Indian J Anim Health (2025), 64(2) : 263 - 270
DOI: https://doi.org/10.36062/ijah.2025.11625

Review Article

Rajbanshi shidal: A minimally explored cuisine of West Bengal

B. Ray[1], S. Nath[1*], S. Chowdhury[1] and P. Murmu[1]

[1]Department of Fish Processing Technology, Faculty of Fishery Sciences, West Bengal University of Animal and Fishery Sciences, Kolkata - 700 094, West Bengal, India

Abstract

Rajbanshi is a community residing in the Northern part of West Bengal, having their own language, food habits, culture, and they use their own traditional culinary practices for the preparation, intake and storage of food products. After the monsoon period, when the rivers, streams, bogs, and other water bodies are filled with a variety of small fish species, such as *Puntius sp*., *Gourami* sp., *Darnica* sp., and so on, Rajbanshi people dry most of these catches for future consumption. These dried fish are then mixed with *Colocasia esculenta* petioles to prepare a dark brown, spherical and fermented fish paste product, shidal. Thus, value addition to the excess low-valued small fish, fetching less market value and less consumer demand, is carried on, and Rajbanshi people consume this shidal during the dry seasons from November to February, when there is a lack of raw and fresh fish in the market. Although, shidalis a traditionally important and nutritious fish paste product of the royal Rajbanshi community of the northern part of West Bengal, it is minimally explored due to the lack of exposure, familiarisation and marketing promotion. Thus, the present review work is focused on the background, relevance and thorough documentation of Rajbanshi shidal, a traditional cuisine of West Bengal.

Keywords: Bio-preservation, *Colocasia esculenta*, Fermentation, Rajbanshi, Shidal

Highlights

- This review focuses about North Eastern Shidal and Rajbanshi Shidal, a traditional fermented fish product of Rajbanshi community residing specially in the Northern part of West Bengal, India.
- Some special Indian fermented fish products relevant to this context are also discussed here.

INTRODUCTION

Rajbanshi, the "Royal Community", refers to the residents of Raj Bansha (Monal & Barman, 2018). Rajbanshi people particularly live in Kamrup, Goalpara, Kokrajhar, Naogon of lower Assam, Rangpur, Pabna, Dhaka, Rajshahi of Bangladesh, Kathiar, Purnia and Kishanganj of Bihar, Morang and Jhapa of Nepal, Meghalaya, Tripura and the northern part of West Bengal (Monal & Barman, 2018). In West Bengal, Rajbanshis are primarily located in the northern districtslike Cooch Behar, Jalpaiguri, Alipurduar, Kalimpong, Darjeeling, North and South Dinajpur (Mandal & Sarkar, 2017) and very less in Maldah (Ashok, 2013). But the lifestyles of North Bengal Rajbanshis with the Rajbanshi peoples of Assam, Meghalaya, or Rangpur are different in their language, culture, food habits, and attire (Monal & Barman, 2018). Rajbanshi are thought to have their ancestral home in the northern region of West Bengal, where they have ruled since antiquity. Rajbanshis make up 2,688,560 of North Bengal's total population of 14,724,940 people (Ashok, 2013). In terms of total numbers, they were the third-largest Hindu caste in Bengal (Kar, 2022). According to caste, around 19% of West Bengal's population is Rajbanshi (Adhikary, 2017). They have their language called 'Rajbanshi or Kamrupi' (Barman, 2022). Raising cattle, keeping chickens, making handicrafts, knitting, weaving, cultivating kitchen gardens, engaging in various agricultural pursuits for one's consumption, processing food, and building houses are the main sources of income for the Rajbanshi people. Raising includes cattle, buffalo, goats, ducks, hens and pigeons. They employ cows and buffalo for agricultural ploughing and milk extraction; goats are preferred for meat; while hens and ducks are used for their meat and eggs. Moreover, utilising the wild nature like collecting fruits and seeds, making honey, gathering medicinal plants, tubers, yams, ferns, leafy vegetables, fodder and other minor forest products, as well as engaging in domestic biofuel production and other unconventional activities are the parallel sources of their income (Ashok, 2013). Besides agriculture, animal husbandry is another source of income generation and livelihood.

