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Economic Analysis of Fish Drying Units in Kozhikode, Kerala

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ABSTRACT

A very rapid loss in quality can occur in the case of fish, after catch, as it is an extremely perishable commodity and hence, the proven preservation method of drying which is the least expensive method of food preservation is still being practiced in India. Even though it is a simple and cheap method, it has great significance in the socioeconomic system of fisher folks, as the dried fish is having remunerative market within the country and abroad. In this backdrop, the present study was conducted to analyse the economics of the fish drying process as a value addition method. The study is carried out by using the primary data collected from ten fish drying processors selected randomly from the fish drying yards of Puthiyapa coastal area of Kozhikode district in Kerala. The

specific objectives were to assess the overall process of drying, seasonality, species used for drying, quantum of drying, etc along with the analysis of cost and earnings of the process. The study reveals the improper and unscientific conventional drying method followed at the study area which can cause serious health hazards. The study also suggest the need for developing fish drying facility which could augment income during fish surplus by imparting better utilities over time, form and space.

Key words: Value addition, dried fishes, fish drying yard, utility, marketing, traditional fish drying, curing, sun drying.

1. INTRODUCTION

At all-India level, fish constitutes about 58 per cent of the total non-vegetarian food. Wide regional variations exist in fish consumption; it is higher in southern, eastern and north-eastern states and lower in western and northern states, the lowest being in the western states. The fish consumption has depicted an increasing trend; during the period 1983-2000, it increased from 6.97 kg/year/ capita to 9.12 kg/capita in the rural areas and from 8.01 kg/year/capita to 11.05 kg/capita in the urban areas (Shyam et al., 2015). The state of Kerala, beatified with a coastline of 590 km, provides livelihood for more than 8 lakh people through the marine fisheries sector. Fishing industry of Kerala which comprises of fish catching, processing and marketing provides employment to over 3.5 lakh personnel who constitute nearly 5% of the workforce of the state (Shyam, 2013). Economically, the fish caught by around two lakh active fishermen contribute to the tune of about 1.86% of the net domestic product (NDP) of the state (Shyam, 2015). A very rapid loss in quality can occur in the case of fish, after catch, as it is an extremely perishable commodity (Khan and Khan, 2001; Musa et al., 2010; Dewi et al., 2011). Hence, the proven preservation method of curing is still being practiced in India. Curing of fish primarily involves two stages viz, salting and drying (Sanjeev and Surendran, 1996; Anon, 2001). Salting decreases the water activity and consists of transporting salt into food structures and is governed by various physical and chemical factors such as diffusion, osmosis and a series of complicated chemical and biochemical processes (Turan et al., 2007). Drying of fishes is a method of food preservation through which the water from the fish is removed to reduce water activity and thereby to extend shelf life. The method of drying is considered as the least expensive method of fish preservation (Balachandran, 2001). The basic principle of fish drying is the reduction of the activity of the muscle enzyme and microorganism to a minimum through the revocation of the water content of the fish by sun drying in a traditional way (Banglapedia, 2014). The traditional method of sun drying is followed for the preservation of fish especially in rural areas (Chakrabarti and Varma, 1999). Artificial dehydration techniques are also implemented to execute the process regardless of weather conditions. Under this technique, microwave electromagnetic radiation or ultrasonic heating is used to supply thermal energy directly to the fish tissue (Clucas, I.J., 1982). Water can also be removed by the action of salt, application of pressure, etc.

Fish drying process:

The process of fish drying is carried out through various stages. In the initial stages, the belly of the fish is slit opened and the scale, gills and internal organs are removed. The fish is then washed, cleaned and kept in the sun for drying. Mainly two phases are there in the drying stage. In the first phase the water on the surface of the fish evaporates, and the rate of drying depends on surface area of the fish (size), speed of air movement over the fish and relative humidity of the air.

The second phase occurs when the surface of the fish has evaporated. The drying rate in this phase depends on:

i. The nature of the fish. Fat in fish flesh retards water movement,
ii. Fish shape. The thicker the fish, the longer the time of drying,
iii. Temperature. Drying will proceed more rapidly at higher temperatures,
iv. Water content. The higher the water content, the longer the time of drying (Clucas, I.J., 1982).

Even though curing is a simple and cheap method of processing requiring least technical expertise, it has great significance and relevance in the socioeconomic system of small scale fisher folk (Felicia and Patterson, 2003). The cured fishes are having ample market in Kerala, neighbouring states, and overseas. Sun dried fishes are considered as the predominant food bringing vital protein to people in rural areas of least developed countries (Graikoski, 1973).

