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Research Article

Knowledge of Fish Farmers Practicing Major Carp Culture in Jamalpur District, Bangladesh

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ABSTRACT

The carp culture in Bangladesh has become a prominent factor in the country's aquaculture industry, economics, and food security. The primary goals of the research were to assess the extent of fish farmers' knowledge in practicing major carp culture, and to determine the influential factors that may impact the knowledge of the fish farmer in practicing major carp culture. Data were collected from three unions named Digpaith, Sahabajpur, and Titpalla of Jamalpur Sadar Upazila (sub-district) under Jamalpur district from June to July 2023 purposefully. Personal interviews were conducted with 102 randomly chosen carp fish farmers. The level of knowledge was assessed using revised Bloom's taxonomy, which employs six levels of the cognitive domain. The main finding of the study highlights that 54.9% of the fish farmers were identified as having a moderate level of knowledge, followed by 45.1% with a poor level of knowledge. Multiple linear regression analysis revealed that, out of the 12 socioeconomic characteristics of farmers, education, training, extension contact, and organizational involvement significantly influenced farmers' knowledge. The stepwise multiple regression analysis showed that factors such as education (47.1%), training received (10.7%), extension contact (2.8%), and organizational involvement (2.1%) collectively account for 62.7% of the observed variations. The Department of Fisheries (DoF), Bangladesh Fisheries Research Institute (BFRI), and other non-governmental organizations (NGOs) need to take appropriate actions including need-based trainings, demonstrations, extension supports etc. to enhance the knowledge of fish farmers in practicing major carp culture.

Introduction

Over the past five decades, there has been a significant surge in fish output on a global scale (Naylor et al., 2021). Many people throughout the world recognize fish farming as a vital component of the economy as it delivers a living for millions of people (Khan et al., 2020). Almost 60% of the world's fish supply is attributed to the seafood trade in Asia (Kobayashi et al., 2015). Bangladesh is a country characterized by an abundance of rivers (Islam and O'Donnell, 2020). A vast network of rivers, canals, ponds, and beels is spread across the entire nation, resembling a spider web (Akter et al., 2016). Bangladesh's ample water resources, conducive atmosphere, acceptable weather conditions, and fertile land make it an optimal location for fish production (Hossain et el., 2018). Since commencement of founding Bangladesh, the fish and fisheries industry has made a substantial socioeconomic contribution and is a vital component of the country's cultural heritage (Rahman et al., 2016). In terms of aquaculture production, Worldwide, Bangladesh ranks as the fifth-largest producer (Mitra et al., 2020), the 3rd largest producer of fish caught in inland waters (Hernandez et al., 2017; Shamsuzzaman et al., 2017), and eleventh in terms of the total amount of marine fish produced (Imran, 2023). Bangladesh's overall fish production increased by almost double in the last 10 years, from 2440 thousand metric tons in 2006–07 to 4664 thousand metric tons in 2021–22 (BBS, 2022). Bangladesh Economic Review (2019) reports that the fishing industry in Bangladesh accounts for three and a half percent of the country's GDP and constitutes 25.72% of the country's agricultural GDP (DoF, 2020). More than seventeen million people, including more than 1.4 million women, rely on fishing, fish handling, and fish processing for their livelihoods (BFTI, 2016). The fish production rate, however, is inferior to the population growth rate (Uddin et al., 2022). Boosting fish production is a key undertaking in Bangladesh to

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guarantee that individuals receive adequate quantities of protein and minerals (Sheheli et al., 2023).

Aquaculture, or fish farming, is essential for satisfying the growing global demand for fish and guaranteeing food security (Pradeepkiran, 2019). When it comes to aquaculture, carp is among the most important fish species globally (Miao, 2020) and is a preferred species due to its fast growth rate, easy reproduction, ability to handle stress from the environment, and an ability to meet market needs (Rahman et al., 2018). On the other hand, Bangladesh only cultivates 4 native and 12 foreign kinds of carp (Mohsin et al., 2013). The principal cultivable fish species in inland aquaculture of Bangladesh are Catla, Rui, Mrigel, Grass carp and Bighead carp (Patwary et al., 2014) and it's responsible for about 85.29% of the overall fish production in ponds in Bangladesh (Monir et al., 2015; Debnath et al., 2012).

