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Study on Existing Technology and Knowledge on Aquaculture by Fish Farmers in Gomastapur Upazila of Chapai Nawabgonj District, Bangladesh

Maksud Alam[1], **Shyamal Kumar Paul**[2*] **and Kongchain Marma**[3]

1Finance Division, Ministry of Finance, Bangladesh Secretariat, Dhaka-1000, Bangladesh

2Department of Fisheries and Marine Science, Noakhali Science and Technology University, Sonapur, Noakhali-3814, Bangladesh

3Department of Aquaculture, Faculty of Fisheries, Bangladesh Agricultural University, Mymensingh-2202, Bangladesh

***Corresponding author:** Shyamal Kumar Paul, Department of Fisheries and Marine Science, Noakhali Science and Technology University, Sonapur, Noakhali-3814, Bangladesh, Tel: +8801716024079; E-mail: shyamal@nstu.edu.bd

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Abstract

A total of 150 farmers from three unions in Gomastapur upazila under Chapai Nawabgonj district were selected for determination of their aquaculture technology and knowledge. In this study, 83% of the fish farmers were adopted with extensive technology and rest 17% with semi-intensive technology. The aquaculture knowledge consisted of 6 levels such as, remembering, understanding, analyzing, synthesizing, evaluating and creating. The aquaculture knowledge of the fish farmers on different aspect of pond fish culture practices such as, pond biology, pond preparation, species selection and stocking density, water colour monitoring, pond fertilization, feed and feeding, disease control, harvesting and restocking, risk management and marketing revealed that most of the fish farmers belonged to low knowledge category. A few portion of the fish farmers had high knowledge. Most of the fish farmers had relatively better score on the first two levels (remembering and understanding) of knowledge. The farmers had low score on the analyzing, synthesizing, evaluating and creating component of knowledge. Among the personal characteristics of the farmers' education, extension media contact and aquaculture training experience were observed to be significant and positively related with their fisheries knowledge. But age, total income, religious affiliation and family size of the respondents had no relation with aquaculture knowledge.

Keywords Farmer knowledge; Fish production; Aquaculture; Technology

Introduction

Fish production in ponds, lakes, floodplains, oxbow lakes and semi closed water bodies are increasing day by day due to adoption of modem aquaculture technology by the fish culturists. In Bangladesh, fish production has been increased to 3.68 million MT in 20142015 [1], which was 3.54 million MT in 20132014 [2]. Indian major carps are the most important and principal species for aquaculture in South East Asian countries, including Bangladesh [3]. Polyculture is the system in which fast growing compatible species of different feeding habits are stocked in different proportions in the same pond, which has been in practice from the very beginning of the fish culture in China and in Indian subcontinent. During 1980's about 95% fish spawn used to be collected from natural sources but currently more than 98% spawn is produced in the hatcheries [1]. In our country about 83.72% of total fish catch comes from inland fisheries, out of this about 55.92% is contributed by culture fishery [1].

In the natural body, the capture fisheries is diminishing day to day due to agrochemicals, dike construction, flood, siltation, industrial effluents etc., [4]. As a result, peoples are engaged to practice of aquaculture in closed water body to meet up the protein requirement in our country [20]. In Bangladesh, most of the peoples meet up their protein requirement from animal sources which comes from freshwater fish sector. Now becoming fresh water aquaculture is enormous industry and major plays role in the sector of agriculture of Bangladesh [5]. There are three aquaculture technology are practiced namely extensive, semi-intensive and in some cases of intensive but most of the fish farmers adopted with extensive technology in [6]. Due to low price and demandable, most of the fish farmers are practiced of monoculture specially tilapia, pangus. Recently, the culture technique has been enormously changed and adopted modern technology by the fish farmers in our country [7]. The sector of aquaculture is not well developed due to lack of insufficient knowledge and awareness of the fish farmers [8,9]. To develop the aquaculture sector in Bangladesh, it will be needed to adopt and introduce the modern technology and genetically improved species where establish good relations among the developers, transfer agencies and the farmers [9]. Before giving any policy directions towards increasing production, it is important to know the socioeconomic characteristics of farmers, inputs used, their outputs, production costs, changes in socioeconomic status, problems associated in fish farming under different management systems. Further, it is imperative to determine the level of adoption of fisheries technology by the fish farmers and their ability to utilize aquaculture knowledge which they have acquired from formal training and extension activities conducted by Department of Fisheries (DoF), and other agencies. Evaluation of the aquaculture knowledge and skill of the concerned fish farmers is not the mere objective but an understanding of the influence of characteristics of the fish farmers on their adoption of modern aquaculture practices are necessary to plan and implement a programme for increasing the yield of fish.