*Corresponding Author, E-mail: swarnadyutinath@gmail.com

Sometimes they rear them to maintain religious customs and for selling purposes (Roy et al., 2020). To save water and prevent soil erosion, smaller agricultural fields known as'*khotu*' are enclosed by earthen raised embankments by Rajbanshi people (Roy et al., 2020). These areas become flooded during heavy monsoon and make a pool of diversified small fish such as punti, darnica, gourami, channa, etc. During the post-flood, Rajbanshi people catch the fish when the field becomes dry. These harvested fishes are utilised as a raw material for shidal preparation.

Fishing practices of the Rajbanshi people

Their occupation is agriculture based for cultivation of crops such as paddy, jute, and wheat, they also produce a variety of other spices, including onion, ginger, garlic, black pepper, black and white cumin seed, cassia, mustard seed, poppy seed, cardamom, labanga, kasai, sorea seed, coriander seed, coriander leaf and so on (Gupta, 2012). Fishing is another important livelihood of the Rajbanshi people. In earlier days, they captured fish in groups of two or three people using the "*Andhari*" fishing method, where one person would hold a torch while the other would use a '*dao'* to chop any fish coming towards the light (Roy et al., 2020). The Rajbanshi people of North Bengal use a variety of bamboo-made fishing gear and traps, such as "*Dzhoka*," "*Dzakhoi*," "*Beki*," and "*Bonchi*," as well as nets like "*Chapdzal*," "*Napi*," and so on, during the monsoon season (Roy et al., 2020). Small fish are caught in shallow water ponds using thin cloth pieces (used as sieves with tiny pores), whereas large fish are caught at once in enclosed water using nets on bamboo frames with large paddles (Gupta, 2012). Rajbanshi women are skilled enough for harvesting various fish from ponds and rivers, including air-breathing fish. They catch fish from local ditches along with small *nadiali* (riverine) fish from local streams and dry them without using salt or turmeric (Ashok, 2013). They frequently engage in paddy-cum-fish farming during the wet season. A net with a bamboo frame can also be used by hand. By building a low-height dam, water may be trapped in an area, and fish can subsequently be removed by allowing the water to pass through a sieve (Gupta, 2012). Fish such as gappi, techokha are essentially mosquito larvae feeders, whereas some other species occasionally consume dangerous beetle and dragonfly larvae (Gupta, 2012). During winter months, large nets are used to move the frigid winter water so that the fish can be fed and made to move for exercise to assess their growth, health, and fertility for the upcoming summer, autumn, and rainy seasons (Gupta, 2012). Immediately to post monsoon, the local and domestic markets become a pool of species such as *Puntius* sp., *Gourami* sp., *Darnica* sp. and some other small fish, harvested from flooded rivers, streams, bogs and swamps. The catch is dried and processed as dry fish or '*sutkimach'* and stored for future consumption. They also use fermentation practices for preservation purposes; thus, post-harvest loss is reduced too.

Fish preservation

Fish, an essential source of animal protein, is highly perishable and spoils quickly due to their biochemical composition (Ashie et al., 1996). The average proximate composition of fish is 70–84% water, 15–24% protein, 0.1-22% fat, and 1-2% minerals, including 0.5% calcium and 0.225% phosphorus (Abraha et al., 2018). Due to high water content, improper post-harvest handling, insufficient storage, and inadequate processing facilities lead to fish spoilage. Fish deterioration is caused by three main processes: enzymatic autolysis, oxidation of fat, and microbial development; thus, the smell, flavour, and texture of the fish meat change by breaking down various components to synthesise new compounds during spoilage (Ghaly et al., 2010). Fish undergo post-mortem chemical and biological changes after capture because of the breakdown and denaturation of macromolecules by enzymes (Ghaly et al., 2010). Both enzymatic and non-enzymatic lipid oxidation can take place in fish. An important factor in fish spoilage is microbial growth and their metabolism, which results in the production of biogenic amines including putrescine, histamine, and cadaverine, as well as organic acids, sulphides, alcohols, aldehydes, and ketones with undesirable off-flavours (Ghaly et al., 2010).Spoilage causing microorganisms include aerobic psychrophilic Gram-negative bacteria such as *Pseudomonas sp.*; Gram-negative, facultatively anaerobic Enterobacteriaceae (*Salmonella*, *E. coli*, *Shigella*, *Yersinia*), yeasts, molds, some hetero fermentative lactobacilli, and spore-forming bacteria (Rawat, 2015).

