



## Evaluation of Phytochemical and Nutritional Potential of Dry Fish (*sukhua*) available in Odisha Coastal Areas, India

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### ABSTRACT

Foods can be divided into three groups based on the value-added through processing by drying. In the case of cereals, legumes, and root crops, very little value is added per ton processed. More value per unit mass is added to foods such as vegetables, fruits, and fish, and considerably more to high-value crops such as spices, herbs, medicinal plants, nuts, bioactive materials, and enzymes. Fish and fishery products play an essential role in human nutrition as a source of proteins, fatty acids, fat-soluble vitamins and micronutrients. As we know, Fresh fish deteriorates quickly unless some way can be found to preserve it. Drying is a method of food preservation that works by removing water from the food, which inhibits the growth of microorganisms. Open-air drying and Sun drying is the ancient method of food preservation and still been practiced since then. An attempt has been made to collect information about the variety, value and health benefits of consuming dried fish. The knowledge of diversity of dried fish was compiled from type of dried fish shop in Balijatra field (Cuttack), Sunakhala (Nayagarh), Sarua (Khordha), Atharabanki (Paradeep) and Rice meal (Paradeep). The information regarding steps of making dry fish has been collected from dry fish godown, local shops and fisher men in Paradeep. The survey was completed from November 2019 to February 2020 to collect the information regarding diversity, process and production of dry fish. Result revealed that dried fish are rich in quality protein, containing 80- 85% protein with fewer calories. 100gm of dried fish contains 80% protein with 300 calories. Most dried fish contains little cholesterol while being high in essential vitamins and minerals. It is a natural product and has retained an immense amount of omega -3 fatty acid and antioxidants from fresh fish. This profile makes dried fish a compelling purchase for those looking to increase their healthy food intake and provides distinct advantages to dries fish retailers. This study aims to study the status of nutritional and phytochemical constituents of dry fish available in adjacent coastal areas of Odisha.

### 1. INTRODUCTION

Odisha has a rich cultural heritage, which is an eternal deity of the Odiya people. As the state covers around

70 percent of coastal areas, hence Fish and kinds of seafood are the edible flesh for several animals, including humans. Fish are preserved through such traditional methods as drying, smoking and salting. The oldest traditional way of keeping fish was to let the wind and sun dry it. Drying food is the world's oldest known preservation method, and dried fish has a storage life of several years. The preservation of foods by drying is the most common method used by mankind. Drying in ancient times was done in the sun, no Now, types During the past few decades, considerable efforts have been made to understand the chemical and biochemical changes that occur during dehydration and to develop methods for

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preventing undesirable quality losses (Ryota et al. 2012, Shaviklo 2010, 2013), Singh 2014). The fisheries and aquaculture sector is a vital source of livelihoods, nutritious food and economic opportunities. Raw foods generally originate from the plant and animal kingdom. Fish and kinds of seafood are the edible flesh for several animals, including humans. The preservation of foods by drying is the most common method used by humankind. The Mesopotamians were making salted, dried fish as early as 3500 BC. The sun-drying of fish and meat was practised from long ago in 2000 BC, and dried vegetables were sold for about a century and dried soups for much longer. Tannahill stated that dry fish became necessary when the Roman church banned the eating of meat on Fridays and during Lent (Rehman, 2006). Drying in ancient times was done in the sun; now, many types of equipment and methods are used to dehydrate foods. During the past few decades, considerable efforts have been made to understand the chemical and biochemical changes that occur during dehydration and to develop methods for preventing undesirable quality losses. The fisheries and aquaculture sector is a vital source of livelihoods, nutritious food and economic opportunities. Fish and fishery products are among the most important agricultural commodities providing a significant contribution to the world's food security and economic development. Fish remains among the most traded food commodities worldwide, worth almost US\$130 billion in 2012 and pointing to an increase for 2013. From 2007 to 2012, global fishery production had continuously increased from about 140.7 million metric tons to 158 million metric tons. With this increasing production and greater availability for consumers, per capita fish consumption continues to rise up from 10 kg in the 1960s to more than 19 kg in 2012 – driven by higher demand from a growing population, rising incomes and more efficient distribution channels (Payra et al., 2016).

