

*Full length Research paper*

## **Traditional methods of fish drying: An explorative study in Sylhet, Bangladesh**

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Accepted 19 August, 2014

The present study investigated traditional process of fish drying in three representative fish drying areas in Sylhet district of Bangladesh namely Taker bazar, Mahtabpur and Amtoli during October 2012 to March 2013. A total of 20 dried fish processors, selected randomly from three sites (6 from Taker bazar, 8 from Mahtabpur and 6 from Amtoli), were interviewed using a semi-structured questionnaire. Results showed that in all sites all together 23 species of fish were used for drying purpose. Drying activities generally started from mid-October to mid-March. A substantial amount of income was found to be generated from the fish drying activities as reported by the respondents where 26.31%, 28.94% and 44.73% dried fish entrepreneurs were found in the income ranges of Tk. 10,000-75,000, 1,00,000-5,00,000 and 6,00,000-10,00,000 respectively. The mean daily wages of male and female labours were Tk. 220 and 70 respectively seems gulf of difference apparently. This study revealed that the fish processors in the studied areas mainly used the traditional methods for drying and substantial improvement was needed at different stages of handling, processing, and transportation of the fresh fish to get the high quality dried fish products. Training of the fish processors on above aspects including hygiene, sanitation, good water quality and raw materials was found very important to ensure high quality dried products for the consumers.

**Key Words:** Sun drying, fish processing, dried fish, consumers, salting.

### **INTRODUCTION**

Fish and fisheries are the intrinsic part of life of Bangladeshi people from the time long past and play a vital role in generating employment, nutrition, earning foreign currency and other aspects of the economy (Alam, 2002). Bangladesh is blessed with diversified fisheries resources (Kibria and Ahmed, 2005). The rivers and several haors in greater Sylhet are famous for producing huge amount of fish during late monsoon. During this time rivers, beels and haors remain calm and quiet and also the fishes attain marketable size grazing in these rich water bodies, as a result fishing activities are

strengthened and a huge amount of fishes are harvested during this period than the other seasons. Therefore, a glut is obtained from the haor areas during winter season. As huge quantities of fresh fish are caught every day, much of them remain unsold because of shortage of buying customers, as a result big amount of post-harvest loss occurs. Bulk catches are destroyed at that time due to unavailability of processing and preservation facilities. Therefore, the local people and also some entrepreneurs come forward to produce dried fish ('shutki' in Bengali). It is estimated that about 20% of the local artisanal fish catch are sun dried and consumed in the domestic market in Bangladesh (Mazid and Kamal, 2005).

Drying is a traditional method which has been used for centuries for preserving fish (Cole and Greenwood-Barton, 1965; Waterman, 1976). Drying method is con-

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idered as the least expensive method of fish preservation (Balachandran, 2001). Dried fish is a very popular and delicious food item in Bangladesh especially, in the coastal, central and north-eastern districts (Nowsad, 2007). It is also a most reliable source of protein to the people in rural areas of least developed countries (Graikoski, 1973). This traditional method is followed for the preservation of fish especially in rural areas (Chakrabarti and Varma, 1999). Edible fishes are preserved through removal of moisture. The basic principle of fish drying is that the activity of the muscle enzyme and microorganism is reduced to a minimum through the revocation of the water content of the fish by sun drying in a traditional way (Banglapedia, 2014). Fish drying is carried out in some selected parts of Bangladesh where modern preservation facilities and good infrastructure for transportation are absent. The methods employed for handling and processing of fish in Sylhet are still traditional and need lot of improvement. The information pertaining to various aspects of post-harvest handling, processing, distribution and socio-economic condition of dried fish processors are important as it acts as an implement for fisheries development and acts as a forward linkage for value addition and quality control with consequent economic and employment benefits. Although, few scientific articles on drying methodologies, household socio-economics, resource use of dried fish processors (Ahmed et al., 1993; DFID, 2001) and entrepreneurs has been conducted in Bangladesh but no such research work was found especially on fish drying activities, socio-economic condition dried fish processors and entrepreneurs in Sylhet district of the country. The present study was conducted to evaluate the fish drying activities and socio-economic condition of dried fish processors and entrepreneurs in two upazilas of Sylhet district through field investigation.