Fish preservation is a series of practices to retain the freshness of fish with slight or negligible modification of fish's flavour, taste, aroma, nutritional value, and digestibility (Nwaigwe, 2017), thus increasing the shelf life. The goal of fish preservation is to deliver fish to final consumer in a healthy, usable state because fish is a perishable commodity. Spoilage starts immediately after harvesting, and sometimes post-mortem changes start in fish after death even

before harvesting from water. Poorly cared fish may not be immediately visible as being spoiled, but theylose value due to odd flavours, mushy texture, or poor colour that deters buyers (Nwaigwe, 2017). Various age-old conventional processing techniques and preservation practices like chilling, freezing, drying, salting, smoking and fermentation are widely used. Specialised preservation techniques namely super chilling, freeze drying, modified atmosphere packaging (MAP), vacuum packaging, irradiation, microwave processing, radio frequency, ultrasound and high-pressure processing (HPP) are also adopted in the fish processing industries to enhance the shelf life of fish by reducing spoilage, thus ensuring food safety (Duarte et al., 2020; Hussain et al., 2021).

Likewise, an age-old conventional fish preservation technique is Fermentation. The usual traditional fish preservation methods employed are sun drying, salting, fermentation and smoking. Fermentation of fish is brought about by autocatalytic enzymes from fish and microorganisms in the presence of high-salt concentration (Rawat et al., 2018). Fish are preserved through the fermentation process, which involves dividing large macromolecules like protein and fat in the fish's muscles into smaller molecules like peptides, amino acids, and free fatty acids. Probiotics, antioxidants, and antihypertensive peptides present in fish have been fermented, thus improving the product's flavour and texture (Kose & Hall, 2010; Zang et al., 2020). In Northeast India, conventionally preserved fish products are *Ngari* and *Hentak* in Manipur and *Tungtap* in Meghalaya; *Karoti* and *Bardia* in Assam. *Shidal* and *Lona ilish* in Tripura; *Gnuchi*, *Sidra* and *Sukuti* in Sikkim (Uchoi et al., 2015). Various types of fermented fish products with associated microorganisms are listed in Table 1.

Benefits of fermented fish product

Foods or drinks that have undergone regulated microbial growth and enzymatic conversion of both major and minor food components are often referred to as fermented food (Marco et al., 2017). During fermentation, novel and enticing flavours and textures are produced that are entirely different from the original ingredients. Naturally fermented foods contain beneficial bacteria that secrete enzymes which can break down food in the intestines, facilitating quicker absorption of nutrients. Additionally, the advantageous bacteria produce vitamins such as the water-soluble vitamin B complex and C, increasing the nutritional value of the fermented meal, such as yoghurt (Hasan et al., 2014). Fibrinolytic enzymes, sometimes known as thrombolytic agents, were found in a variety of fermented foods, such as '*shedal*' and '*ngari*' (Cha & Yu, 2024). Enzymatic processes during fish fermentation produce bioactive peptides, which have advantageous anti-oxidative, anti-microbial, anti-thrombotic, anti-hypertensive, and anti-hypocholesterolemic benefits in addition to their good nutritional and sensory qualities (Şanlier et al., 2019). Fermented fish sauce can fight diabetes by increasing insulin secretion and lower hypertension by generating ACE-inhibitory peptides (Şanlier et al., 2019). There are various types of lactic acid bacteria (LAB)