The cultivation of carp in Bangladesh has become a prominent factor in the country's aquaculture industry, economics, and food security (Islam et al., 2016). It has played a crucial role in providing employment opportunities, meeting the demand for fish, improving nutrition and promoting sustainable practices (Boyd et al., 2020). However, challenges such as disease outbreaks and market fluctuations persist, requiring continuous research, government support and investment and most importantly needing farmers' skills and knowledge improvement (Ahmed and Ahmed, 2016). That's why, to ensure the success and sustainability of major carp farming, it is essential to gain insight into the knowledge levels of fish farmers involved in this practice (Hossain et al., 2020). Usually, knowledge of fish farmers in practicing major carp cultures encompasses various aspects, including breeding techniques, pond management, feeding practices, disease management and market dynamics (Opiyo et al., 2018). To boost fish production and make healthy, high-quality fish, it is important to use better methods and management (Assefa and Abunna, 2018) such as guaranteeing adequate nutrients (Elekwachi, 2018). Fish feeds boost farmers' incomes by providing the nutrition fish need to thrive to their full potential (Rahman, 2013; Dauda et al., 2018). To support all these items, it is very important for the fish farmers to have a good knowledge of carp culture.

There has been limited research completed on the knowledge of different aquaculture practices. However, Sheheli et al. (2023) performed a study that focused on the knowledge of fish farmers regarding the utilization of artificial feed for catfish cultivation. Uddin et al. (2022) conducted a study on the factors that influence the training requirements of tilapia (*Oreochromis sp*.) fish producers in Bangladesh. Nevertheless, no existing study has been found that evaluates the level of knowledge among fish farmers about the implementation of major carp culture.

The aforementioned facts were duly considered over the course of the ongoing investigation to i) assess the extent of knowledge of fish farmer in practicing major carp culture, and ii) determine the influential factors that may impact the knowledge of the fish farmer in practicing major carp culture.

Materials and Methods

Study area

The research was carried out in three rural communities, specifically Chontia, Mirzapur, and Maguripara villages located in the Digpaith, Sahabajpur, and Titpalla unions of the Jamalpur Sadar upazila (sub-district) in Jamalpur district (Figure 1). Jamalpur Sadar Upazila was selected purposively because it is one of the most remarkable upazila where a lot of fish farmers are involved in major carp fish culture. There was 15 union parishad in Jamalpur Sadar Upazila but these 3 unions were selected because of the availability of major carp culture. The study area has great importance because of good soil quality for aquaculture, availability of water, electricity facility, marketing facility and availability of farmers.

Population and sampling

The respondents were selected to ensure that the sample accurately reflects the community of carp producers in the research area. The most recent database of aquaculture practitioners was supplied by the Local Extension Agent for Fisheries (LEAF) and the Upazila Fisheries Officer (UFO). There were 680 carp fish farmers in the research region. Using a list as a sample frame, the study participants were chosen. Fifteen percent of the population (102) was chosen at random using a random sampling technique in order to obtain a sample Cochran (1977). The distribution of carp fish farmers sampled is displayed in Table 1.

Selection and quantification of dependent variable

The dependent variable that was investigated in the study was 'knowledge of fish farmers in practicing major carp culture'. To carry out the evaluation, a scale was constructed in accordance with six levels of Bloom's taxonomy of intelligence, which were initially proposed in 1956 and were subsequently modified by Anderson and Krathwohl in 2001. The six levels are as follows: remembering, understanding, applying, analysing, creating, and evaluating. The number of close-type questions at each level as well as the significance, complexity, and depth of understanding needed at each level were considered while calculating the score for each level. There were eighteen questions

in total for each respondent. This approach was replicated by Roy (2014), Dhali (2013), and Shorif (2011). Each question was assigned a distinct ranking based on its significance, intricacy, and depth. The researcher assigned scores to each question based on the accuracy of the respondents' answers. The total knowledge score for all dimensions ranged from '0' to '48', where '0' denotes absolutely no knowledge of major carp culture practices and '48' denotes the maximum level of knowledge.