## MATERIALS AND METHODS

The present study was carried out at Tukur bazar of Sylhet sadar upazila; Mahatabpur and Amtoli of Bishwanath upazila in Sylhet district. The study was conducted for a period of five months from October 2012 to March 2013. A total of 20 dried fish processors were interviewed from the study areas that were selected randomly (6 from Tukur Bazar, 8 from Mahtabpur and 6 from Amtoli). A semi-structured questionnaire was prepared and then modified with necessary corrections for field data collection. Respondents were asked about drying season, overall drying process, amounts of fish dried per lot, the months that were most favourable for fish drying, and the fishes that are very suitable and rare for drying. Additionally information regarding activities of processors during off season and total dried fish

production, cost, income and labour wages for drying activities was also collected. Questionnaire based interview was taken in collecting data. The data were cross-checked and then summarized and tabulated. Finally tabulated data were analysed by using computer software Microsoft Excel. One way analysis of variance (ANOVA) was performed and compared in a repeated measure ANOVA. If the main effect was found significant, the ANOVA then followed Duncan's Multiple Range Test (DMRT) to compare the variations among the treatments means. All statistical tests were carried out at a 5% significance level using SPSS (Statistical Package for Social Science) (Version 11.5, SPSS Inc, and United States of America).

## RESULTS AND DISCUSSION

### Fish drying activities

#### Fish drying yard

Fish drying yards were suitable places where the drying activities were carried out. They were situated near the fish market or highway for easy communication. In Tukur bazar twelve fish drying points were observed while they were twenty in Mahtabpur and six in Amtoli. Among the three sites, Mahtabpur was the largest fish drying area. The bamboo-marked territory was locally known as 'Dangari'. Both bamboo-made mat and rack was used for drying purpose. Mainly drying activities were carried out in commercial basis. The hygienic conditions of those areas were not satisfactory. Although the fish drying points were separated from the locality, the stench of dried fish could cause serious health hazard and also pollute the environment. Reza et al. (2005) studied about traditional drying of marine fishes of Bangladesh where commercial drying was carried out in sandy beaches of Cox's Bazar region, where fishes were contaminated with sand, blowflies and microorganisms. Bhat et al. (2013) conducted a study in district Bandipora of Kashmir valley and reported the conventional method employed in drying of fishes was unscientific and can cause serious health hazards and more or less similar studies was also conducted by Immaculate et al. (2013), where they found the poor quality of dried fishes were mainly due to unhygienic processing and drying methods, inadequate salting, use of spoiled fish for processing and lack of air tight packing of the dried fishes which was more or less similar of the present study. Patterson and Ranjitha (2009) studied about qualities of commercially and experimentally sun dried fin fish, *Scomberoides tol*. The hygienic and nutritional qualities of the fish that are dried by using rack was good enough to the fishes dried directly on the ground, surface of rocks, wooden platforms, and palm leaves. Drying of fish in rack enables

**Table 1.** Available fish species that are used for sun drying in the study area.

Availability	Fish Name	Scientific Name	Drying duration (day)
Higher	Punti	<i>Puntius sp.</i>	3-5
	Chanda	<i>Chanda sp.</i>	3-4
	Kakila	<i>Xenentodon cancila</i>	3-4
	Tengra	<i>Mystus vittatus</i>	3-4
	Kholisha	<i>Colisa sp.</i>	2-3
	Baim	<i>Mastacembelus sp.</i>	5-6
	Chingri	<i>Macrobrachium sp.</i>	2
	Chapila	<i>Gudusia chapra</i>	3-4
	Mola	<i>Amblypharyngodon mola</i>	2-3
	Dhela	<i>Rohtee cotio</i>	2-3
	Meni	<i>Nandus nandus</i>	3-5
	Batasi	<i>Pseudeutropius antherinoides</i>	3-4
	Bacha	<i>Eutropiichthys vacha</i>	2-3
	Darkina	<i>Esomus danricus</i>	2-3
	Rani	<i>Botia dario</i>	2-3
	Gutum	<i>Lepidocephalus guntia</i>	2-3
	Less	Buzuri	<i>Mystus tengara</i>
Bele		<i>Glossogobius giuris</i>	3-4
Potka		<i>Tetraodon sp.</i>	4-5
Shol		<i>Channa striatus</i>	5-6
Boal		<i>Wallago attu</i>	5-6
	Taki	<i>Channa punctatus</i>	2-3

well exposed of fish muscle to sun light and moving air that made the fish to be dried quickly and the end product would be clean and hygienic.