Table 1. Various types of fermented fish products

Fermented products		Microorganisms present	Reference
Ngari	Manipur	*Lactococcus lactis* subsp. *cremoris, L. plantarum, Bacillus subtilis, Candida, Saccharomycopsis*	(Zang et al., 2020)
Hentak	Manipur	*Bacillus cereus, B. subtilis, Staphylococcus aureus, Enterococcus faecium, Candida* sp.	(Thapa et al., 2004)
Shidal	Tripura	*Lactococcus plantarum, Lactobacillus plantarum, Bacillus subtilis, B. pumilus, Micrococcus* sp., and *Enterococcus faecium*	(Thapa et al., 2004; Zang et al., 2020)
Lona ilish	Tripura	*Lactococcus lactis* subsp *cremoris, Lactobacillus plantarum, Enterococcus faecium, Micrococcus* sp.	(Rawat et al., 2018)
Tungtap	Meghalaya	*Enterococcus,* homofermentative cocci (*Enterococci, Streptococci*), heterofermentative rods (*Lactobacillus*), endospore-forming rods (*Bacillus*), aerobic coccus (*Micrococcus* sp.) and yeasts (*Candida* sp., *Saccharomycopsis* sp.)	(Rapsang & Joshi, 2012).
Hukuti maas	North-East India	*Lactococcus lactis* ssp. *lactis*	(Zang et al., 2020)
Utonga-kupsu	Manipur	*Bacillus* sp., *Staphylococcus* sp.	(Singh et al., 2018).

fermented products in India, such as yoghurt, cheese, kefir and so on (Castellone et al., 2021). LAB-fermented food products are enriched with bioactive peptides, vitamins, organic acids, bacteriocins, signalling molecules (NO), and antimicrobial chemicals (H_2O_2) by LAB, which are crucial for enhancing and sustaining consumer health (Castellone et al., 2021). Fermented foods are beneficial for health because they improve flavour, restore the proper balance of intestinal bacteria, aid in digestion, and contain a wealth of enzymes and vitamins (Hasan et al., 2014).

Shidal, a fermented fish product of North East India

North-Eastern India comprises 75% tribal ethnic population (Das et al., 2016) to whom fish preservation by sun drying for a prolonged time is an ideal method. On the other hand, due to severe rainfall, the climate of North-East India doesn't favour sun-drying of fish. Due to the high humidity and frequent rainfall, specifically during May to September, also regarded as the main fishing seasons, sun drying is not sufficient to dry the higher catch. Therefore, to reduce the post-harvest loss, the fishermen opt for an effective and economic way to preserve their large catches. The tribe community have their own age-old and unique ways of fermenting food for preservation and flavour enhancement (Ahmed et al., 2016). *Shidal* in Tripura, *Tungtap* in Meghalaya, *Ngari*, *Hentak* in Manipur; *Seedal*, *Sepaa*, and *Hidal* in Assam, Arunachal Pradesh, and Nagaland are the most popular fermented fish products in North-Eastern India. Shidal is a salt-free, fermented fish product, which is indigenous to some northern parts of West Bengal and North Eastern states (Arunachal, Assam, Manipur, Meghalaya, Mizoram, Nagaland, Tripura) of India (Kalita et al., 2020). For shidal preparation, dried *Puntius* sp. and *Setipinnaphasa* (Majumdar et al., 2016b) are used as raw material. The Gangetic hairfin anchovy can also be used as raw material to prepare the estuarine dried fish product (Kakati et al., 2018). Locally, fermented *Setipinnaphasa* is referred to as *Phassya Shidal*, *Telas Maach*, *Sepa*, *Hidol*, etc. (Kakati et al., 2018). It is typically produced in households or small factories with minimal process control to ensure product quality and safety, and is sold in local markets. The product has a semi-solid, bilaterally compressed, pasty look, and the fish's shape is essentially preserved except for some little disintegration near the belly and caudal section (Ahmed et al., 2016). The colour of the highest-quality product is dull white, which progressively turns from a light brown to a deep brown colour when exposed to air over time. The air inside and around the storehouse is with strong odour, giving off the distinctive aroma of shidal (Majumdar et al., 2016a). In Tripura, Assam, Mizoram, Arunachal Pradesh, and Nagaland, this Shidal is commonly referred to as "*Seedal*," "*Sepaa*," "*Hidal*," "*Verma*," and "*Shidal*" (Majumdar et al., 2016a). The indigenous people prepare a variety of dishes using shidal, including *shidal chutney*, *mosdeng* (a paste made by pulverizing roasted chili, onion, salt, and roasted shidal), *ghodak* (a semi-liquid paste made by pulverizing boiled vegetables, chili, salt, and roasted shidal), and *bermabutui* (a vegetable curry) (Uchoi et al., 2022). Indigenous people drink raw shidal extracts to provide temporary relief while accidental poisoning takes place. Furthermore, indigenous people have a long-held notion that the shidal diet could be used to treat malaria. In addition, being a good source of proteins, peptides, and bioactive substances, fermented fish products may also have bioactivities, especially natural antimicrobial, antioxidative properties, blood pressure-lowering, cholesterol-lowering, and antithrombotic properties (Majumdar et al., 2016b).