Now considerable effort is being undertaken through research and extension delivery system to increase fish production. But actual increase in fish production will depend on the activities of the fish farmers. The behaviour of the farmers is influenced by his personal, economic social and physiological characteristics [10,11]. Therefore,

collection of information related to fish culture is an important factor for the promotion of aquaculture development in our country.

Materials and Methods

Study area and sample number

The present investigation was conducted in three arbitrarily selected unions under Gomastapur upazilla of Chapai-Nawabgonj district, Bangladesh (Figure 1). The selected unions were Bangabari, Alinagar and Rahanpur from where 12 villages were selected for collection of data. Data were collected from 150 farmers. The farmers for this study were randomly selected based on principle of simple random sampling. Data were collected from the concerned fish farmers through a well-structured questionnaire. The questionnaire as used in the present study was almost similar to that developed and used [12,13]. In this study, we were sketch out the existing aquaculture technology based on stocking density, culture type and feeding management. The knowledge of the selected fish farmers were determined based on six level of cognitive domain of learning as postulated by Bloom, 1956 which are remembering, understanding, analyzing, synthesizing, evaluating and creating.

The responses of the farmers towards the selected questions were quantified by means of scoring system as outlined in Table 1.

Response quality	Scores	Grade	Status
76 to 100 percent correct answer	4	A	High knowledge
51 to 75 percent correct answer	3	B	Medium knowledge
26 to 50 percent correct answer	2	C	Low knowledge
Below 25 percent correct answer	1	D	Poor knowledge
Wrong answer	0	F	No knowledge

Table 1: Scoring system for determination of farmer's response.

The responses of each question of the concerned respondent were graded according to the above mentioned scale. The score of respondent for a certain question representing each level of cognitive domain could vary from 0 to 4 as per scoring system outlined in Table 1. Then the total score of a respondent against a particular component of an aquaculture practices could range from 0 to 24, as there were 6 sub-levels of knowledge under each component. The total score of a respondent covering all the 10 components of aquaculture practices could vary from 0 to 240. From each technical area, six questions representing 6 sub-levels of cognitive domain were asked to the farmers. Attempts were made to find out the relationship between the personal characteristics of the respondent with their knowledge. For this purpose a null hypothesis was set which means that "There is no relationship between the selected characteristics of the fish farmers and their knowledge on semiintensive system of fish culture". Relationship between the knowledge and the personal attributes of the respondents were determined by simple correlation analysis.