### Species that are used in drying purpose

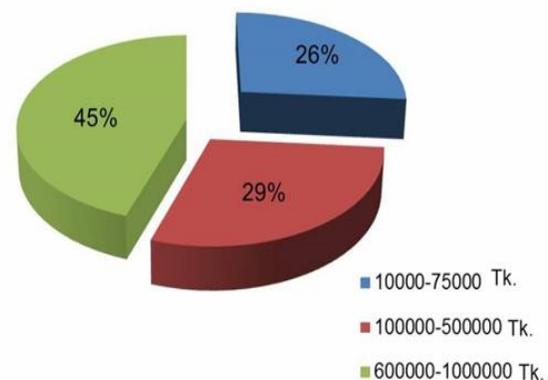
Various types and sizes of fish were used in sun drying. Generally, small fishes were selected for drying than larger ones. This was because of the availability and market demand of small species. A list of major species used for sun drying in different fish drying areas with their drying duration is given in Table 1. Drying duration varied from 2 to 6 days depending on the size of the raw fishes, availability of sunlight, relative humidity, surface area of fish and wind action etc. But in cloudy weather, 2 to 4 days or more were required for complete drying. Other similar studies by Flowra et al. (2012) and Samad et al. (2009) conducted in Chalan Beel areas of Bangladesh on fish drying also reported the drying duration recorded to be varied from 2-6 days depending on the size of the raw fishes at normal weather condition, which are in concert with this study findings.

### Season and seasonal income of fish drying activities

Fish drying generally started in mid-October and ended in mid-March. Sufficient sunlight was available during that time and wind moisture content was less which enabled proper drying of fish. Fish drying activities also depended on the raw materials availability and market demand of fresh fish. Flowra et al. (2012) also found most of the fish drying points were operated seasonally (from July to March) where the peak period of drying was September-October.

The seasonal income of drying enterprise might vary from area to area. This variation was due to the raw material availability, processing cost and demand of the consumers. The average seasonal income of fish drier enterprise in three study areas is given in Fig. 1.1. It showed that 26.31%, 28.94% and 44.73% fish drier enterprises were found in the income range of Tk. 10000-75000, Tk. 100000-500000 and Tk. 600000-1000000 respectively.

The data revealed that only nearly half of the fish drier entrepreneurs had the handsome earnings from the business. Flowra et al. (2012) reported the average monthly income of dried fish processors of Chalan Beel area that, 30.71%, 50.00% and 14.28% seasonal dried fish processors were grouped into the TK. 2000- 5999, Tk. 6000-10999 and Tk. 11000 -15000 income range. The earnings of the processors in the present study were higher than Flowra et al. (2012). The difference in income range might be due to the scale of drying activities, raw materials availability and the consumer preference about dried fish in certain area. Therefore, it was very much profitable and suitable businesses in this area as the seasonal fishes were available during glut catch.



**Figure.1.1.** Percentage of seasonal fish drier enterprise in different income groups.

### Traditional Sun Drying Methods of Fish

#### Raw material collection system

Raw fishes were harvested by fishermen from rivers, haors and beels of Sylhet District. Then the fishes were

brought to the nearest markets by rickshaw, van, pickup van, truck etc. Directly fishermen also sold their catches into the drying yards. In the Tukur bazar fish drying area, the fish processors collected fish from Kazir Bazar fish market, in Mahtabpur, from Mahtabpur Bazar fish market, and in Amtoli, from adjacent haor named 'Boro haor'. Generally, semi-spoiled fishes were used as raw materials for drying. Reza et al. (2005) conducted a study on traditional drying activities of commercially important marine fishes of Bangladesh and found poor quality raw materials were used for drying which coincides with the findings of the present study. Latif et al. (1983) studied on the status of the dried fish processing industry in the East Coast states of Kelantan and Terengganu where most processors agreed that freshness of fish before processing was a very important factor in producing good quality dried fish which agreed with the present finding. Transportation of raw fishes from fish markets to drying point was mainly carried out by non-mechanized van, rickshaw, boat, and bicycle or by head load or shoulder load.