Preparation procedure of North Eastern Shidal

Between November and February, shidal is typically made from dried, salt-free *Puntius sp.* or *Setipinnaphasa* in pots locally known as "*matka*" (Majumdar et al., 2016a). In the case of new *matka*, it should be oil-smeared until they are completely saturated with oil, followed by a drying process for 7 to 10 days. However, if the *matka* is reused, only 2 to 5 days of oil smearing and drying are needed (Majumdar et al., 2016a). Fish oil is utilised for commercial and small-scale production of shidal, but for large-scale production, vegetable oil, especially mustard oil, is used to make the *matka* virtually impermeable to air and vapour (Majumdar et al., 2016a). Similar-sized fish *Puntius* sp. is dried for two to three days in direct sunlight. Depending on the texture of the fish, washing is done in water using a bamboo basket and submerging it for 5 to 15 minutes, followed by spreading it on a shady surface to dry overnight (Muzaddadi & Mahanta, 2013). The *matka* is covered with a gunny bag and buried in the ground up to the belly height in an upright position to fix it firmly. Then a thin layer of fish is spread inside the *matka*, followed by pressing down repeatedly with the foot so that there are no air gaps between the fish, until the *matka* is filled up to the neck (Majumdar et al., 2016a). For one to two days, the mouth is covered with

a sheet of banana leaves or polythene and kept in a protected area, making them undisturbed. Then they are kept for 4 to 6 months for fermentation at ambient temperature by sealing the mouth of the *matka* using soil (Ahmed et al., 2013; Majumdar et al., 2016a; Thapa, 2016).

During shidal preparation, additional oil is used instead of salt (Muzaddadi & Basu, 2012). After 6 months of fermentation, the texture of the final product becomes softer, although the fish remains solid. After the *matka*'s seal is broken and exposed to air, the quality quickly degrades due to changes in fat (Majumdar et al., 2009). Although, shidal is a salt-free fermented food, salt is added during selling to prevent quality deterioration after being removed from the *matka* (Muzaddadi & Basu, 2012). The tribal people consume traditional dishes prepared by the shidal. Using various combinations of vegetables and bamboo shoots, shidal is boiled to make the popular traditional dish known as *godak*. Shidal is cooked with onions and other spices by the Bengali community to make *shidal chutney*. The procedure of North Eastern Shidal Preparation is depicted in Fig. 1.

Health benefits of shidal

Shidal has specific health benefits such as Puthi Shidal is a good source of polyunsaturated fatty acids and contains good amounts of eicosatetraenoic acid (EPA) and docosahexaenoic acid (DHA) (Kakati et al., 2018). In the Northeastern states, malaria has been a frequent and fatal illness (Muzaddadi & Basu, 2012). Ethnic groups such as the Naga, Chakma, Debbarma, and Kukis believe that consumption of shidal has a therapeutic value due to its ability to treat malaria (Muzaddadi & Basu, 2012). Shidal may be used as a potential nutritional and antioxidant source (Zang et al., 2020), thus helping to decrease both protein and other nutrient deficiencies (Majumder et al., 2016a).

