

Original Research Article

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Livelihood Promotion of Women Farmers through Development of Value Added Fish Products in Nalbari District, Assam

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ABSTRACT

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Income is an important factor for the empowerment and social status of women. Therefore, value addition of dry fishes and marketing may be a sustainable source of income within their capacity. The Krishi Vigyan Kendra, Nalbari, Assam conducted demonstrations on drying and value addition of fishes employing solar tent driers using low cost locally available material for sun drying of fishes in farmer's field in Nalbari district. Sundried fishes (moisture content reduced to 55%) were dip treated in 5% and 10% tulsi (*Ocimum tenuiflorum*) leaves solution for 20 minutes. Tulsi treated fishes were sundried again to final moisture content of 10%. Sensory analysis using 9 point hedonic scale showed that the product treated with 10% tulsi leaves solution had better olfactory acceptance. After analysis of ANOVA it showed that calculated F value (66.258) more than the tabulated (*Crit*) F value (3.68). Hence H₀ (Null hypothesis) is rejected it means there is significant difference among the three groups ($P < 0.05$) in colour, odor, taste, Shape, texture and Overall acceptability in all treatment (T₁, T₂ & T₃). The B:C ratios determined for low cost solar tent drying (hygienic) and open sun drying (unhygienic) were found to be 3.3(T₁), 3.5 (T₂) and 1.2(T₃), respectively. The novel product fortified with immunoboosting tulsi has a potential entrepreneurial prospect with unexploited market ahead and can be undertaken by women/youths and SHGs for their economic upliftment.

Introduction

Fishes are the major food stuffs in our diet due to its cheapest source of animal protein, essential fatty acids, amino acids along with some important vitamins and minerals which are required for a healthy body (Andrew, 2001; Sanayaima Devi *et al.*, 2015). Therefore, the economically weaker sections of the people mainly depend on fish due to cheap and readily accessible source of protein

and essential micronutrients (Baruah, 2014). In Assam, during monsoon and post monsoon season, different Small Indigenous Fish Species (SIFS) are caught by women from the rivers, beels and ponds.

The SIFS are the only vital source of protein and other important vitamins for the rural poor people of Assam (Chakraborty *et al.*, 2015). The fishing communities comprise about 20-25 per cent of women engaged in

aquaculture and fisheries in Assam (Baruah, 2015). A large section of women are engaged in fishing activities as it provides the livelihood, employment and income (Baruah *et al.*, 2013). A bulk amount of such catch is sold in the fresh condition or preserved by different traditional drying techniques (Sharma *et al.*, 2013). Dry fish is a popular fish product among the tribal community of Assam. Presently, dry fishes are mainly imported from outside states like Andhra Pradesh, West Bengal *etc.* and also locally produced by open sun drying. It has been observed that the dry fish available in the market are of inferior quality with high moisture content, insect infestation, high filth content and most importantly off odor and flavor deter consumers as well as aspirants to undertake it as entrepreneurial venture. The harmful chemical pesticides are commonly incorporated for preventive and curative control of insect infestation in spite of having serious lethal effects (Reza *et al.*, 2005).

For the protection of human health many scientists suggested the alternative additives such as different herbal products for repelling dry fish insects (Lithi *et al.*, 2012). However, there is no study conducted so far about the effect of these herbal products on the quality of dried fish. Therefore, Krishi Vigyan Kendra, Nalbari conducted demonstrations on drying and value addition of fishes employing solar tent driers using low cost locally available material for sun drying of fishes in farmer's field in Nalbari district. Thereafter, Sundried fishes (moisture content reduced to 55%) were dipped in tulsi (*Ocimum tenuiflorum*) leaves solution as flavoring agents and those tulsi treated fishes were again sundried to a final 10% moisture content. Value addition of dry fishes with deodouring cum flavoring agents along with other health beneficial qualities would attract consumers besides paving the way for women/youth contenders to undertake this as

a business tool for livelihood and self employment. Therefore, the aim of the present study was to assess the effect of Tulsi (*Ocimum tenuiflorum*) treatment on sensory qualities of dry fish along with economic feasibility analysis of low cost solar tent dryer and open sun drying.