### The demand for Dry fish in an adjacent part of Odisha

Paradeep is one of the significant dry fish production centre in Odisha. Dried fishes are in great demand both within and outside the state. The demand is high in Rourkela, Anugul, Sambalpur, Baragarh and some parts of western Odisha besides, West Bengal, Kerala, Chhattisgarh and Assam. More than 15,000 families of Telegu and Bengali communities have running dry fish business in Paradeep for several generations and around 500 families are indirectly employed in the trade. Approximately 5,000 tonnes of dry fishes are produced in the area every year. Dried fish now caters to different sectors such as quality fish/prawns for human consumption, and low value fishes for the preparation of fish feed as well as poultry feed.

### Study on Nutritional Status of Fish

Fish is regarded as an excellent source of proteins, lipids, vitamins, fatty acid, essential amino acids, minerals and other nutrients. However, their richness in nutrients as well as higher moisture content increases its perishability and needs the processing and preservation of fish. Despite fish being a highly nutritious and economically viable food, it is perishable because of its suitable medium for the growth of microbes after harvest. Spoilage and deterioration is much faster amongst tropical fish species because of high ambient temperature prevalent in the tropics. Most dried

fish contains little salt or cholesterol while being high in essential vitamins and minerals. It also is low in saturated fat, which is known to cause heart and blood-pressure problems. As awareness of obesity, diabetes and heart disease continues to increase, the demand for dried fish will also increase, benefiting retailers (Ghaly et al. 2010). Most tropical fish species could become unfit for consumption within 12– 20 hours of capture unless subjected to some of the processing (Ames et al. 1999), including preservation by drying. Various factors such as fish health status, parasites, wounds and bruises, mode of capture, handling, and protection after capture are responsible for fish spoilage (Akinneye et al. 2007; Tawari and Abowei 2011). Chemical, microbial and enzymatic actions on captured fish bring about spoilage with resultant deterioration in the flesh, body tissues, and organs through physical and biochemical changes (Ghaly et al., 2010).

### Medicinal Uses

Pure dried fish is an entirely natural product that retains the antioxidants and omega-3 benefits of fresh fish. It constitutes a healthy and widely available food for both people and dogs. The expiry dried fish is also used in poultry and fish feeding. Fish helps to mitigate the occurrence of heart attacks and keeps the body's circulation functioning well. These benefits provide essential marketing tools that can make dried-fish retailing a profitable business.

### High Protein with Low Calories

Protein is a crucial source of antibodies and enzymes for all living beings and makes up essential muscles, hair, and other bodily components. Dried fish provides an excellent source of protein with fewer calories than other foods. One hundred grams of dried fish contains about 80 percent protein with 300 calories. The protein content in Mullet is helpful to promote the healing of wounds. This profile makes dried fish a compelling purchase for those looking to increase their healthy food intake and provides a distinct advantage to dried-fish retailers.

### Fatty acid

The dry fish such as *Chauli / bali kokoli*, *Coilia dussumieri*, *Glossogobius giuris*, *Tenualosa ilisha*, *Karandi*, *Nandus nandus*, *Scomberoides commersonianus*, *Ilisha elongata*, *Engraulis ringens* etc. contains polyunsaturated fatty acid particularly DHA (docosahexaenoic acid). DHA play an important role in development of neural system, especially in infants and children. Omega-3-polyunsaturated fatty acid such as DHA and EPA have a great contribution against heart and tissue-related disease. They have beneficial effects on hypertension, diabetes, macular degeneration etc. Eating fish could prevent rheumatoid arthritis. Polyunsaturated fatty acid can promote defence mechanism for protection against invasion of human pathogen. It can reduce the risk of dementia, including Alzheimer's diseases. Eating fish regularly can help to keep the eyes bright and healthy.

### Vitamins and minerals

The selenium present makes enzymes that can help to protect us from cancer, and iodine present is important for thyroid



gland. It contains vitamin D, which plays an important role in calcium metabolism and offers protection from cancers. It contains vitamin B-9, which is essential in maintaining a healthy digestive system, hair, skin, kidneys and eyes. The fish and fish oil lower the heart attack risks. Vitamin -A and omega-3's are essential for healthy mucosa and skin. The mineral content in dried fish is also essential for the formation of bones (Table 3), connective tissue, blood clotting factors, calcium absorption, blood sugar regulation etc. The squid ink of squid fish has anti-bacterial, anti-cancer and anti-inflammatory activity (Leech, 2019; James, 2018; Tilami et al., 2017).

