing insignificant variables from the model (Quddus and Kropp, 2020). The equation is as follows (Eq. (1)).

$$Y_i = \beta_0 + \beta_1X_1 + \beta_2X_2 + \beta_3X_3 + \beta_4X_4 + \beta_5X_5 + \beta_6X_6 + \beta_7X_7 + \beta_8X_8 + \epsilon_i \dots\dots\dots (1)$$

Where, y_i =farmers' satisfaction, β_0 = constant, X_1 = age, X_2 = education, X_3 = household size, X_4 = annual family income, X_5 =farm size, X_6 = credit received, X_7 = extension media contact, X_8 = training, ϵ_i = Error term

Ten problems were identified through FGD and using available literature. A four-point rating scale was used to measure the extent of the problem. Each problem had four possible responses: serious problem, medium problem, low problem, and not at all, with ratings of 3, 2, 1, and 0 corresponding to each. The respondents were categorized into three groups: low, medium, and high, based on the score. Again, a problem-faced index (PFI) was used to create a rank order of the identified problems. PFI helps to identify the most critical problems and make a rank order of them (Eq. (2)) (Hamid et al., 2020).

$$PFI = (P_h \times 3) + (P_m \times 2) + (P_l \times 1) + (P_n \times 0) \dots\dots\dots (2)$$

Where PFI = Problem Facing Index, P_h = number of women with serious problems, P_m = number of women with medium problems, P_l = number of women with low problems, and P_n = number of women with no problems. The PFI of a single issue could be somewhere between 0 and 210, where 0 indicates no difficulty and 210 denotes a significant problem in farmers accessing agricultural extension services.

Results and Discussion

Socio-economic characteristics of the respondents

A summary of the socio-economic characteristics of the respondents is presented in Table 1. It shows that the rural women ranged from 20 to 62 years. The age category indicates that the majority of the respondents (54.3%) belong to the young category (up to 35 years), and the rest (45.7%) are middle-aged and old respondents. Education status shows that most participants had primary-level educational attainment (61.4 %), 24.3% of the participants had secondary education, and 14.3% had no education.

Table 1. Socio-economic characteristics of the rural women involved in fish processing (n = 70)

Variables & Categories	Respondents (%)	Mean	SD	Min	Max.
Age					
Young (up to 35) years	54.3				
Middle-aged (36-55) years	25.7	40.01	13.17	20	62
Old above (above 55) years	20				
Education					
Illiterate	14.3				
Primary education	61.4	3.82	2.30	0	8
Secondary education	24.3				
Higher secondary	0				
Household size					
Small family	12.9				
Medium family	55.7	5.80	1.13	3	8
Large family	31.4				
Farm size					
Landless	16.2				
Marginal	63.2				
Small	20.6	0.11	0.09	0.011	0.345
Medium	0				
Large	0				
Annual family income					
Low annual income	10				
Medium annual income	90	144.67	27.72	70	194
High annual income	00				
Credit received					
No credit	0				
Low	40	32.50	14.81	15	60
Medium	30				
High	30				
Extension media contact					
No contact	0				
Low	7.1	13.97	2.59	7	18
Medium	92.9				
High	0				
Training exposure					
No training	0				
Short-term training	34.3	17.24	9.04	7	30
Mid-term training	34.3				
Long-term training	31.4				

Source: Author's field survey

The average household size of the respondent was six persons (5.80), which is larger than the national average of 4.06 (HIES, 2016). In detail, most respondents (87.1%) had medium to large household sizes, while only 12.9% had small household sizes. The average farm size for the respondent surveyed was 0.11 hectares. This was less than the national average farm size of 0.6 hectares (Uddin et al., 2017). The average annual family income of the respondent in the sample area was 0.144 million Bangladeshi takas per year (\$2478.49 US), which is slightly more than the national average of 0.142056 million Bangladeshi takas (\$1675 US) (BBS, 2019). Arifullah et al. (2014) and Uddin et al. (2017) also found a similar pattern of annual family income in their study. Table 1 shows that most rural women received some credit facility. Most rural women (92.9%) surveyed stated medium extension media contact. Karim et al. (2016) observed a similar pattern of extension media contact in their study. Data presented in Table 1 indicate that more than half of the respondents (68.6%) received short to mid-term training, while 31.4% received long-term training. Training enables farmers to employ their skills to tackle various uncertain circumstances (Uddin et al., 2017).