Materials and Methods

The study was conducted in Nalbari district and it is located in Central Western part of Assam State between 91° 07' E 91° 47' E latitudes and 26° 0' N and 26° 5' N longitude. The total geographical area of the district is 1052 sq km, which is 2.6% of the total area of the state of Assam. Three numbers of beneficiaries were selected under the mandated OFT (on farm trial) programme of the Krishi Vigyan Kendra.

Construction of low cost solar tent dryer

The low cost solar tent dryer is made up of a polythene sheet worn over a wooden frame. It works through evaporative drying using the green house principle. The drawing of the solar tent dryer consists of transparent plastic polythene sheet stretched over a wooden frame work (4 feet wide by 6 feet long by 4 feet high) with side and top vent (1 by 1 feet) and the fish rack (2 feet by 1.5 feet) were placed with wire mesh under and underneath a black polythene sheet which was used as a heat collector and transmitter area. Sun drying rack was constructed by placing wire mesh over wooden framework (Table 2 & Plate 1, 2, 3).

Preparing the fish for drying

The fish species *Puthi* (*Punctius ticto*) and Tulsi (*Ocimum tenuiflorum*) were selected for the experiment and were collected from farmers' field. Tulsi leaves were washed, ground well and 5% (5 gm tulsi leaves per

100 ml of potable water) and 10% tulsi solutions (10 gm tulsi leaves per 100 ml of potable water) were prepared. Fishes were dressed, gutted, washed and dried in solar tent drier up to 55% moisture content. Dry fishes with 55% moisture content were divided into 3 groups, T1 (dip treated in 5% tulsi solution), T2 (dip treated in 10% tulsi solution) for 20 minutes and T3 as control without any treatment. The treatment fishes were dried again in solar tent drier upto a final moisture content of 10% (Plate 4, 5).

Packaging

After drying, value added fish product were packed in polyethylene bag using sealer to prevent moisture absorption (Plate 6, 7).

Evaluation of sensory quality

Sensory characteristics of three treatment groups viz. T1, T2 & T3 were evaluated at monthly intervals following the method of Siddaiah *et al.*, (2001) with 10 numbers of trained taste panels using a 1-9 point Hedonic scale. The sensory quality of the pickle was judged for attributes such as appearance, colour, texture, odour as well as overall acceptability and the mean of the scores given by the panelists were taken.

Statistical analysis and economic analysis

Statistical analysis were done by analysis of variance (ANOVA) to determine significant differences among means at $\alpha = 0.05$ level and Coefficient of variation (CV) measure of consistency of different sensory parameters using statistical tools of Microsoft Office Excel (2007). The economic feasibility of low cost Solar tent dryer (T1 and T2) and Open sun drying were also analysed considering net income, cost of production and benefit-cost ratio.

Results and Discussion

According to Huss (1995) and Meilgaard *et al.*, (2006) defined evaluation of sensory quality of food as the scientific means of quantifying and interpreting the variations in food characteristics (odor, taste, texture, appearance etc) by using human senses of sight, smell, taste, touch and hearing. The acceptability of fish and fishery products during storage depends on the changes in their sensory attributes (Cao *et al.*, 2009). The result obtained from sensory evaluation (Table-1) showed that, there were changes in all the sensory parameters after treating the fishes with tulsi solutions of different strength. ANOVA analysis showed that the calculated F value (107.326) more than the tabulated F (Crit) value (3.68). Hence, H_0 (Null hypothesis) is rejected; it means there is significant difference among the three groups ($P < 0.05$) among colour, odor, taste, shape, texture and overall acceptability in all treatment groups (T1, T2 & T3). Significant highest values of color, odor, taste, shape, texture, Overall acceptability were 7.85 ± 0.11 , 8.66 ± 0.08 , 8.12 ± 0.19 , 7.65 ± 0.23 , 7.37 ± 0.15 , 8.32 ± 0.11 respectively found in T2 group when compared with treatment T1 and T3 which were 7.06 ± 0.15 , 7.63 ± 0.11 , 7.09 ± 0.18 , 6.76 ± 0.30 , 6.56 ± 0.32 , 7.72 ± 0.13 and 4.99 ± 0.67 , 4.64 ± 0.48 , 4.42 ± 0.605 , 4.33 ± 0.68 , 4.95 ± 0.40 , 4.41 ± 0.19 respectively (Table 1). The sensory evaluation was carried out by 10 panel members on the basis of 9 Hedonic Scale Rating. The mean score by the panelists for Tulsi dried fish produced by the solar tunnel drying method during 3 months storage period showed that (T1 & T2) was excellent in quality according to the sensory properties such as color, odor, texture, taste and shape whereas the traditionally produced dried product had decreased scores in respective qualities. This may be due to low moisture content, homogenous drying, maintenance of optimum temperature, air velocity and