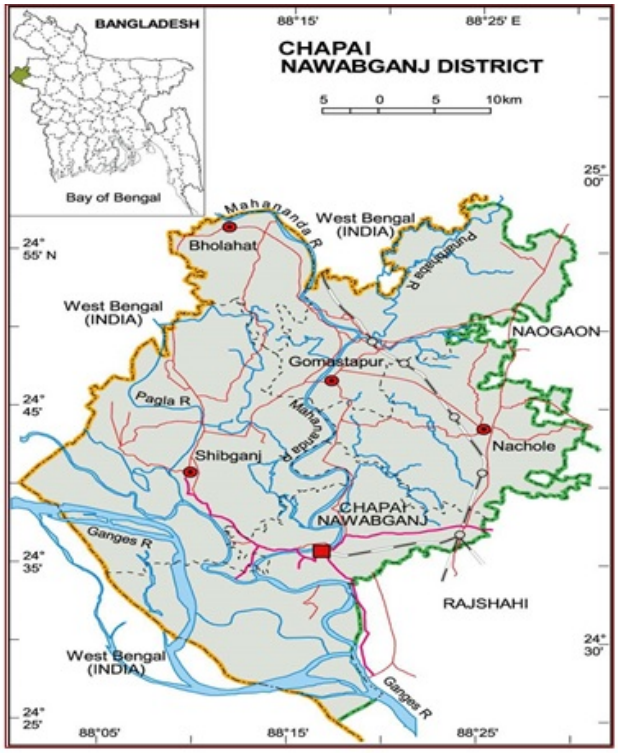

Figure 1: Map of Chapai Nawabgonj district showing Gomastapur upazila, Bangladesh.

Conceptual framework of the study

To explore the depth of knowledge is the important aspect of measuring a variable. The depth of knowledge or its level has been postulated by Bloom's since long. To measure knowledge of farmers, these levels have been incorporated. Farmers' knowledge has been conceptualized as the sum of knowledge at each of ten technical contents, and at each of six levels of Bloom's cognitive taxonomy for each content area. Relationship of this knowledge with independent variables has been determined to test the hypothesis of this study (Figure 2).

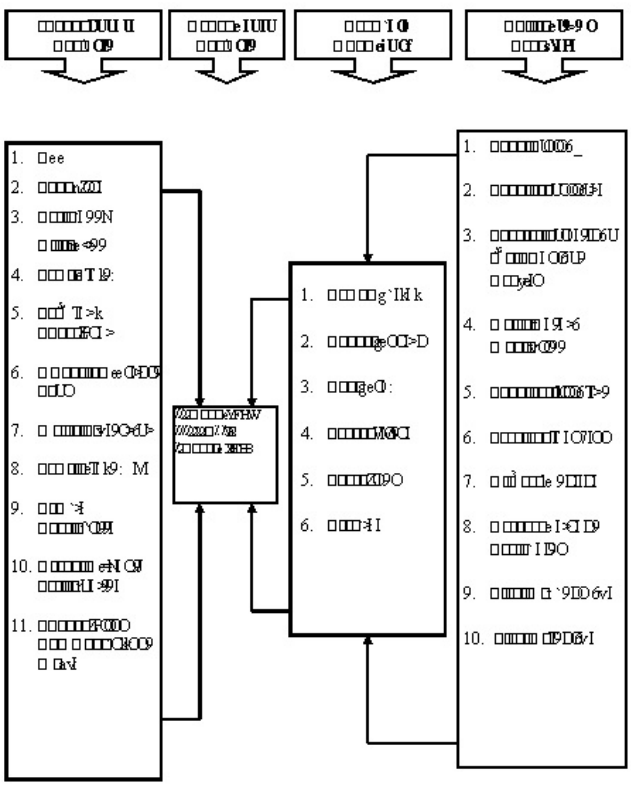

Figure 2: Conceptual framework of the study.

Measurement of dependent variable

Extent of knowledge on pond fish farming was measured based on content and level of knowledge. The contents included ten technical aspects of fish culture such as: Pond Biology (PB), Pond Preparation (PP), Species Selection & Stocking Density (SS), Water Color Monitoring, (WC) Pond Fertilization (PF), Feed and Feeding (FF), Disease Control (DC), Harvesting and Restocking (HR), Risk Management (RM) and Fish Marketing (FM).

Data processing and analysis

After data collection, data were verified to eliminate errors and inconsistencies. Any kind of inconsistencies in the data were searched and avoided out from the relevant data. Data were processed and finally analyzed using Microsoft Excel, SPSS. The data of local units were converted into international units before data analysis.