Shidal, a fermented fish product of the Rajbanshi people

Rajbanshi people, majorly residing in Cooch Behar, Alipurduar, and Jalpaiguri districts, prepare shidal, a round-shaped fermented fish paste product, following their traditional practices as described in Fig. 2. Immediately after the monsoon, the local and domestic markets become the pool of species such as *Puntius* sp., *Gourami* sp., *Darnica* sp. and some other small fish, harvested from flooded rivers, streams, bogs and swamps, which are the raw material for regional shidal preparation of Rajbanshi people. After catching the fish from water or collecting from the market, they clean and wash the fish properly with potable water, followed by drying under the sun for 7 days (Roy & Das, 2015), and the formation of powder takes place using a wooden mortar and pestle, colloquial nomenclature is *chham* and *gaine*. Smashed black-arum petiole is added to make soft dough, followed by making small balls; mustard oil and turmeric powder are used to coat the balls (Monal & Barman, 2018). The balls are then sun-dried for 3 days and stored in dry ash (Roy & Das, 2015), although the present health consciousness of people has led to skipping the practice of ash storage. Shidal balls have a very savoury flavour and strong aroma (pungent) and are preserved for over a year (Roy et al., 2020).

With the exception of minor disintegration close to the belly and caudal region, the morphology of semi-dried fish in the North Eastern shidal preparation process is essentially retained, giving it a semi-solid, bilaterally compressed, pasty appearance (Ahmed et al., 2016). However, Rajbanshi Shidalis simply like a ball.

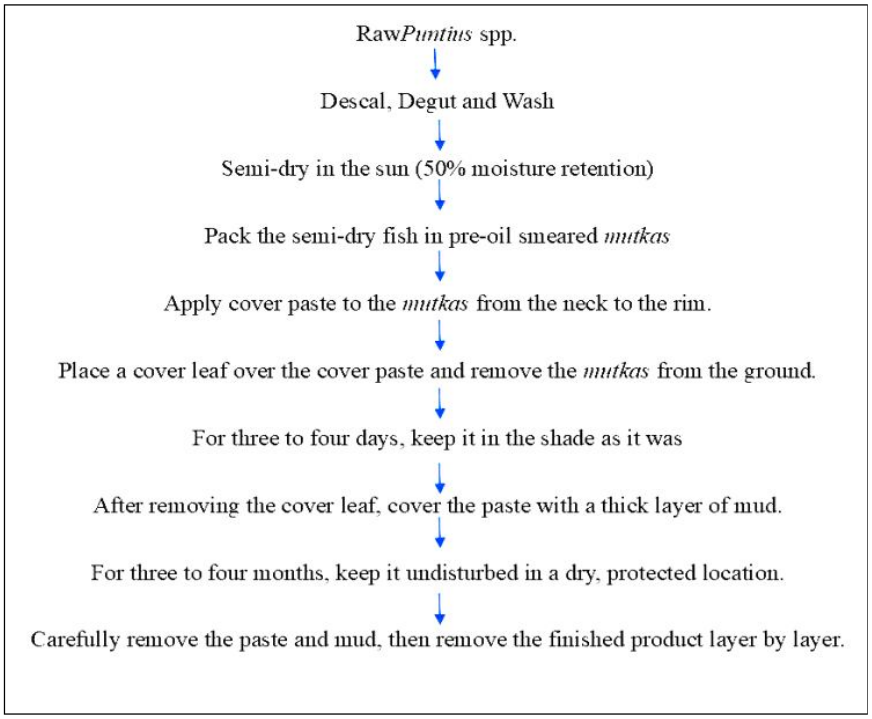

Fig. 1. Flow diagram of North-Eastern shidal preparation (Muzaddadi, 2013)