Extent of livelihood change of rural women involved in fish processing

Figure 3 represents information about the extent of livelihood change of the rural women who are involved in fish processing. The findings indicate that most of the respondents (68%) had a medium level of change in different aspects (see Table 2) of livelihood outcome through working in fish processing, followed by 24.85% having a low change. Only a few women (7.5%) reported

a high level of change in their livelihood through working in fish processing.

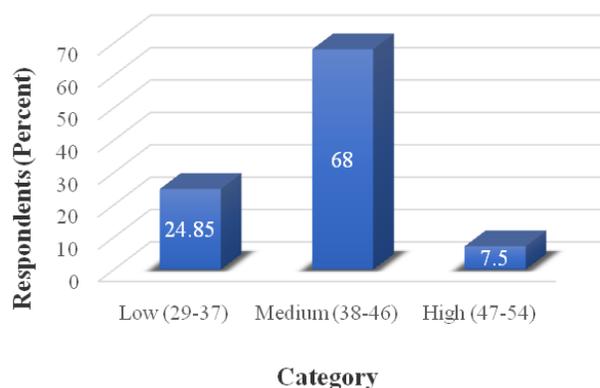


Figure 3. The extent of livelihood changes of rural women involved in fish processing

This finding is similar to other studies, which found that rural women's involvement in fish processing has brought low to medium levels of change in their livelihood (Ali et al., 2008; Mittra et al., 2021).

Table 2 provides information about the livelihood changes of the rural women for the 27 selected aspects under the three significant livelihood outcomes. The livelihood change score ranged from 0 to 140 against a possible range from 0 to 140. In the case of food security outcome, it was found that majority of the respondents have the highest food security during the Poush month (Mid-December to Mid-January), followed by Maagh and Falgun (Mid-January to Mid-March). This result is similar to the findings of Ahmed et al. (2012).

Table 2. Ranking of the aspects of livelihood change of the rural women

Aspects	Score	Rank
Food security		
Poush (Mid-December to Mid-January)	125	1
Maagh (Mid-January to Mid-February)	120	2
Falgun (Mid-February to Mid-March)	118	3
Kartik (Mid-October to Mid-November)	117	4
Augrahasan (Mid-November to Mid-December)	116	5
Ashwin (Mid-September to Mid-October)	112	6
Baishakh (Mid-April to Mid-May)	105	7
Ashar (Mid-June to Mid-July)	105	8
Jaishthya (Mid-May to Mid-June)	101	9
Bhadra (Mid-August to Mid-September)	100	10
Chaitra (Mid-March to Mid-April)	100	11
Sraban (Mid-July to Mid-August)	98	12
Income		
Services (GOs and NGOs)	134	1
Livestock farming particularly dairy, poultry (broiler and layer) farming	104	2
Crop mainly rice, vegetables, fruit, and flower farming	103	3

Aspects	Score	Rank
Fish, mainly pangas, tilapia, and carp farming	97	4
Business mainly small business	95	5
Remittance mainly from middle east countries	77	7
Others	82	6
Well-being		
Better quality meal	128	1
Better clothing	122	2
Change in household assets	114	3
Better education	102	4
Improve living	101	5
Sanitation facilities	97	6
Medical facilities	95	7
Environment facilities	91	8

Regarding income outcome of livelihood change, the most significant change occurred due to work in service-related activity, followed by livestock and crop. An earlier study in Bangladesh shows that rural women now work in different services to contribute to family income, besides performing their household responsibilities (Kabir et al., 2019).

The findings also show that women fish processors' well-being has changed positively through involvement in fish processing work. Perhaps the most obvious reason for changing the well-being of rural women is increased income and the ability to buy daily necessities of life. The findings also demonstrate that in terms of changing the livelihood of well-being outcome, rural women were able to take a better-quality meal, followed by better clothing and a change in household assets due to work in the fish processing plant. A similar result was revealed in a study by Choudhury et al. (2017).