Results

Characteristics of fish farmers

Age of the farmers ranged from 25 to 65 years with an average of 41.16 ± 10.74 years. Table 2 indicated that approximately 46% of the farmers were in middle age category, whereas young category was 32% and 22% in old category. The educational status of the farmers varied from 1 to 12 with an average of 5.27 ± 2.83 years of schooling. About 64% of the farmers had primary level education, while 28% had secondary level. About 8% of the farmers had the higher secondary level of education. Farmers were classified into two categories namely, Muslims and Hindus on the basis of religion. About 90% of the fish farmers were Muslim and 10% of them were Hindus. The family size of the fish farmers varied from 2 to 12 with an average of 6.18 members. Data furnished in Table 2 indicate about 68% of the respondents had medium family whereas, 22% and 16% having small size family and medium family, respectively. There are about 82% of the fish farmers had crop cultivation as a major professional pursuit, while 12% had business and 6% of them had fish farming as the major occupation. The annual income of the fish farmers of Alinagar, Bangabari and Rahanpur union was highly variable. Their annual income ranged from BDT 30,000 to BDT 85,000 having an average of BDT 44,220. Most of the income of the respondents came from crop cultivation and business. The moderate income of the respondents in the research area could be due to the mango business in that area where a huge amount of mangoes is produced every year. The extension media scores of the fish farmers varied from 2 to 12 with an average of 5.08 ± 2.48. According to the media contact scores, farmers were classified into three categories such as, low contact (2-4), medium contact (5-8) and high contact (9-12). Table 2 showed that 48% of the farmers had low extension media contact whereas, 42% had medium exposure and only 10% of the respondent had high media contact. Aquaculture training experience of the respondents ranged from 0 to 7 days with and average value of 2.56 ± 1.67. On the basis of their aquaculture experience, the participants were classified into three groups (Table 2). About 68% of the farmers had received aquaculture training for 1-3 days while only 12% received no training and about 20% of them received medium level (4-7 days) of aquaculture training.

Characteristics	Fish farmers		Range		Mean±SD
	Nos.	(%)	Min.	Max.	
Age					
Young (25-35)	16	32			
Middle aged (36-50)	23	46	25	65	41.16±10.74
Old (51-65)	11	22			
Education					

Primary level (1-5)	32	64			
Secondary level (6-10)	14	28	1	12	5.28±2.83
Above secondary level (11-12)	4	8			
Family size					
Small (2-4)	11	22			
Medium (5-8)	34	68	2	12	6.18±2.17
Large (9-12)	5	10			
Religious affiliation					
Muslim	45	90			
Hindu	5	10			
Major profession					
Crop farming	41	82			
Business	6	12			
Fish culture	3	6			
Family income					
Low (30,000-45,000)	13	26			
Medium (46,000-65,000)	29	58	30000	85000	54220±13235
High (66,000-85,000)	8	16			
Extension media contact					
Low (2-4)	24	48			
Medium (5-8)	21	42	2	12	5.08±2.48
High (9-12)	5	10			
Aquaculture training received					
No training (0)	2	4			
Short training (1-4)	40	80	0	7	3.14±1.60
Medium training (5-7)	8	16			

Table 2: Characteristics of the fish farmers.

Since either parametric or non-parametric test used, the test of hypothesis by coefficient of correlation are shown in Table 3. Age of the fish farmers had no relationship with farmers' fish culture knowledge. In this way it can be summarized that farmers' knowledge on fish culture does not depend on their religious affiliation, family size and total income. The aquaculture training experience, extension media contact, education and major profession of the fish farmers were observed to be significant and positively related. On the basis of this, it appears that aquaculture training experience, extension media contact, education and major profession are the important characteristics of the fish farmers which influence them to attain and increase aquaculture knowledge.