Scope of the study:

Kozhikode is one of the leading coastal districts in marine fish production as well as marine fish consumption in Kerala which contributed a total quantity of 1.02 lakh tones to marine fish production in 2014 (Kerala Fisheries Statistics, 2014). Puthiyapa harbour is one of the major landing centres of Kozhikode district with a very good infrastructure and market accessibility. According to the study conducted by Shyam et al., (2015), nearly 25 to 30 marine fish species are marketed in Puthiyapa market.

In this backdrop, the present study was conducted to analyse the economics of the fish drying process as a value addition method. The study is carried out by using the primary data collected from ten fish drying processors selected randomly from the fish

drying yards of Puthiyapa coastal area of Kozhikode district in Kerala. The specific objectives were to assess the overall process of drying, seasonality, species used for drying, quantum of drying, etc along with the analysis of cost and earnings of the process

2. MATERIALS AND METHODS

Location:

The study was conducted at the fish drying units near the Puthiyapa fisheries harbour of Kozhikode district, Kerala. The study area is located very near to the landing centre and so that the availability of fresh fish, the primary raw material for the drying units, will not be a big issue.

Data collection:

The study is carried out by using the primary data collected from the fish drying yards of Puthiyapa, Kozhikode. A semi structured questionnaire after a reconnaissance study was used for the field data collection. A total of ten fish drying processors were randomly selected and interviewed, from the study area. The information was sought on the overall process of drying, drying seasons, usual as well as rare species used for drying, quantum of drying, etc. were asked to the respondents. In addition data regarding the ownership details, off season activities, cost and expenditure, labour, and income were also collected.

3. RESULTS AND DISCUSSION

The major findings of the study are discussed under the following heads:

i. Profile of fish drying yard
ii. Operations in the fish drying yard
iii. Economics of the drying process

(i) Profile of Fish drying yard:

The fish drying yard of Puthiyapa, Kozhikode is situated at the coastal area near the Puthiyapa fishing harbour, which can be considered as the most suitable location for the drying process as it provides the easy avenue of the two major inputs of fish drying, viz, fresh fish and sunlight.

Altogether, 10 units were observed near the Puthiyapa harbour, which together constituted an area of 25 cents of land in the beach. Each unit is using an average of three cents of land for open ground drying of the fishes. Some area of the drying yard is having concreted floor whereas in the majority of the areas green agro shade nets and tarpaulins is used on the floor. The drying activity is completely carried out in commercial basis.

While observing the ownership pattern, both partnership as well as sole ownership was there in the dry fish business. Both drying and salting (curing) are executed in the same area and from among the various methods of drying, the method of sun drying is only carried out in this area. Special concrete tanks filled with salt are used for the process of salting. During winter season, only salting is possible, as it is functioned indoors.

Figure 1 Fish spread on the ground for drying

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The study exposes the lack of hygiene in the drying yards as the major drawback. The Puthiyapa fish drying yard is following the traditional sun drying method and hence the hygienic conditions are not satisfactory. During the time of drying the fishes are getting polluted by the blow-flies, stray dogs, and microorganisms which makes it highly unsafe for human consumption. Similar results were pointed out by Immaculate et al. (2013) and Bhat et al. (2013) in their studies at Tuticorin villages and Kashmir valleys, respectively.

(ii) Operations:

The different operations included in the fish drying process can be categorised in to two as the pre drying activities and the drying process.

Pre drying activities:

Fishes are bought through auctions from the Puthiyapa fishing harbour. Only fresh fish are selected for drying and are kept iced or atleast covered with a wet cloth, to protect from sunlight, dust, and flies, until the drying process starts. Anchovies, sardine, mackerel, malabar sole, silver bellies, etc. are the major species used for drying and salting in the study area. The raw fishes are collected from two sources viz, Puthiyapa landing centre (95%), located 300 mtrs away from the drying yard, and from fishermen directly (5%). It was observed that low quality damaged fishes were also brought from the landing centres for drying.

In the pre drying stage, the belly of the fish is slit opened and the scale, gills and internal organs are removed. The fish is then washed, cleaned and are either kept in the sun for drying or salted. Fish are gutted and prepared for drying, depending on the size. Large fishes are cut in to strips or small rectangles for proper drying. Small fishes are gilled and gutted.