### Dog and Human Benefits

As opposed to fresh or cooked fish, dried fish is firm to touch. The act of chewing this kind of food helps clean dogs teeth, removing the tartar. Soft dried fish can easily be consumed by both humans as well as dogs with issues with teeth. Dogs, as well as humans, tend to live longer and healthier lives with a fish-based diet. It can also be used against malnutrition (Remya, 2018).

### Preservation of Fish

Preservation methods such as drying cExtend the fish product's shelf life by lowering the water activity to prevent microbiological, chemical and biochemical deterioration. Fish drying is an age-old practice and was adopted as a



**Figure 1:** Types of Dry Fish and its recipes Google Source Images

practical method of preserving fish that have not been immediately consumed or sold in the fish market. The dried fish and their processing techniques of drying and its recipes are shown in Figure 1. Drying is the cheapest and popular mode of fish preservation (Das *et al.*, 2013). The dried fish retains most of the goodness of fresh fish with a higher concentration of proteins, vitamins, iron and calcium. When packed and appropriately stored, dry



fish has a shelf life of more than two years. Dried products are in great demand both within and outside the country and form an essential protein-rich food source in various forms. Dried fish now caters to different sectors such as quality fish/prawns for human consumption and low-value fishes to prepare fish feed and poultry feed (Dona et al. 2013, Haard 1995. Das et al., 2013). Indian dry fish export contributes 7.86% of all forms of fish exports and earned 819 crores during 2013-2014 ( Payra et al., 2016). Fish and fishery products play an essential role in human nutrition as a source of proteins, fatty acids, fat-soluble vitamins and micronutrients (Altschul 1989; Belitz et al., 2009). They are also highly digestible and contain all essential amino acids (Haard 1995). However, fish and fishery products are very perishable (Gill 1995), and a preservation method such as drying can extend the shelf life of these products by lowering the water activity to prevent microbiological, chemical and biochemical deterioration (Belitz et al., 2009).

## MATERIAL AND METHODS



**Figure 2:** Map showing the collection of Dry Fish, source Google Maps

### COLLECTION OF DRY FISH

Paradeep is one of the significant dry fish production centres in Odisha (Figure 2). The dried fish samples were collected from Rice meal, Paradip. These dried fish samples are (). Dried fish samples were brought to the laboratory in aseptic condition by keeping them in polythene bags.

### PREPARATION OF ANIMAL EXTRACTS

For the making of powder, the two different dry fish samples were kept in ovan for two days. After two days, the samples were taken away from ovan and powder was made through the grinder.

### PHYTOCHEMICAL ASSAY

Phyto-chemical analyses were carried out on extracts of two different dry fish using standard procedures to identify the bioactive compounds (Harborne 1973; Trease and Evans 1989; Sofowara 1993; Raaman 2006; Tiwari et al. 2011).

#### Test for Saponin

0.5 g of the dried powder was boiled in 15 mL of distilled

water and filtered with Whatman 42 filter paper. 5 mL of filtrate was mixed with 2 mL of normal distilled water and shaken vigorously. The stable persistent froth indicated the presence of saponins.

#### Test of Terpenoids

6mL of extract was mixed in 2.5 mL of chloroform and then 3 mL of concentrated sulphuric acid was added. A reddish-brown colouration of interface indicated the presence of terpenoids.

#### Test of Phenolic compounds

0.5 ml of extract was treated with 3-5 drops of 1 % ferric chloride solution. Formation of bluish black colouration indicated the presence of phenolic compounds.

#### Test of Flavonoids

To 1 ml of extract few drops of dilute sodium hydroxide was added. An intense yellow colour was produced in the fish extract which become colourless on addition of 2-3 drops of 50% dilute acid, indicates the presence of flavonoids.

#### Test of Tannin

5 ml of fish extract was added with 5 drops of 10% lead acetate. A light yellow precipitate was formed , which confirmed the presence of tannins.

### QUALITATIVE TEST FOR PRIMARY METABOLITES

A primary metabolites directly involved in normal growth, development and reproduction. This qualitative test for primary metabolites was carried out by Sheela (2014).

#### Test for Protein

1ml of aqueous extract was mixed with 2-5 drops of Million's reagent in a testube. Then the testube was kept in water bath for 30 minutes. The appearance of pink colour indicates the presence of protein.

#### Test for Carbohydrate

1 ml of aqueous extract was mixed with 2-5 drops of Fehling A and 2-5 drops of Fehling B reagent. The blue colour was appeared , then the solution was kept in water bath for 30 minutes. The appearance of orange colour or red precipitate indicates the presence of carbohydrate.