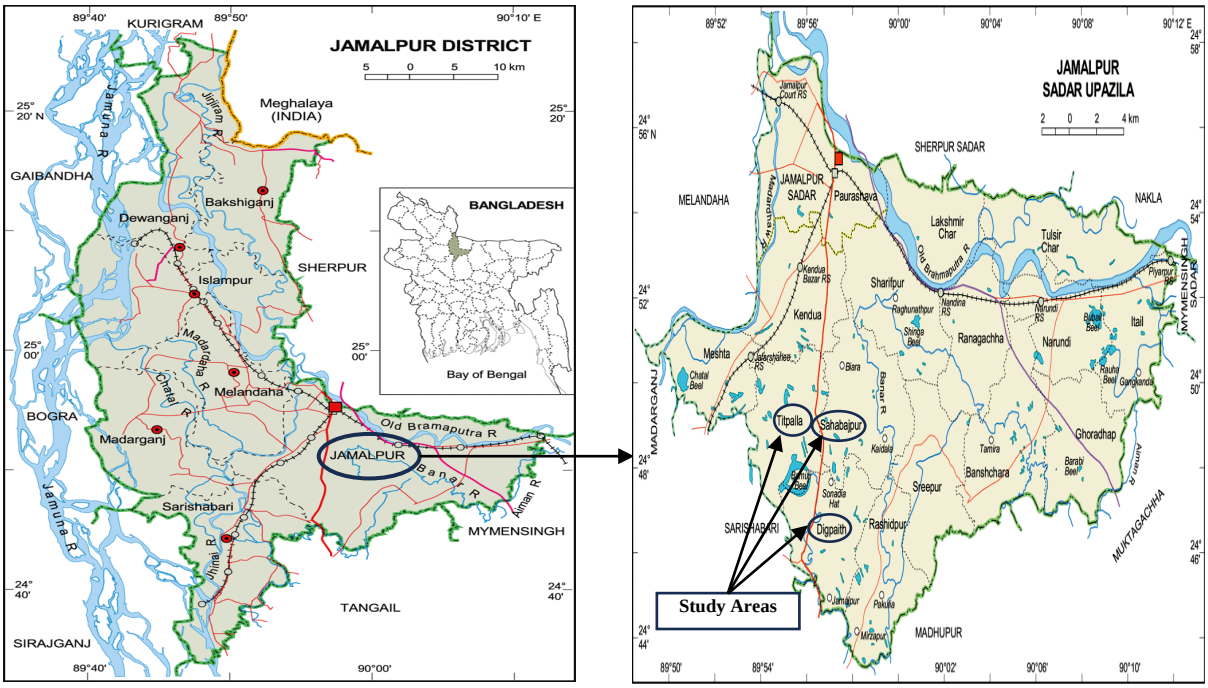

Figure 1. Maps of Jamalpur district and Jamalpur Sadar upazila (sub-district) showing the study areas.

To have an appropriate understanding of the comparative knowledge of the farmers, a knowledge index was computed. Therefore, six indices for six levels were computed. As the number of questions under six levels was not the same, the sum of computed scores for each of these levels was also different. Therefore, the Standardized Knowledge Index (SKI) for a given degree of knowledge was calculated using the following formula:

SKI = CS/PS X 100

Here,
SKI = Component's Standardized Knowledge Index
CS = The total score for the level of knowledge all farmers earned.
PS = The sum of all the possible scores for each farmer's level of knowledge

Possible SKI for a level of knowledge could range from '0' to '100', while '0' indicates no knowledge and '100' indicates very high knowledge.

Table 1. The sample size allocation of the fish farmers according to upazila, union and villages

Name of the upazila	Name of the union	Name of the village	Number of population	Sample size
Jamalpur Sadar	Digpaith	Chontia	306	46
	Sahabajpur	Mirzapur	160	24
	Titpalla	Maguripara	214	32
Total			**680**	**102**

Selection and measurement of the independent variables

The study included independent variables that included the following: age, education, family size, fish culture experience, farm size, area under major carp culture, annual income, credit obtained, training received, social mobility, organizational involvement and extension contact (Table 2). The variables were assessed utilizing suitable scales and a scoring system.

Table 2. Measurement of independent variables of the study

	Characteristics	Type of indicator	Unit
1.	Age	Individual	Years
2.	Education	Individual	For each year of schooling=1; no schooling=0
3.	Family size	Individual	Number
4.	Fish culture experience	Individual	Years
5.	Farm size	Individual	Hectare
6.	Area under major carp culture	Individual	Hectare
7.	Annual income	Individual	Taka
8.	Credit obtained	Individual	Taka
9.	Training received	Individual	Days
10.	Social mobility	Aggregated	Score between 0 to 18
11.	Organizational involvement	Aggregated	Score between 0 to 21
12.	Extension contacts	Aggregated	Score between 0 to 36

Note: Numbers shown in parenthesis indicate the total number of items under each variable

Statistical analysis

Data was analysed with care for the research objectives in mind. Statistical measures like frequency distribution, mean, percent, standard deviation, and rank order were used as needed to explain the chosen dependent and focal variables. Tables were utilized to illustrate the data and to clarify understanding. Data analysis was completed using the SPSS (Statistical Package for Social Sciences) computer program, version 21.