The pre drying stage involves the employment of men as well as women for the cleaning process. For this, local workers, both men and women, as well as other state workers are opted. An average amount of Rs.40 is paid as wage for cleaning one box of fish comprising 40 kgs. An average of 50 boxes of fish are cleaned per day which shows that each drying unit is dealing with an average of 2 tonnes of raw fish per day. An average of 0.7 tonnes of dry fish can be produced from 2 tonnes of raw fish.

Drying process:

The drying process of fish usually operates from the end of the August to May, as there will be sufficient sunlight and less atmospheric moisture content for the proper drying of the fish during this time period. The availability of raw materials may also affect the drying activity. The daily operations in a drying yard starts by spreading the fish at 8 am and ends up with the gathering back of fishes by 6 pm. The gutted fish is dried in the open ground for days, depending on the size of the fish. Instead of the popular method of rack drying, open ground drying is followed in the Puthiyapa drying units. Small fishes like anchovies need an average time period of 15 hours in the sun to get dried completely, whereas silver belly takes an average of 10 hours to get dried. Medium sized or fatty fishes like sardine takes almost 25 hours in the sun to get dried up. Small fishes were directly taken for drying without much dressing up. Similar findings are there in the study conducted by Samad et al. (2009). The duration of drying of the major species used in the study area, along with their cost price and selling price are interpreted in table 1.

Figure 2 Fish turned over at regular intervals for proper drying

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In the drying process, either brined or normal fishes are used. While drying the brined fish, depending on the tastes of the consumers and the purpose of drying, it will be necessary to wash away the salt by dipping it in water. The fishes are spread on grounds which are partly concreted and the rest of the sandy area layered with green agro shade nets. No any rack system for drying is followed here, which could have been more scientific and hygienic. The fishes were turned over at regular intervals by the workers to quicken the drying process. The study conducted by Soegiyono (1994) also reports the same procedure of turning the sequentially arranged fishes upside down at regular intervals to accelerate the drying process.

Fishes are taken back to the tent by 6 pm, as the salted fish absorbs moisture from surrounding when the relative humidity rises during night or rainy time. Fishes are accumulated and covered inside the tent to reduce the absorption of moisture. High humidity levels may cause the re-absorption of moisture by the dried fish and become susceptible to bacteria, fungal or insect attack (Azam, 2002).

(iii) Economics of drying:

Table 1 Major fish species used for curing in the study area

Fish name	Scientific name	Cost price (Rs/Kg)	Drying duration (No of days)	Selling price (Rs/Kg)
Anchovy	*Stolephoruscommersoni*	20	1.5 - 3	120
Anchovy	*Encrasicholinapunctifer*	20	1.5 - 3	120
Sardine	*Sardinellalongiceps*	25	3 - 5	100
Sole	*Cynoglossussemifasciatus*	20	3 - 5	100

The duration of drying varies from 2 to 5 days depending on the size of the raw fishes, availability of sunlight, relative humidity, surface area of fish, etc. In case of cloudy weather, more days are required for complete drying. The lean fishes such as shark loses almost 75 per cent of their original weight, after proper drying. Medium fatty fishes such as tilapia loses almost 70 per cent of their original weight, whereas fatty fishes like sardine loses 65 per cent, after carrying out a proper sun drying process.

From the study, it is found out that the average number of working days in a fish drying yard is 25, employing three labours for spreading the fish at an amount of Rs.750 paid on daily basis. Also, the drying operations are active for nine months of a year.

Figure 3 Anchovies spread on the ground for drying

Seasonality operates in the case of drying process only, as salting process can be executed during the winter season also. It was observed that low quality salt was used for salting process. The study conducted by Suparno (1994) in Indonesia reports that the use of impure salts causes the growth of halophilic bacteria and affects the penetration of salt in to the fish flesh. The low quality salt bought from tuticorin at whole sale price of Rs.4 per kg is used in the study area. An average of 30 kg of salt is required for the salting process of 100 kg of fish.