#### Test for Lipid

1ml of aqueous extract was mixed with 2-5 drops of Sudan III . Formation of pink droplets indicates the presence of lipid.

#### Test for Amino acid

1ml of aqueous extract was mixed with 2-5 drops of Ninhydrin reagent , then kept in water bath for 30 minutes. Appearance of purple or bluish colour indicates the presence of amino acid.

**QUANTITATIVE ESTIMATION OF PRIMARY METABOLITE**

Primary metabolites are required for growth and development

**Estimation of carbohydrate**

1 ml of aqueous extract was added with 2 ml of Benedict's reagent. Then the solution was kept in water bath for 2-5 minutes. If green colour appears then it indicates 0.1% - 0.5% of sugar is present. Appearance of yellow colour indicates the presence of 0.5% - 1% of sugar in solution. Appearance of orange colour indicates the presence of 1% - 1.5% of sugar in solution. Appearance of red colour indicates the presence of 1.5% - 2% of sugar in solution.

**Estimation of Total Lipid (%)**

5gm of sample was taken in a whatman filter paper-1. 150 mL of petroleum ether was added in to the Soxhlet unit. The thimble was put in the soxhlet unit and 50 mL of petroleum ether was added to cover the thimble. The soxhlet unit was fitted properly and was run for 6 hrs at a room temperature of 70°C. After 6 hrs the thimble was taken out from the extractor and petroleum ether was collected up to the last drop carefully. The flask was heated at a temperature of 100 for 1.5 hr inside the oven and cooled in the desiccators for 30 min. The weight was taken at last.

$$\text{Total Lipid (\%)} = \frac{\text{Final weight} - \text{Initial weight}}{\text{Weight of the sample}} \times 100$$

**QUANTITATIVE ESTIMATION OF SECONDARY METABOLITE**

Secondary metabolites are not directly involved in growth and development, and they have been worked as biocatalysts.

**Estimation of Total Phenol**

1 gm of powder was added with 20 ml of 60% methanol then the solution was kept for 30 minutes in room temperature. Then the extraction was filtered through filter paper. 6 testubes were taken and numbered as 1-6. Then 0.1ml of extraction and 0.9 ml of 60% methanol were added in 1<sup>st</sup> testube. 0.2 ml of extraction and 0.8 ml of 60% methanol were added in 2<sup>nd</sup> testube. 0.3ml of extraction and 0.7 ml of 60% methanol were added in 3<sup>rd</sup> testube. 0.4 ml of extraction and 0.6 ml of 60% methanol were added in 4<sup>th</sup> testube. 0.5 ml of extraction and 0.5ml of 60% methanol were added in 5<sup>th</sup> testube. No extract and 1ml of 60% methanol were added in 6<sup>th</sup> testube. ( Bhalodia et al. 2011; Patel et al. 2010).

**Estimation of Total Terpenoid content (Ferguson, 1956)**

1gm of dry fish powder was mixed with 10 ml of ethyl alcohol and left for 24 hours in room temperature. Then the extraction was filtered by filter paper and 2 ml of petroleum ether was mixed with it. The ether extract was taken as the measure of total terpenoid.

$$\text{Total terpenoid content} = \frac{\text{Final weight of the sample} - \text{Initial weight of the extract}}{\text{Weight of the sample}} \times 100$$

**Estimation of tannin ( Sadashivam and Manickam, 2010)**

500 mg of dry fish powder was added in 75 ml of distilled water in a beaker and boiled for 30 minutes. Then it was taken in two viles and centrifuged at 2000 rpm for 20 minutes. Supernatant was taken and made up 100 ml by adding distilled water. 1 ml of sample was taken from it and added with 75 ml of distilled water, 5 ml of folin reagent and 10 ml of 20% sodium carbonate. Volume made upto 100 ml. After shaking 5 minutes the reading were taken at 720 nm.

**Hatching of brine shrimp**

Black salt of about 3.6 gm was weighed in weighing machine and taken in a conical flask. 200 ml of distilled water was added in that flask and stirring was continued which helped to dissolve all the salt and then 10 gm of brine shrimp eggs were sprinkled with a spatula into the flask. 1gm of yeast was added that was the food for the shrimp. After 48 hours the shrimp were developed (Sarah et al., 2017).