Using the acquired data, a multiple linear regression analysis was carried out (Equation 1). This method was used by the researcher for investigating the association between a single dependent variable and several independent variables. The study utilized multiple regression analysis to identify pertinent factors that could significantly impact fish producers' proficiency in major carp farming. The individual contributions of each significant variable on the variation in knowledge of fish farmers engaged in major carp farming were ascertained by step-wise multiple regression analysis (Sakiluzzaman et al., 2018; Izzah et al., 2020).

$$Y=\beta_0+\beta_1X_1+\beta_2X_2+\beta_3X_3+\beta_4X_4+\beta_5X_5+\beta_6X_6+\beta_7X_7+\beta_8X_8+\beta_9X_9+\beta_{10}X_{10}+\beta_{11}X_{11}+\beta_{12}X_{12}+e \quad \text{..... (Eq. 1)}$$

Here,

Y= Focus variable (knowledge of the fish farmer in practicing major carp culture),
β = Regression coefficient,
e= Error term,
X= Independent variable viz.,
X_1 = Age,
X_2 = Education,
X_3= Family size,
X_4= Fish culture experience,
X_5= Farm size,
X_6= Area under major carp culture,
X_7= Annual income,
X_8= Credit obtained,
X_9= Training received,
X_{10}= Social mobility,
X_{11}= Organizational involvement, and
X_{12}= Extension contacts.

Findings and Discussion

Socio-economic features of the fish farmers

The most important aspects of the features of carp fish farmers are presented in Table 3.

Table 3. Selected features of the respondent fish farmers

Traits	Grading scheme	Range		Categories	Respondents (n=102)		Mean	SD
		Possible	Observed		Frequency	Percent		
Age	Actual years	Unknown	18-58	Young (18-35)	4	3.9	41.61	7.49
				Middle age (36-55)	93	91.2		
				Old (>55)	5	4.9		
Education	Year of schooling	Unknown	0-12	Illiterate (0)	5	4.9	3.81	2.58
				Primary (1-5)	74	72.5		
				Secondary (6-10)	20	19.6		
				Above secondary (>10)	3	2.9		
Family size	No of member	Unknown	2-8	Small (2-4)	3	2.9	7.00	1.19
				Medium (5-7)	83	81.4		

				Large (>7)	16	15.7		
Fish culture experience	Year	Unknown	3-15	Low (Up to 5)	9	8.8	6.56	2.09
				Medium (6-10)	88	86.3		
				High (>10)	5	4.9		
Farm size	Hectare	Unknown	0.19-3.00	Marginal (0.02-0.2)	0	0	0.76	0.83
				Small (0.21-0.99)	55	53.9		
				Medium (1.0-3.0)	36	35.3		
				Large (>3.0)	11	10.8		
Area under major carp culture	Hectare	Unknown	0.5-4.5	Small (<1)	41	40.2	1.56	1.07
				Medium (1-3)	55	53.9		
				Large (>3)	6	5.9		
Annual income	Taka ("000")	Unknown	105-790	Low (<350)	65	63.7	355.57	173.77
				Medium (351-550)	24	23.5		
				High (>550)	13	12.8		
Credit obtained	Taka ("000")	Unknown	0-150	Not received (0)	15	14.7	52.25	35.18
				Low (up to 50)	31	30.4		
				Medium (51-100)	49	48.0		
				High (>100)	7	6.9		
Training received	Days	Unknown	0-5	No training (0)	20	19.6	1.36	0.94
				Short (Up to 3 days)	78	76.5		
				Medium (4-7 days)	4	3.9		
				Long (>7 days)	0	0		
Social mobility	Score	0-18	1-11	Low (up to 6)	34	33.3	6.89	1.18
				Medium (7-12)	68	66.7		
				High (above 12)	0	0		
Organizational involvement	Score	0-21	1-17	Low (up to 7)	33	32.4	8.39	3.56
				Medium (8-14)	66	64.7		
				High (>14)	3	2.9		
Extension contact	Score	0-36	9-29	Low (up to 12)	38	37.3	15.83	5.81
				Medium (13-24)	50	49.0		
				High (>24)	14	13.7		

Results presented in Table 3 show the important traits of carp fish farmers, highlighting important results. The respondents' average age was 41.61 years, and they had been in school for an average of 3.81 years. Additionally, it was determined that they had been cultivating fish for an average of 6.56 years. The majority (81.4%) of the respondent fish farmers had a medium sized family with a mean score of 7.00 and a farm size of 0.76 that indicates most of them were small farm sized family. Though they were a small farm sized family, they maximized their pond space by cultivating carp fish. The average area covered by carp culture was 1.56 ha.