Cost and Earnings:

The major findings of the study regarding the cost and earnings of the fish drying process are furnmished in Table 2 given below

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Table 2 Cost and earnings of the fish drying process

Operating cost		
	Average monthly quantity (in tonnes)	**Average monthly cost (in lakhs)**
Raw fish	20	4.40
Salt	7	0.27
Wages for Pre drying operations (gutting and cleaning)	20	0.20
Wages for spreading the fish	20	0.56
Total monthly operating cost		5.43
Total annual operating cost		**48.86**
Fixed cost		
Annualised fixed cost for drying yard materials (in lakhs)		0.04
Depreciation		0.08
Total monthly cost (in lakhs)		5.55
Total annual cost (in lakhs)		**49.99**
Revenue		
Gross monthly output (in tonnes)		6.7
Gross monthly revenue (in lakhs)		7.11
Gross annual output (in tonnes)		60
Gross annual revenue (in lakhs)		**64**
Profit		
Gross annual profit (in lakhs)		**14.01**

The total annual cost of the drying yard is detected to be Rs.49.99 lakhs of which 98 per cent contributes to the operating cost which includes the purchase of raw materials such as raw fish and salt, along with the wages of the workers employed for gutting, cleaning, and spreading the fish. The remaining two per cent of the total cost is committed by the fixed cost which includes the storage house, concreted floor, agro shade nets, tarpaulin, etc.

The average quantity of dry fish manufactured annually in a drying yard in the study area is worked out to be 60 tonnes by making use of an average quantity of 180 tonnes raw fish, delivering an annual revenue of Rs.64 lakhs and hence caters an amount of Rs.14.01 lakhs as the gross annual profit.

Ratio Analysis:

Based on the cost and earnings analysed the following ratios had been worked out and is furnished in Table 3.

Table 3 Ratio Analysis

1	Net operating income (in lakhs)	$Gross\ revenue - Total\ operating\ cost$	15.14
2	Net profit (in lakhs)	$Gross\ revenue - Total\ cost$	14.01
3	Operating ratio	$Total\ operating\ cost \div Gross\ revenue$	0.76
4	Input-Output ratio	$Input\ costs\ (excluding\ labour) \div Gross\ revenue$	0.67
5	Profitability ratio	$Net\ profit \div Operating\ cost$	0.29
6	Net profit ratio	$Net\ profit \div Gross\ revenue$	0.22

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Figure 4 Drying yards and storage tents

Marketing and trade:

The dried fish was found out to be stored in small huts with thatched roofs, near the drying yards. The properly dried fishes are packed in gunny bags and are sold as wholesale to the neighbouring states such as Tamil Nadu, Karnataka, and also to the various parts of Kerala. The retail packing system which was once active in the drying units of Puthiyapa area is in halt nowadays due to some inconveniences. Each gunny bags meant for whole sale holds 30 kg of dry fish. Quality wise and species wise variation occurs in the case of price. The simple marketing channel of the dry fish business is shown in Fig 5.

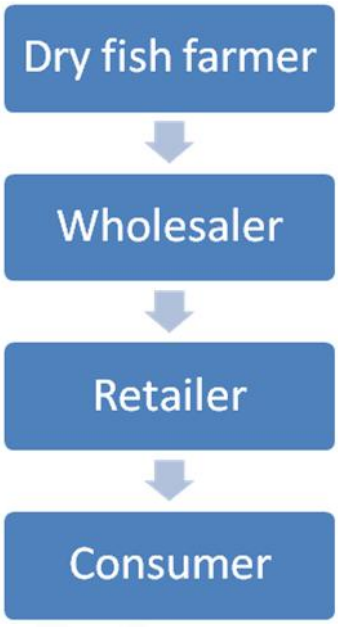

Figure 5 Marketing channel of dried fish

4. CONCLUSION

The study indicated that the traditional methods of drying are practiced in the drying units of Puthiyapa. The unhygienic conditions in the open ground drying method are also recognized. The ample opportunities and the scientific ways of drying process is not yet explored in the study area. Instead of the better hygienic method of raised drying or suspended rack drying, the unhygienic and time consuming method of open ground sun drying is executed in the Puthiyapa drying units.

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The unhygienic conditions may accelerates the fungus growth and causes off flavours, even potentially dangerous mycotoxins, which may results in the decline of the dried fish market. The use of low quality salt is also a notable factor. Apart from the low quality salt and unhygienic condition, contaminated water, air and soil around the drying yard can also have negative effects upon the fish. Proper hygienic and sanitation practice in all stages of fish would help to increase the quality and shelf life of dried fish.

As the method practiced by the drying units are unscientific, the traders need to be educated and trained in scientific fish drying. Proper awareness over the various drying methods like Suspended rack, Solar drier, Freeze drier, Mechanical drier etc. would help to increase the quality and could fetch higher economic benefits. The study also suggests the need for developing fish drying facility which could augment income during fish surplus by imparting better utilities over time, form and space.

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