Characteristics of the farmers (Independent variable)	Farmers knowledge of fish culture (Dependent variable)
Age of the farmers	r =-0.039NS
Total income	r=-0.152NS
Religious affiliation	r =-0.199NS

Family size	r =-0.124NS
Major profession	r=0.419*
Education	r=0.387*
Extension media contact	r=0.215*
Aquaculture Training received	r=0.228*
Note: *=Significant at 0.05 level, NS=Non-significant	

Table 3: Correlation coefficient (r) showing relationship between independent and dependent variables (n=50).

Aquaculture technology

From the study, it was revealed that there were two types of aquaculture practiced by the fish farmers. For extensive aquaculture, about 60% of the fish farmers were involved and other 40% were in semi intensive aquaculture. In the extensive aquaculture, farmers were use 22 species per decimal in monoculture but 33% in polyculture system. But in semi-intensive culture system, 40 species were cultured per decimal in monoculture and 62 were in polyculture (Table 4). For both culture systems, most of the fish farmers were use pangus, tilapia and koi and feeding as rice bran or mustard oil cake individually in the monoculture system, respectively. But in case of polyculture system, different types of species such as Rui, Mrigel, Catla, Thaipunti, Silver carp were use in both culture systems (Table 4).

Location	Name of Technology	Culture type	No. of fish (decimal)	Cultivable species	Feeding Management	Farmers responds (%)
Bangabari	Extensive	Monoculture	21	Pangus, Koi, Tilipia	Rice bran	29
		Polyculture	32	Rui, Catla, Silver carp, Mrigal	Mustard oil cake and rice bran	33
	Semi-intensive	Monoculture	33	Koi, Tilipia, Pangus	Complete feed (floating)	24
		Polyculture	63	Rui, Tilipia, Catla	Complete feed (Sinking)	14
Alinagar	Extensive	Monoculture	19	Pangus, Tilipia	Rice bran	24
		Polyculture	28	Mrigel, Thaiputi, Catla, Rui	Mustard oil cake and rice bran	41
	Semi-intensive	Monoculture	38	Koi, Tilipia, Pangus	Complete feed (floating)	20
		Polyculture	59	Catla, Rui, Silver carp	Complete feed (Sinking)	15
Rahanpur	Extensive	Monoculture	26	Pangus, Tilipia	Rice bran	18
		Polyculture	30	Rui, Catla, Silver carp	Mustard oil cake and rice bran	32
	Semi-intensive	Monoculture	48	Koi, Tilipia, Pangus	Complete feed (floating)	18
		Polyculture	64	Rui, Catla, Silver carp, Mrigal	Complete feed (Sinking)	32

Table 4: Types of Aquaculture with stocking density and feeding management.

Farmers' knowledge of fish culture

As per our scoring system, the score of a fish farmer under each of the 10 components of aquaculture practices could vary from 0 to 24. It could be seen from data in Figure 3 that the average score of the surveyed fish farmers ranged from 11.5 to 12.9 with an average of 12.2 ± 0.5. The component-wise average scores of the farmers were slightly above 50% of the possible score (24.0) which could be remarked as medium knowledge category.

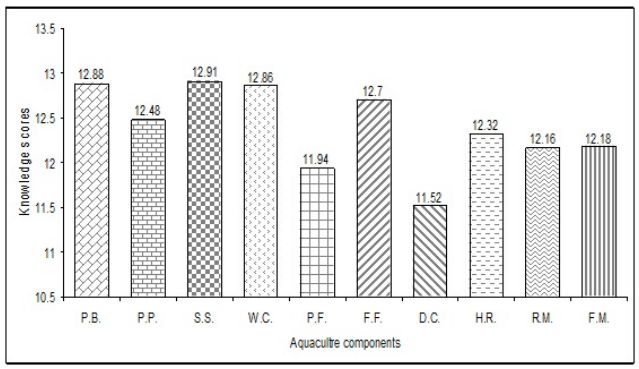

Figure 3: Overall average aquaculture knowledge of the fish farmers based on different components of aquaculture.