The average annual family income of the respondents was 355.57 thousand Bangladeshi taka (BDT) whereas most of them (63.7%) belonged to low family income category. It's noteworthy to point out that most of the respondents (48.0%) received medium-sized loans, with an average of 52.25 thousand Tk. Only 14.7% of them didn't not receive any kind of loan. These numbers show how much money the fish farmers surveyed had and how easy it was for them to get supplies. Fish farmers were very much aware of the utilization of credit for which they were not taking credit as a burden. Two-thirds (66.7%) of the fish farmers had moderate social mobility. The more social movement there is, the more likely it is that you will encounter experts. Farmers with higher social mobility are more interested in adopting new technologies. Those who travel frequently to different places have more knowledge than those of others.

The majority (76.5%) of farmers had received short duration training with a mean of 1.36 days of training. That means farmers had little opportunity to have training on carp fish culture. Around two-third (64.7%) of the respondents were actively involved as members of social organizations at medium term basis. This also helps to acquire new knowledge and explores creative approaches of doing tasks. It is also important to note that around half (49.0%) carp fish farmers kept in moderate touch with extension agents, while 37.3% didn't respond well to such communication.

Knowledge of the respondent fish farmer in practicing major carp culture

The observed knowledge scores of the fish farmers were varied between 26 and 45, with an average of 33.6 and a standard deviation of 6.33. The respondents

were divided into three groups based on their knowledge scores: poor knowledge (up to 16), moderate knowledge (17–32), and high knowledge (above 32) (Vinod et al., 2012; Rahman, 2018). These groups are depicted in Figure 2.

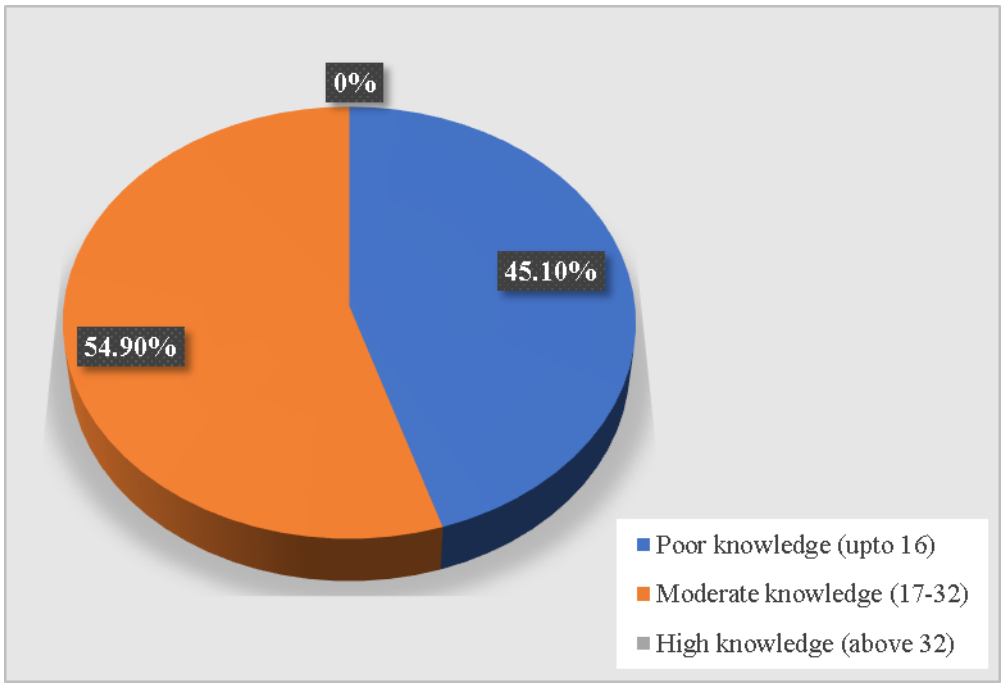

Figure 2. Categorization of the respondent farmers according to their knowledge in practicing major carp culture