### Processing of fish

After collection of fish, they used it for processing. Sorting of fish was not common before drying in the study areas. After completion of drying, it was practiced to separate the fish according to the species, size and quality. Primary washing was not common after collection of fresh fish for drying. Dressing was observed there for larger fishes like large *Puntius sp*, *Wallago attu*, *Channa striatus* and *C. marulius* and splitting is also observed for *W. attu*, *C. striatus* and *C. marulius* which was done for uniform drying of all parts of muscle. It was also observed that the smaller fishes were directly dried under the sun without any types of dressing. Our findings agreed with the findings with Samad et al. (2009).

Addition of salt was also practiced in the study areas. But mainly low quality salt was used. Suparno (1994) reported that, the use of solar and impure salt in fish drying in Indonesia was a source of halophilic bacteria and affected salt penetration into the fish flesh. The production of salted or unsalted dried fish depended on the choice of processor, consumer demand and market price of the product. But in our study sites, fisherman only used salt in fish in the cloudy weather. The rate of salt mixing was observed as 1 Kg non-brand commercial salt per 8-10 Kg of fishes. Wooden pole was used for mixing of salt with fish. Then it was used to keep covered by bamboo mat for 5-7 hours.

After salting, fishes were used to wash in water for the removal of salt. In Amtoli village dry fish farmers used haor water for this purpose. In most cases, fishes were used to wash in water containing plastic drums. The water of the drums was not changed frequently after

washing a batch. The waste water was also dumped in the nearby areas. The remaining salts in the waste water were strained and sun dried which were used in salting for second time use in fresh fish. Sugathapala et al. (2012) also studied about salt based dry fish processing and marketing by fishers of Minneriya reservoir in Sri Lanka. After dressing, fishes were washed thoroughly and salted at a ratio of 1:3 (salt: fish), mixed well and packed into plastic buckets (20L) and kept for 2-3 day. The salted fish were then spread on large stones and sun dried. But in Sylhet district, Salting of fish can be done for 5-7 hours and 1 Kg salt was used for 8-10 kg fish. Salt was used less amount in fish of study area than Sugathapala et al. (2012). This might be due to the climatic condition of Bangladesh as during the drying season, moisture content of air was comparatively less and it took comparatively fewer days to complete drying.

### Chemicals used in fish drying

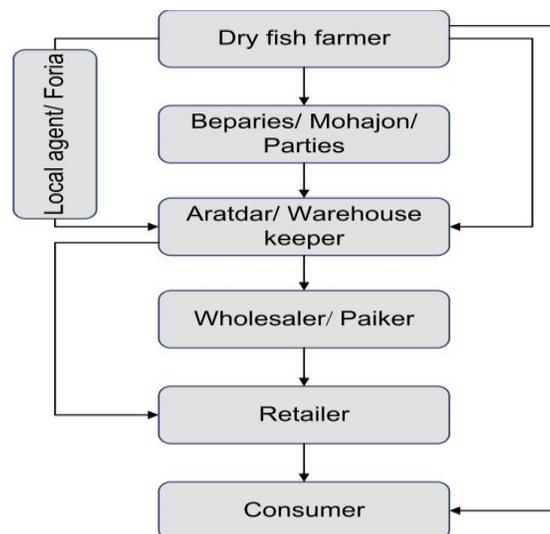
In Mahtabpur and Amtoli, fish processors didn't use any type of chemicals or preservatives to store the dry fishes for long time both during processing and storage because their products were sold within a very short period of time. But in Tukur bazar areas, few processors used agricultural pesticides for long time storage and prevention of blowflies' infestation in dried fish. Most citable of them were DDT and Nogos. Both are banned for use in Bangladesh. As the processors have no knowledge about the action of pesticides, dose limit and residual effects of chemicals, they used 5-6 drops of pesticides in 80 litre of water during washing of fresh fish. The use of pesticide was sharply reduced in sunny days. Reza et al. (2005) studied the traditional drying activities of commercially important marine fishes in the coastal region of Bangladesh and observed that the processors soak the raw fishes in various kinds of insecticides including DDT, Nogos (Dichloroves) prior to drying with concentration ranging from 20-80 ppm (parts per million). Our study reveals that, processors were not found interested in using red pepper and turmeric powder (having pesticidal effects), because they reported, spices changed the original fishy colour of dried fish and consumers were also not interested about those fishes.