Relationship between farmer's characteristics and their knowledge of fish culture

Aquaculture knowledge of the farmers on different aspect of pond biology (PB) was measured and that about 73.17% of the fish farmers belonged to low knowledge category. A very insignificant portion of 2.83% of the fish farmers had high knowledge on pond biology (Table 5). Most of the fish farmers had relatively better score on the first two levels (remembering and understanding) of knowledge. The farmers had low score on the analyzing, synthesizing, evaluating and creating component of knowledge. Regarding pond preparation (P.P.) knowledge, most of 80.17% farmers fell in low category. About 22.33% of the surveyed farmers belonged to medium knowledge category an opposed to 4.67% in high knowledge category. It is noteworthy that a great majority of the respondent were very good in remembering level of knowledge profile. They were relatively poor in analyzing, synthesis, evaluation and creation sub-level of knowledge about pond preparation which was similar to that recorded for pond biology. For species selection and stocking density (SS), most of 73.67% farmers fell in the low category (Table 5). About 21.33% of the farmers belonged to medium knowledge category; while only 2% respondent was found to possess high knowledge in species selection and stocking density. Like other components of fish culture, the fish farmers had good knowledge on the remembering and understanding sub-level of knowledge on species selection. Farmers' mastery on the succeeding levels of knowledge was found to be very low. About 68.17% of the fish farmers belonged to low knowledge category and only 2.83% of the fish farmers had high knowledge on water color monitoring (WCM). Most of the fish farmers had relatively better score on the first two levels (remembering and understanding) of knowledge. The farmers had low score on the analyzing, synthesizing, evaluating and creating component of knowledge.

P.B.	Grade	Remembering	Understanding	Analyzing	Synthesizing	Evaluating	Creating	Mean
	Low	52	48	72	88	84	95	73.17
	Medium	40	50	26	12	16	0	24
	High	8	6	3	0	0	0	2.83
P.P.	Low	62	74	78	82	88	97	80.17
	Medium	43	55	20	12	4	0	22.33
	High	10	6	2	0	0	0	4.67
S.S.	Low	50	60	76	81	85	90	73.67
	Medium	50	43	22	13	0	0	21.33
	High	6	4	2	0	0	0	2
W.C.M.	Low	42	56	68	75	81	87	68.17
	Medium	42	48	20	13	8	0	21.83
	High	9	3	4	0	0	0	2.66
P.F	Low	55	40	78	89	92	98	75.33
	Medium	48	53	20	16	0	0	22.83
	High	10	5	6	0	0	0	3.5
F.F.	Low	63	51	73	85	82	99	75.5
	Medium	48	58	30	15	10	0	26.83
	High	14	6	3	1	0	0	4
D.C.	Low	43	58	67	79	86	89	70.33

	Medium	46	48	23	15	10	0	23.66
	High	6	2	1	0	0	0	1.5
H.R.	Low	47	42	67	82	85	90	68.83
	Medium	37	45	23	13	0	0	19.67
	High	7	2	2	0	0	0	1.83
R.M.	Low	42	38	55	73	79	85	62
	Medium	34	41	10	5	10	0	16.67
	High	8	3	2	1	0	0	2.33
F.M.	Low	55	45	76	87	82	96	73.5
	Medium	46	52	28	15	8	0	24.83
	High	17	7	6	3	0	0	5.5

Table 5: Distribution of the respondents according to their knowledge (%).