It is evinced from Figure 2 that more than half (54.9%) of the fish producers possessed moderate level of knowledge followed by 45.1% of them had poor knowledge and none of them had a high level of knowledge in practicing major carp culture. The reason behind this moderate level of knowledge may be due to having a poor education with medium level of fish farming experience, short duration training, medium level of social mobility, organizational involvement and extension contact. Sheheli et al. (2023) discovered that a significant proportion of small-scale fish producers possessed a moderate knowledge on major carp culture and Shorif (2011) discovered that most fish farmers possessed a moderate amount of knowledge regarding cage culture which are almost like the knowledge of fish farmer in practicing major carp culture.

To have an appropriate understanding of the comparative knowledge of the respondent fish farmers, a knowledge index was computed. Therefore, six indices for six levels were computed. As the number of questions under six levels was not the same, the sum of computed scores for each of these levels was also different. Hence, the Standardized Knowledge Index (SKI) for a level of knowledge was determined. The Standardized Knowledge Index (SKI) was presented in Table 4.

Table 4. Knowledge of the fish farmer in practicing major carp fish culture.

Level of knowledge	Sum of possible scores for level of knowledge (PS)	Sum of computed scores for a level of knowledge (CS)	Mean	Standardized Knowledge Indices (SKIs)
Remembering	612	422	4.14	69
Understanding	612	337	3.30	55
Applying	612	267	2.62	44
Analyzing	918	363	3.56	40
Evaluating	918	301	2.95	33
Creating	1224	288	2.82	24

Information presented in Table 4 reveal that respondent fish farmers exhibited a superior capacity for memory retention and a comparatively worse

capacity for generating new ideas among the six categories of knowledge assessment. Ali (2017) reported a similar result in his study. Still, the situation was not satisfactory as far as the extent of knowledge is concerned. The situation was made further worse by the fact that the farmers had relatively low analyzing and evaluating capabilities.

Factors influencing the knowledge of the fish farmer in practicing major carp culture

The study employed multiple regression analysis to determine the elements that could potentially exert a substantial influence. The results of the linear regression analysis were shown in Table 5.

Table 5. Summaries of the multiple linear regression analysis.

Explanatory variables	Unstandardized Coefficients		Standardized Coefficients	t-value	Sig.	Collinearity Statistics	
	B	Std. Error	Beta			Tolerance	VIF
(Constant)	29.525	3.998		7.385	.000		
Age (X_1)	-0.048	0.064	-0.057	-0.755	0.452	0.618	1.618
Education (X_2)	1.121	0.229	0.456	4.889	0.00	0.406	2.465
Family size (X_3)	-0.593	0.390	-0.096	-1.522	0.131	0.880	1.136
Fish culture experience (X_4)	-0.407	0.248	-0.135	-1.644	0.104	0.524	1.907
Farm size (X_5)	-1.013	0.866	-0.132	-1.170	0.245	0.277	3.616
Area under major carp culture (X_6)	0.043	0.547	0.007	0.078	0.938	0.417	2.400
Annual income (X_7)	0.005	0.004	0.128	1.063	0.291	0.245	4.082
Credit obtained (X_8)	-0.012	0.017	-0.066	-0.717	0.475	0.411	2.430
Training received (X_9)	1.846	0.545	0.275	3.385	0.001	0.537	1.863
Social mobility (X_{10})	-0.096	0.359	-0.018	-0.268	0.789	0.784	1.275
Organizational involvement (X_{11})	0.391	0.158	0.221	2.470	0.015	0.441	2.268
Extension contact (X_{12})	0.204	0.093	0.187	2.201	0.030	0.488	2.048
n = 102, R = 0.828, R^2 = 0.686, Adjusted R^2 = 0.643, F-value = 16.167							

Results shown in Table 5 demonstrate that the adjusted R^2 value in the linear regression analysis was 0.643, with the corresponding F-value of 16.167 which was found significant at 1% level. Of the twelve independent variables, the linear regression analysis's findings indicated that only four variables showed statistical significance: education (X_2), training received (X_9), organizational involvement (X_{11}) and extension contact (X_{12}). Four independent variables together explained a 64.3% variance in the knowledge of the fish farmer in practicing major carp culture.