**Cytotoxic bioassay**

Five test tubes were taken and 1000µl of water was pipette out into the test tube and marked by the marker up to the point. Five dilutions are prepared by transferring the dry fish extract into the set of five graduated test tubes by transferring 100µl, 200µl, 300µl, 400µl, 500µl of extract and was made the solution 1000µl by using brine water. Pipette are used to put 10 shrimps into the test tubes. Then they were kept in room temperature and in every 10, 20, 30, 40, 50, 60 minutes, live larvae counted. Mortality rate is counted in this way for every extract.

$$\% \text{ of inhibition} = \frac{\text{Live in control} - \text{live in sample}}{\text{Live in control}} \times 100$$

**Table 1:** Phytochemical test of dry fish *Channa striatus*

Fish Name	Solvents	Phytochemical
Chauli / bali kokoli	n-Hexane	Flavonids Phenol content
	Methanol	Tannin, Saponin
	Distilled water	Terpenoid

**RESULT AND DISCUSSION**

Most of the worker reported several experiments on phytochemical and nutritional components analysis of dry Fish. Based on the information collected on the medicinal value of the dry fish from study area and literature, an attempt was made to identify the presence of bioactive components in dried fish extract through qualitative tests (Abdulbasir et al., 2014, Altschul 1989, Lawrence et al. 2016. Mishra et al. 1999). The extracts of selected dried fish were analysed to know the presence of metabolites in them. The phytochemical screening revealed that they have diverse metabolites. The role of several primary and secondary metabolites described by several scientists (Beveridge et al.

2013, Das et al. 2013)The secondary metabolites present in most of the extracts of dry fish were saponin, flavonoids, tannin etc. Saponins are amphipathic glycosides.

In the present study, the phytochemical analysis of *Chauli / bali kokoli* shows different phytochemical components in the treatment of different solvents. The solvents were *n-Hexane*, *Methanol* and *Distilled water*. In *n-Hexane solvent*, *Flavonoids* and *Phenol content* was observed, while the methanol solvent shown the observation of Tannin and Saponin content. The content of terpenoid was observed in the solvent of Distilled water (Table 1). Besides, the present study revealed that dried fish are rich in quality protein, containing 80- 85% protein with fewer calories. 100gm of dried fish contains 80% protein with 300 calories. Most dried fish contains little cholesterol while being high in essential vitamins and minerals. It is a natural product and has retain immense amount of omega -3 fatty acid as well as antioxidants from fresh fish. flavonoids and tannins are present in selected dry fishes . Flavonoids are rich in antioxidants activity and helps our body ward off everyday toxins. It helps in regulating cellular activity. It also lower high blood pressure and also decreases the risk of diabetes. Tannins can help to fight diarrhea, tonsillitis , pharyngitis , hemorrhoids , skin eruptions etc. Saponin present in *Chauli / bali kokoli* helps in lowering cholesterol level , it also helps the immune system to protect the human body against cancer. Lipid contents in both the fishes helps in theproper functioning of body organs, It also acts as a source of energy, aid in the absorption of fat-soluble vitamins, insulate our body and provide essential fatty acids.

The content of carbohydrates seems to be lower in each species of fish enrolled in the present experiment.. The highest content of carbohydrate, protein and Lipid was observed was *Chauli / bali kokoli* (Table 2). While out of different species of dry fish used in this study, *ofPuntius chola* Showed lower content of carbohydrates, protein and Lipids.

**Table 2:** Nutritional components of different species of fishes

Name of species of Fish	Nutritional Contents		
	Carbohydrate	Protein	Lipid
<i>Chauli / bali kokoli</i>	32.0%	82%	76%
<i>Glossogobius giuris</i>	19.2%	63%	69%
<i>Nandus nandus</i>	12.9%	72%	62%
<i>Ilisha elongata</i>	11.3%	68%	59%
<i>Puntius chola</i>	10.0%	50%	51%
<i>Setipinna phasa</i>	16.2%	60.9%	59%
<i>Coilia dussumieri</i>	17.4%	59%	53%
<i>Karandi</i>	12.7%	64%	74%
<i>Kharpani</i>	14.9%	52%	58%

## CONCLUSION

From the above study, it was concluded that fisheries make an important contribution to nutrition and food security in Odisha. It has got a large amount of protein which has its own benefit for the immune system. Thus more scientific study needs to explore the novel work on dry dishes. This

work may also strengthen the better upliftment of coastal people living nearby coastal areas.

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