Regarding aquaculture knowledge of pond fertilization (PF); about 75.33% of the farmers fell in low category and 22.83% of the surveyed farmers belonged to medium knowledge category an opposed to 3.5% in high knowledge category (Table 5). Majority of the farmers like as 75.5% fell in the low category and 26.83% of the farmers belonged to medium knowledge category; while only 4% respondent was found to possess high knowledge in feeds and feeding (Table 5). The farmer's responses on knowledge about disease control are shown in Table 5. It can be seen that about 70.33% of the fish farmers belonged to low knowledge category. Only 1.5% of the fish farmers had high knowledge on disease control. Regarding 6 level of knowledge, most 68.83% of the fish farmers was found to be in the low knowledge category on harvesting and restocking. About 19.67% of the fish farmers had medium knowledge whereas; only 1.83% farmers belonged to high knowledge category.

Data furnished in Table 5, indicated that about 62% of the fish farmers belonged to low knowledge category. A very insignificant portion that was 2.33% of the fish farmers had high knowledge on risk management. Based on the scores obtained, farmers were classified into three categories such as, low, medium and high. In consideration of 6 level of knowledge, about three-fourth like as 73.5% of the respondents were found to be in the low knowledge category on fish marketing associated with pond fish farming. About one-fourth that was 24.83% of the fish farmers had medium knowledge as against of 5.5% farmers having high knowledge on the subject regarding analysis, synthesis, evaluation and creation profile of knowledge on fish marketing, the fish farmers fell into poor level.

Discussion

The age of the fish farmers was found to have no significant relationship their aquaculture knowledge. [14,15] Found significant relationship between age and adoption of modern aquaculture technology. Education is a pre-requisite for acceptance and adoption of aquaculture practices. Education helps a farmer to gain necessary ideas and judge the profitability of aquaculture enterprises in socio-economic development. In the present study aquaculture knowledge of the fish farmers was positively correlated with farmers' educational status. Similar result have been reported [11,16]. Fish farming was previously considered to be minor activities of the rural farmers. In our surveyed areas fish farming is predominately confined with those farmers who derive income from different sources. The similar conclusion was also reached in some studies [17,18]. Extension media contact was positively correlated with farmers' knowledge on pond aquaculture practices. Similar types of findings were noted [19,20].

Training brings about desirable changes in the cognitive, psychomotor and affective behaviour of the farmers and helps them to perform their job effectively and efficiently [21,11]. Results of our present study showed that aquaculture knowledge of the fish farmers were positively correlated with the intensity and duration of training. Aquaculture knowledge of the fish farmers is influenced by a variety of interrelated factors such as, social, environmental, physical, economic and technical traits [22,23]. The farmers in the surveyed areas were found to have low level of aquaculture knowledge on most of the components of pond fish culture. Farmers knowledge score on the subsequent sub-levels of cognitive domain particularly on analyzing, synthesizing, evaluation and creating were found to be in diminishing order in all the components of pond aquaculture. Comparatively low score of the respondents in the above sub-level of knowledge seemed to be related with the difficulty and complexity of questions as put forward to the fish farmers which required much thinking, greater aptitude, psychological and intellectual exercise on the specific technical matters. Diminishing trend of knowledge score of the fish farmers as observed in our study are comparable to those reported in their field level of studies [12,24-28]. The Department of Fisheries (DoF) and the local NGO's have a greater role and responsibility to undertake appropriate plan and programme to train up the fish farmers with a view to providing them with new knowledge, develop skill and building up of positive attitude [22,23] so that the farmers become encouraged and motivated to practice aquaculture for their socio-economic development. Before recommending any aquaculture technology to the fish farmers, it is important to consider their socio-techno-economic and educational background [11,22].

Conclusion

Most of the farmers of the surveyed areas were found to possess low aquaculture knowledge, though a small proportion of them had

medium knowledge. This is not a desirable situation for the promotion and development of freshwater aquaculture. As the Department of Fisheries (DoF) is entrusted with the responsibility of disseminating and popularizing aquaculture technologies in the country, therefore, DoF should take comprehensive plan and programme to educate the fish farmers through providing training and extension support. The NGO's may also come forward to supplement the government effort to strengthen aquaculture activities for the socio-economic development of the rural fish farmers.

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