relative humidity, low filth content, less insect, bird and animal attack inside the drier. This finding was similar to the results obtained by Olorok (2019), Karthikeyan (2007), Kalaimani (1988), Azam *et al.*, (2003). The colour of T2 was more greenish than T1 and the colour of T3 was dark due to inadequate preservation and unhygienic mode of drying. Greenish color of the dried products indicated that the fish was treated by Tulsi solution. The most excellent qualities of the treatment such as T1& T2 dried fish products were excellent. The best taste and odor was recorded for fishes of T2 treatment group. The most attractive appearance was recorded for T1 & T2 while the least attractive was recorded for sun-dried samples (T3). Coefficients of variations (CV) were taken as a measure of consistency of different

sensory parameters (Table-1). In the treatment group T1, the lowest CV value in terms of odour, colour and overall acceptability were 1.52, 2.16 and 1.68 while in T2 group lowest variation of odour, colour and overall acceptability were 0.96, 1.48 and 1.32. But, in case of taste, texture and shape scores, the range of variations were higher i.e, 2.55, 4.89, 4.44 and 2.39, 2.07, 3.10 in T1 & T2 respectively. The CV value justified the fact that the product from treatment T2 is consistent against the treatment T1 in terms of color, odor, taste, shape, texture, Overall acceptability. The Tulsi fish product prepared in the present lessons can be considered acceptable as it retained good appearance, colour as well as taste during the storage period of 90 days (Fig. 1).

Table.1 Sensory score of dip treated Tulsi solution T1, T2 & T3

Sample characteristics	T1		T2		T3	
	Mean ± SD	CV	Mean ± SD	CV	Mean ± SD	CV
Colour	7.06±0.15	2.16	7.85±0.11	1.48	4.99±0.67	13.52
Odour	7.63±0.11	1.52	8.66±0.08	0.96	4.64±0.48	10.42
Taste	7.09±0.18	2.55	8.12±0.19	2.39	4.42±0.605	13.67
Shape	6.76±0.30	4.44	7.65±0.23	3.10	4.33±0.68	15.88
Texture	6.56±0.32	4.89	7.37±0.15	2.07	4.95±0.40	8.20
Overall acceptability	7.72±0.13	1.68	8.32±0.11	1.32	4.41±0.19	4.43

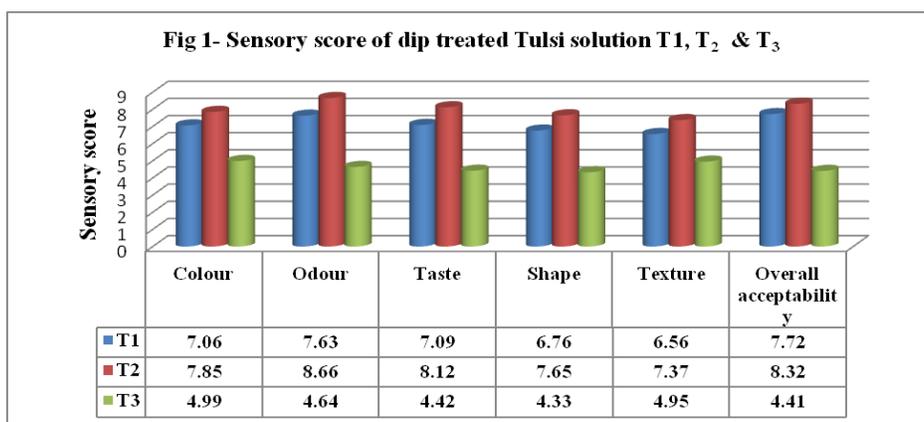
**Note: Each observation is mean ± standard deviation of triplicates (n=3) CV = Coefficient of variation. Significant differences within three groups (P<0.05)