Factors influencing livelihood change of the rural women working in fish processing

The results of different statistical methods explaining the factors related to livelihood change of the rural women working in fish processing are discussed below.

Multiple linear regression analysis

Multiple linear regression analysis was conducted to determine the factors' relevance in predicting the focus variable. The regression analysis results (Table 3) show that all the explanatory variables, such as age, education, household size, annual family income, farm size, credit, extension media contact, and training, significantly influence livelihood change ($R^2 = 0.478$). The multicollinearity test among the model's variables was performed using the Variance Inflation Factor (VIF). Because the maximum VIF value was 1.684, multicollinearity was not a problem, and the variables also had high tolerance values.

Table 3. A summary of multiple linear regression explains the focus variable (n = 70).

Independent Variable	B	Std. Error	Beta	T	p-value	Tolerance	VIF
(Constant)	33.804	3.074		10.995	0.000		
Age	0.021	0.027	0.077	0.771	0.444	0.861	1.162
Education	-0.011	0.161	-0.007	-0.067	0.947	0.809	1.237
Household size	-0.644	0.278	-0.242	-2.320	0.024**	0.786	1.272
Annual Family Income	0.029	0.014	0.260	2.170	0.034**	0.594	1.684
Farm Size	-0.162	3.718	-0.004	-0.044	0.965	0.928	1.077
Credit	-0.007	0.023	-0.029	-0.303	0.763	0.956	1.046
Extension Media Contact	0.418	0.137	0.310	3.061	0.003***	0.834	1.198
Training	0.099	0.048	0.221	2.077	0.042**	0.756	1.324
F (8,61)	6.989***						
$R^2 = 0.478$, Adjusted $R^2 = 0.410$							

Note. * = $p < 0.10$; ** = $p < 0.05$; *** = $p < 0.01$

Household size ($t = -2.320$; $p < 0.05$), annual family income ($t = 2.170$; $p < 0.05$), extension media contact ($t = 3.061$; $p < 0.01$), and training ($t = 2.077$; $p < 0.05$) had significant influences in changing the livelihood of the

rural women's working in the fish processing industry. The results of the study also showed that these four variables collectively could explain 41 percent variation (Adjusted $R^2 = 0.410$) of livelihood change of the rural women working in fish processing, which is statistically highly significant ($F = 6.989, p < 0.05$).

Household size: The household size of the rural women had a significant negative impact on livelihood change, indicating that if household size decreases by one unit, the rural women's livelihood will improve by 0.644. In other words, the smaller the household size, the more significant the livelihood change in a positive way. This observation resonates with other studies that suggest that vulnerability to poverty worsens in terms of declining household savings rates and levels, as well as the reduced scope of working outside for rural women when one moves from a smaller to bigger family size (Orbeta et al., 2005; Adepoju et al., 2013).

Family income: It is also evident from Table 3 that the annual income of the respondents showed a significant positive relationship with the change in the livelihood status of rural women involved in fish processing. This means that rural women with a high annual income had a positive change of livelihood than the others with low annual income, i.e., with one unit rise in annual family income, the livelihood is changed by 0.029 units. The increased income of rural women enabled them to consume nutritious food, use it for better healthcare purposes, and purchase their livelihood needs. This result is similar to the findings of Ahmed et al. (2012) and Mitra et al. (2021).

Extension media contact: The extension media contact of the respondents also positively impacted rural women's livelihood change, indicating that if the extension media contact of the respondent increases by one unit, the

livelihood change is increased by 0.418. Extension communication is considered an essential factor in changing the livelihood of rural women. The reason might be that rural women involved in fish processing with a high extension media contact were introduced to improved fish processing latest information, skills, and technologies. However, it is suggested that accessing more extended extension communication offers an individual fish processor to understand the challenges of fish processing quickly, use improved technologies in different fish processing activities and thereby reduce poverty and hunger towards positive change in livelihood (Jaji et al., 2014).

Training: The respondents' training significantly impacted livelihood change, indicating that 0.099 units changed their livelihood with one unit change of training facility. Rural women with higher training facilities had a positive change in livelihood patterns because participation in fisheries-related training programs enables to improve the capacity of the rural women (Caffaro et al., 2020) and thereby improves livelihood, which is reflected in their income (Khatun et al., 2012; Mahmud et al., 2017).