The regression results (Table 5) indicate that for every one unit increase in education (equivalent to one year), there is a corresponding rise of 1.121 units in knowledge in practicing major carp culture. Education helps to broaden the mind as well as increases the power of observation, understanding and decision-making in farm activities. It implies that increasing the level of education enhances the knowledge of the fish farmer in practicing major carp culture. Similar finds also found in the studies conducted by Roy (2014) and Ghosh (2014).

The results of the multiple linear regression analysis, displayed in Table 5, indicate that the training received had a substantial and favourable effect. Remarkably, the researcher discovered that a one-unit increase in training results in a 1.846unit gain in knowledge regarding the practice of major carp culture. Training makes a man skilled. A person who attends any training programme will automatically have a higher level of knowledge than a person who never have any training. Similar finds were also found in the studies conducted by Saha (2011).

The results of the multiple linear regression analysis also show that organizational involvement had a significant and positive trend. An increment of one unit (equivalent to one year) in organizational involvement leads to a proportional rise of 0.391 unit in knowledge of practicing main carp culture. Thus, fish farmers who demonstrate a high degree of organizational involvement have a larger level of expertise in the implementation of large-scale carp farming. In the example of organizational involvement and farmers' knowledge on aquaculture techniques in the Bogura district of Bangladesh, Sakib et al. (2014) reported findings that were nearly identical to those described above.

The results of the multiple linear regression analysis show that extension contact exhibited a substantial and advantageous trend. The knowledge of practicing major carp cultivation is increased by 0.204 unit if the extension contacts increase by one unit (one year). The opportunity for farmers to acquire information about the most recent fisheries technologies and advanced

agricultural techniques is enhanced by their interaction with various extension media. Similar findings about the application of extension media and the adoption of enhanced scientific techniques in composite carp culture technology were published in South 24 Parganas, India by Shasani et al. (2022).

Step-wise multiple regression analysis was performed and shown in Table 6 to ascertain the contribution of each significant variable to the variability in farmers' knowledge on major carp culture practices. The instrument was utilized to ascertain the significant independent variables that influence fish farmers' knowledge in practicing major carp culture.

Table 6. Step-wise multiple regression analysis for fish farmers' knowledge in practicing major carp culture

Model	Combination of the factors	Co-efficient of determination	Adjusted R^2	Percent of increase in adjusted R^2
1	Constant + X_2	0.477	0.471	47.1
2	Constant + X_2 + X_9	0.586	0.578	10.7
3	Constant + X_2 + X_9 + X_{11}	0.617	0.606	2.8
4	Constant + X_2 + X_9 + X_{11} + X_{12}	0.642	0.627	2.1

Results shown in Table 6 revealed that education (X_2) expresses the focus variable by 47.1%, training received (X_9) expresses 10.7%, extension contact (X_{11}) expresses 2.8% and organizational involvement (X_{12}) expresses 2.1% knowledge in practicing major carp culture by fish farmers. Fish culture requires technicalities regarding the use and management of instruments (Olaoye et al., 2013), where education can play a significant role in enabling farmers' knowledge as well as constraints resolution. According to Ogunmefun and Achike (2017), the educational level of the farmers influences management and adoption of suitable technologies. Yusuf et al. (2010) and Agboola (2011) stated that high literacy level facilitates effective fish farms management. This research is in line with the aforementioned studies where fish farmers education was considered as a vital variable which can have significant contribution to increase their knowledge level.

Conclusion and Recommendations

The vast majority of fish farmers only had a moderate knowledge on carp culture techniques. Four characteristics namely education, training received, contact with extension, and organizational involvement are shown to be the most significant and relevant factors among the twelve socioeconomic characteristics of farmers.

It is crucial that stakeholders like the Department of Fisheries (DoF), Bangladesh Fisheries Research Institute (BFRI), and other non-governmental organizations (NGOs) may take the necessary action because most respondents had just a moderate degree of knowledge regarding carp culture practices. This entails arranging field days, conducting method and result demonstrations, offering frequent need-based training in place of conventional training methods, and putting additional extension activities into place to improve the knowledge of fish farmers. The local NGOs and the Ministry of Education might undertake their adult education initiatives. By providing adequate facilities, it is important to encourage farmers who are young or middle-aged to participate in fishing activities. Furthermore, it is imperative for the extension workers to guarantee that every fish farmer receives the necessary extension service, meaning that the extension service must be accessible to all farmers. Measures may be taken by DoF for increasing farmers' organizational involvement.

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