Table.2 Capital cost of solar tent dryer and open sun drying of Puthi fish

Sl. No	Particulars	Low cost Solar tent dryer (T1 & T2)			Open sun drying (T ₃)		
		Quantity	Unit cost (Rs)	Total cost (Rs)	Quantity	Unit cost (Rs)	Total cost (Rs)
a.	Construction of solar tent dryer	01 nos	2,000.00	2,000.00	-	-	-
b.	Fish (<i>Puthi</i>)	30 kg	Farmer field	-	30 kg	Farmer field	-
c.	Tulsi leaf	2.25kg	Farmer field	-	-	-	-
d.	Packaging	154 nos	10.00	1540.00	154 nos	10.00	1540.00
Grand total cost				3540.00	-	-	1540.00

Table.3 Income from solar tent dryer and open sun drying of *Puthi* fish (1st batch)

Sl. No.	Income	T ₁	T ₂	T ₃
a)	Production of Tulsi Dry fish (kg) (1st batch)	27	27	12
b)	Quantity of packing (nos)	154	154	68
c)	Sale of Tulsi Dry fish 175gm (Rs)	100	110	50
d)	Gross income (Rs)	15,400.00	16,940.00	3400.00
e)	Net income (Rs)	11860.00	13,400.00	1860.00
f)	BCR	3.3	3.7	1.2:1
g)	Increase of man days per family on 1 st batch	10	10	40



	
<p>Plate 4- Puthi (<i>Punctius ticto</i>) and Tulsi (<i>Ocimum tenuiflorum</i>)</p>	<p>Plate 5- Dip treated in 5% tulsi solution</p>
	
<p>Plate 6- Immunoboosting Tulsi fish product</p>	<p>Plate 7- Packing of Tulsi add dry fish</p>

Economic analysis

The economic feasibility analysis carried out on solar tent dryer and open sun drying (T1&T2) & treatment (T3) showed that the net income from open sun drying is Rs 1,860.00 whereas it was Rs 11,860.00 (T1) and 13400.00 (T2) in case of solar tent dryer. The Benefit Cost Ratio for open sun drying (T3) was 1.2 and 3.3 for solar tent dryer (T1) and 3.5 for (T2). The details of the economic analysis are given in the Table 3.

In conclusion the attempts on dry fish preparation treated with herbal treatment of tulsi leaves (*Ocimum tenuiflorum*) and dried in low cost solar tent driers were first taken by Krishi Vigyan Kendra, Nalbari, Assam as demonstrations basis in farmer's field in Nalbari district. The medicinal properties of the selected herbs viz. tulsi leaves were used as masking agent and to add a desirable flavour. After drying, the novel fish products fortified with immunoboosting tulsi, were packed in polyethylene bag using sealer to

prevent moisture absorption. It was found that the dried fish treated with the herbal treatment had admirable organoleptic quality. It was also found that the herbal treatment acted as a repellent as well as good preservatives to protect dry fish from blowflies and insects infestations which were very dangerous during storage, ultimately increased the shelf life of the dried products in storage. The novel product fortified with immunoboosting tulsi has a potential entrepreneurial prospect with an unexploited market ahead and can be undertaken by women/youths and SHGs for their economic upliftment. Hence, value addition of dry fishes with deodouring cum flavoring agents along with other health beneficial qualities would attract consumers besides paving the way for women/youth contenders, entrepreneurs and aspirants to undertake this business for livelihood and self employment. Therefore, government and non-governmental agencies linking the women fish workers with other line departments for credit, technology, infrastructure, training and trade can engage the rural women in the

preparation of value added fish products. These enterprises can become a powerful tool in improving the livelihoods and economic security of the rural poor. There is no doubt that safety and security issues can be mitigated through properly planned markets construction with sufficient facilities for women to sale their product without fear of harassment.

Practical applications

Dry fish is a popular fish product among the people of North-east India. However, inferior quality with high moisture content, insect infestation, high filth content and most importantly off odor and flavor deter consumers as well as aspirants to undertake it as entrepreneurial venture. Hence, value addition of dry fishes with deodouring cum flavoring agents along with other health beneficial qualities would attract consumers besides paving the way for women/youth contender to undertake this business for livelihood and self employment.

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