Step-wise multiple regression analysis

A step-wise multiple linear regression analysis was applied to identify significant explanatory variables that affect rural women's livelihood changes. The results of the analysis are shown in Table 4. The results of the multiple regression analysis show that among the explanatory variables, four variables, such as annual family income, extension media contact, household size, and training, significantly influence the livelihood changes of rural women.

Table 4. Factors influencing livelihood change of the rural women working in fish processing (Step-wise Multiple Regression)

Model	Variables Entered	Multiple R	Multiple R ²	Variation Explained (percent)	Significance Level
Constant + X ₄	Annual Income (X ₄)	0.500	0.250	25.0	0.000
Constant + X ₄ + X ₇	Extension Media Contact (X ₇)	0.623	0.388	13.8	0.000
Constant + X ₄ + X ₇ + X ₃	Household Size (X ₃)	0.658	0.433	4.5	0.000
Constant + X ₄ + X ₇ + X ₃ + X ₈	Training (X ₈)	0.687	0.471	3.8	0.000

The findings revealed that the model comprised all four explanatory variables reported in multiple linear regression analysis. Table 4 also indicates that the variables ($R^2 = 0.471$) explained close to 47 percent of the variation in the livelihood change of the rural women

involved in the fish processing industry. The findings indicate that annual family income ($R^2 = 0.250$) was the first variable to enter into the model, which made the highest contribution (25 %), explaining the most prominent variation in rural women's livelihood change.

This implies that rural women having a higher annual family income are more likely to have a change in livelihood outcome. Another study confirms that rural women spend their increased income on different livelihood outcomes, such as spending income to ensure household food security (Ahmed et al., 2012). The second variable entered into the model was the extension media contact ($R^2 = 0.388$). The findings indicate that about 13.8 percent of the variation in change in livelihood outcome was explained by extension media contact exposure of the rural women.

This suggests that more frequent extension contacts tend to show a positive change in livelihood outcomes (Jaji et al., 2014). Respondents' household size ($R^2 = 0.433$) was the third variable to enter into the model that, explained about 4.5 percent of the variation in rural women's livelihood change. The findings indicate that rural women with larger household sizes tended to show an adverse change in livelihood outcomes (Orbeta et al., 2005; Adepoju et al., 2013).

The final variable entered into the model was ($R^2 = 0.471$) training on fish processing activities, which explained about 3.8 percent variation in change in livelihood outcome, which indicates that rural women with more training facilities related to fish processing activities, the more likely to have a change in livelihood outcomes. Previous studies have shown that participation in fish processing training activities significantly influences the livelihood outcome of rural women (Khatun et al., 2012; Mahmud et al., 2017).

Extent of problems faced by rural women in the fish processing activity

Women in Trishal involved in fish processing faced the same problems as their counterparts in other rural communities. Figure 4 shows information about the extent of the difficulties faced by rural women. It indicates that most women (60%) faced low problems in the fish processing activity, while 34 % faced a medium problem. In contrast, a few respondents (6%) reported high problems in fish processing activity. Therefore, it could be concluded that appropriate measures should be undertaken to remove the existing problems to encourage the respondents of this study area in fish processing activities.

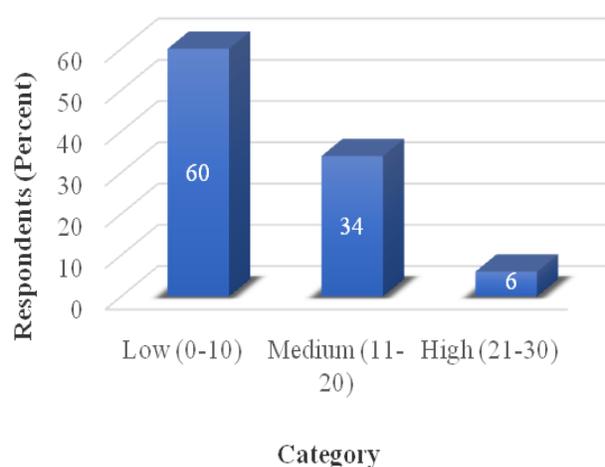


Figure 4. The extent of problems faced by rural women in the fish processing activity