### Drying under the sun

Drying method varied with the type or size of fish to be dried. Both bamboo made rack (1.5-3 feet high from earth) and mat were used for spreading of fish. In most of the places, fishes were spread on mat directly on earth without using any bamboo rack. Sometimes large fishes like *W. attu*, *C. striatus* and *C. marulius* were hanged from a rope that tied horizontally to the two poles placed



**Fig. 1.2.**(Clockwise): (a) Fish drying yard, (b) Collection of raw materials for drying, (c)Salting of fish, (d) Salted fish is keep covered by bamboo mat, (e) Washing of salted fish in water containing plastic drum, (f) Spreading of fish in bamboo matfor sun drying, (g)Dried fish sorting by women workers, (h) Bamboo basket is used for temporary storage purpose (Photo credits: S.S. Marine).



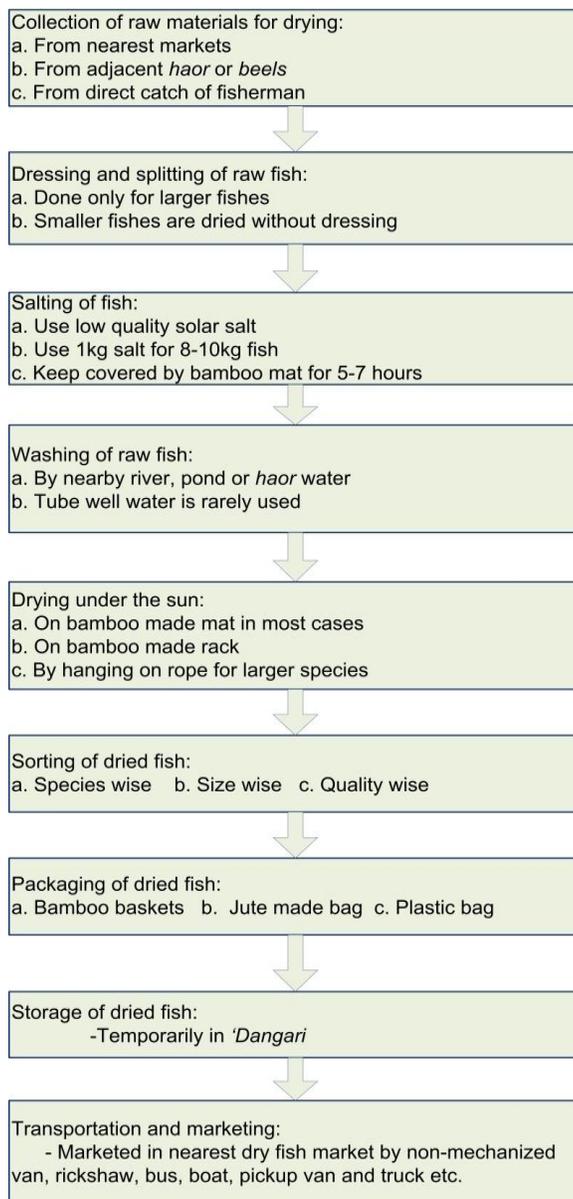
**Figure.1.3.**Marketing channel of dried fish in Sylhet.

vertically for drying instead of using any rack. The finding agrees with the findings of Samad et al. (2009) where people of Chalan Beel areas carried out their drying activities on bamboo rack or fishing net directly on earth for business purpose and by hanging of bamboo baskets and small earthen pots for home consumption. In the present time, drying of larger fishes is not common due to the scarcity of raw materials. During drying, dry fish processors turned over the spread fishes at regular interval to

accelerate the drying process. Soegiyo(1994) also reported that traditional sun drying was carried out in trays, where fishes were arranged sequentially. When the fishes were dry enough on one side, they were turned upside down to complete the drying process.