Results presented in Table 5 indicate the extent of problems rural women face in the fish processing activity and their rank order. It suggests that lack of technical knowledge constituted a significant problem, as claimed, with a PFI score of 203. Technical knowledge is a must for the fish processing industry. Successful fish processing activity requires learning new skills, techniques, and ways of promptly obtaining and using the information. When looking at the socio-economic characteristics of rural women involved in fish processing, we see that most of the respondents had only primary education (see Table 1). This low education level of rural women may directly or indirectly influence the lack of technical knowledge for fish processing. This problem was also stated in the study of Akter et al. (2019).

Lack of transportation facilities was ranked second, with a PFI score of 190 by the women in fish processing as an impediment to their timely reach in the working place. Most respondents stated that long distances and poor transportation facilities make working in the fish processing industry problematic and even costly. Thus, ensuring proper transport facilities such as public transport facilities for the fish processors and/or providing additional transportation costs to the women fish processors may save time and money, which can be used to improve their household food security or other family expenses. Similar results were revealed in a study by Jaji et al. (2014).

Poor salary of the rural women in fish processing activity was considered as the third major problem with a PFI score of 85. This poor salary of the women impeded positively changing livelihood outcomes. However, our findings imply that there are potential opportunities to improve the socio-economic situation of rural women by paying an acceptable salary range, which will ultimately

contribute to changes in livelihood outcomes regarding food intake, housing, physical assets, sanitation, and income. It is also evident from the previous study that to ensure balanced socio-economic development of the country, the emancipation of women with changed

social status is a precondition that can be achieved only through increased paid employment of rural women (Kabir et al., 2019). However, sexual harassment and gender biases were identified as minor problems by the respondents.

Table 5. The rank order of the problem faced by the women workers in fish processing

Problems faced by the rural women	The extent of the problems				PFI	Rank
	High	Medium	Low	Not at all		
Lack of technical knowledge	67	0	2	1	203	1
Lack of transportation facility to reach the workplace	57	6	7	0	190	2
Poor salary	15	5	30	20	85	3
Lack of security	7	10	12	41	53	4
No scope for maternity levels	5	12	10	43	49	5
Lack of training for skill development	3	7	8	52	31	6
Lack of good behavior from the owner	2	3	8	57	20	7
High traveling cost	1	4	4	61	15	8
Sexual harassment	0	2	6	62	10	9
Gender bias	0	3	4	63	10	10

Notes: high = 3, medium = 2, low = 1 and not at all = 0; PFI = Problems Facing Index, Source: Field survey, 2019

Conclusion and Policy Recommendations

The present study gives an overview of the livelihood changes of rural women due to working in the fish processing industry. Working in a fish processing industry for rural women has proven to be effective in changing livelihood outcomes of different aspects. After involvement in the fish processing industry, the extent of livelihood change for various respondents has increased remarkably regarding food security, income, and well-being. As a consequence of working in the fish processing industry, rural women can spend their earned money on diversified aspects of livelihood other than fulfilling basic requirements such as better quality meals, better clothing, change in household assets, and better education.

The livelihood change of rural women is affected by numerous factors; age, education, household size, annual family income, farm size, credit, extension media contact, and training. The analysis of the extent of problems faced by rural women in the fish processing activity showed that 94% of the respondents faced low to medium levels of problem. However, the study also indicated significant challenges/problems, such as a lack of technical knowledge, transportation from home to work, and poor salaries. In order to address these problems faced by rural women, this research emphasizes the need to implement some pragmatic initiatives, with particular emphasis on improving technical knowledge and skill through frequent extension contact and providing relevant training for fish processing activities. To provide the relevant training for fish processing, a regular training program can be

arranged from various sources, such as the local government and non-government organizations. By participating in fish processing-related training, it would be possible to strengthen rural women's working skills and performance, which will ultimately help them get an increased salary. Moreover, developing a common platform between the national and local labor organizations would be adequate to ensure an acceptable salary range for working rural women.

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