### Sorting of dried fish

Smaller fishes were remained in mixed condition and were



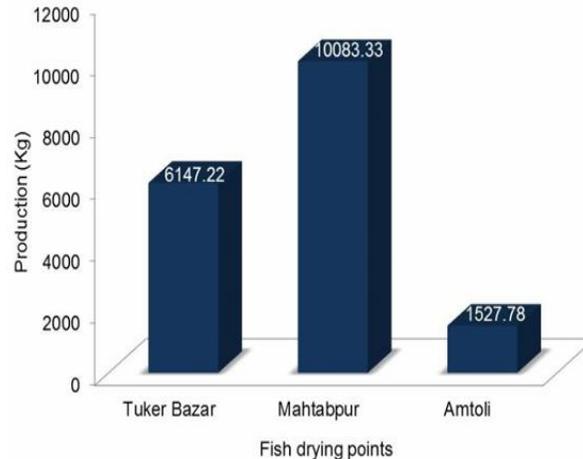
**Figure.1.4.**At a glance fish drying activities in Sylhet.

sorted out after drying. Generally women workers sorted out the mixed dried fishes and separated the fish according to the species, size and quality of the dried fish. However, sorting of fish could be varies from area to area. Flowra et al. (2012) reported that sorting of dried fish was not common in ChalanBeel areas of Bangladesh but it was only performed after collection of raw fishes for drying. This difference might be due to the variation in traditional processing activities of two study areas.

### Packaging and storage

After drying of fishes, packaging was done by plastic and

jute made bags. Sometimes bamboo baskets (which are called 'tukri' locally) were also used for this purpose. Storage of dried fish was found to be performed in the 'Dangari' generally made of tin, wood and bamboo splits and used for temporary storage of dried fish until marketing. Samad et al. (2009) reported that the bagged dried fishes were kept into the tents generally made of thin plastic sheet and bamboo splits for temporary storage until marketing or selling. Gopakumar (1994) reported that packaging materials that were used for dried fish in India were coconut leaf baskets, bamboo baskets, or gunny bags. But none of them were found as an efficient packaging material for dried fish in our study



**Figure.1.5.** Mean monthly production of dried fish in three drying points in Sylhet.

sites. If any infestation was found during storage of the stored product, sun drying was performed again for 1-2 days and restored as reported by the processors. (Fig. 1.2).

### Transportation and marketing

Dried fishes were transported from drying point to wholesale market by non-mechanized van, rickshaw, bus, track, Pickup van, boat etc.

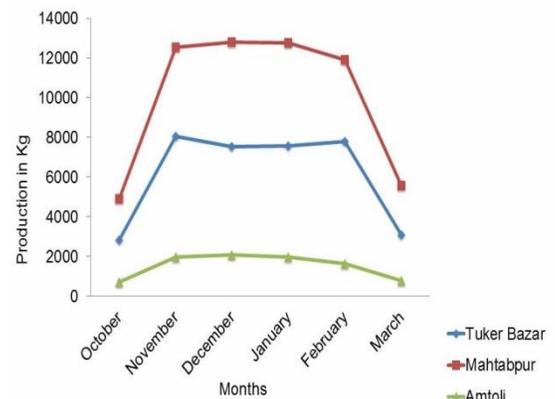
In Mahtabpur and Toker bazar areas, they used to sell their products to the Aratdars of Shorarpar, Mahajanpur and Machimpur Bazar dry fish market. In case of Amtoli areas, they sold their product in Rampasha Bazar or adjacent areas. Marketing channel of dried fish in the study areas includes dry fish farmers, several intermediaries (local agent/ Foria, Beparies, Aratdar/ Warehouse keeper, wholesaler/ Paikers and retailer), and consumer which is shown in Fig. 1.3. A common dried fish marketing channel was observed during the investigation period. This result coincides with Samad et al. (2009). (Fig.1.4).

### Production of dried fish

The production of dried fish might be varied from area to area and drying points to drying points. Sylhet region of Bangladesh supports huge water resources and a part of huge catch were used for processing of dried fish because of its consumer demand and public preference. Total dried fish production from Toker bazar, Mahtabpur and Amtoli of Sylhet district were 73766.64 kg, 201666.6 kg and 9166.68 kg respectively which is shown in Fig.1.5.

The fluctuation of dried fish production in different months is shown in Fig.1.6. The dried fish production was always higher at the Mahtabpur area followed by Toker bazar and Amtoli area.

In October and March, the average production was lower than other months which were due to the scarcity of raw materials for dry fish production.

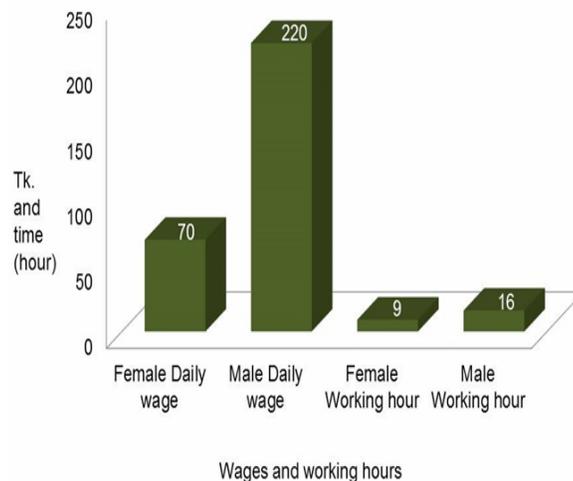


**Figure.1.6.** Average dry fish production in different months at three fish drying points

### Labour cost of fish drying activities

The male labours got their wages on monthly basis whereas females worked only daily basis. Their wages varied from drying points to drying points. Male workers worked 7.00 a.m. to 11 p.m. while female workers worked 7.00 a.m. to 4.00 p.m. Females were mainly involved in dressing and sorting activities whereas male workers handled the whole drying process other than dressing and sorting of fish. Rabbanee et al. (2012) studied about women involvement in dry fish value chain approaches towards sustainable livelihood where they found women workers were involved in different income generating activities like drying, sorting and grading, cleaning and salting etc. that supports the finding of the present study.

The average daily wages of male and female labor was



**Figure.1.7.** Labour wages and working hours in study areas.

recorded Tk. 220 and Tk. 70, respectively (Fig. 1.7). The average monthly wages of male labor was Tk. 4080. There was a distinct difference in the daily wages between male and female labor. Male labor got daily 13.75 Tk. per hour but the female labor got only 7.78 Tk. per hour which indicated prevalence of gender discrimination in fish drying labors.

## CONCLUSION

From the study it was clear that the fish drying in three drying areas of Sylhet district was traditional. Poor quality raw materials were used for drying to fetch higher price than usual. As it was relished by many people of the country, there was ample opportunity to improve the quality of the fish drying process in the study areas. For the improvement of quality of dried fish, it was not necessary to use any sophisticated equipment based technology. Maintaining proper sanitation and hygienic practice in all stages of fish drying in processing area, and introducing adequate packaging and storage methods would increase the shelf life of dried fish to larger extent. A satisfactory dried product is highly desirable at all consumer levels and for that reason drying process should be practiced following scientific ways. Extension work is needed to increase the awareness among dry fish farmers on proper handling procedures and quality standards to ensure reduction in losses and improving the quality of products. In these instances, low cost solar dryer can be constructed by using locally available materials that will ensure high quality dried products, safe for consumption and will fetch higher economic benefits for the dried fish processors and consumers.

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