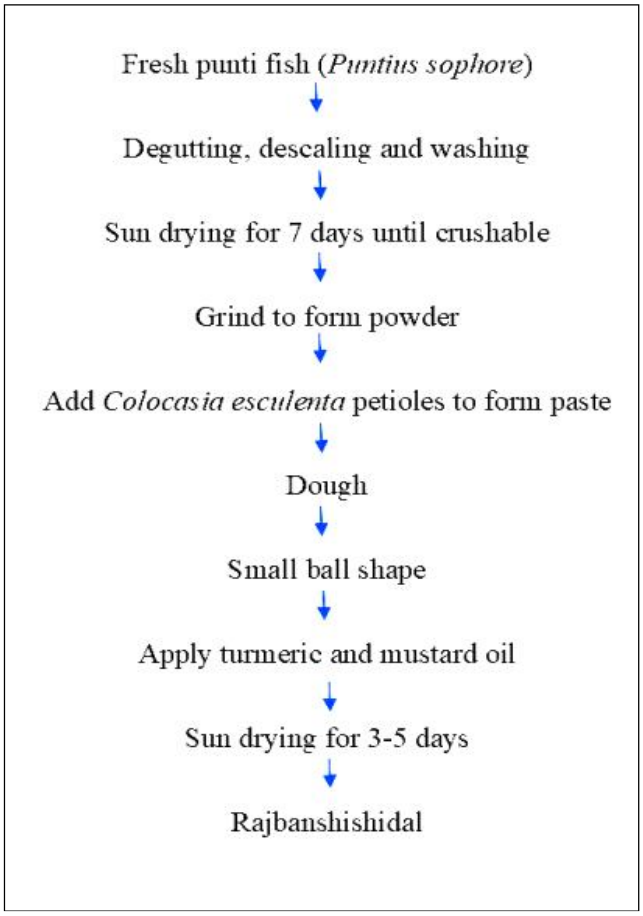

Fig. 2. Flow diagram of Rajbanshi shidal preparation (Roy & Das, 2015; Monal & Barman, 2018)

Consumption process of Rajbanshi shidal

Shidal is mostly produced, preserved, and cooked by the Rajbanshi women's community. Shidal is rich in calcium, iron, vitamin A, B, and E (Monal & Barman, 2018). Shidal is thought to increase hunger, regulate blood pressure, and strengthen the heart (Monal & Barman, 2018). Shidal is grilled over an open flame, followed by washing with water, combined with Chhyaka, black pepper, green chilli, and garlic paste, and cooked for five minutes to make shidal curry (Roy & Das, 2015). For the preparation of shidal curry, Rajbanshis use chhyaka, an alkaline liquid. Small parts of *Musa balbisiana* Colla's rhizomes and pseudostems are sun-dried and burned to create ash for chhyaka preparation. The ash mixture is then filtered by adding some water, jute and coconut husk through a perforated coconut shell. Here, jute and coconut husk act as filter media, whereas coconut shell is used as a container. The filtered liquid is known as chhyaka (Roy & Das, 2015), is used for shidal consumption.

Conclusion

Although it is a traditionally important and nutritious fish paste product of the royal Rajbanshi community of the northern part of West Bengal, Shidal is minimally explored due to the lack of exposure and marketing promotion. Moreover, scientific literatures are scant on the production, nutritional profile, and shelf-life analysis of this fermented fish paste product, indicating a real research gap about the study of West Bengal traditional cuisine. Thus, this traditional culinary practice of Rajbanshi people requires thorough documentation and improvement of the cooking method, hygienic practices and quality attributes are to be taken care of. Therefore, future studies might be conducted by standardising the Shidal preparation recipe used by the Rajbanshi community in Dooars, North Bengal. In-depth research may also be done to ascertain the probiotic nature of the shidal sample, as well as the prevalence and characterisation of LAB present in the shidal to accelerate the fermentation process. Future studies can be carried out on the storage stability and shelf-life study of the traditionally prepared shidal sample and the effect of the incorporation of food-grade additives to the traditional cuisine. The impact of storage temperature on quality changes in shidal and changes in the microbial profile of shidal over the storage period can also be focused on in future.

Conflict of interest: The Authors have no conflict of interest in this study.

Author's contribution: BR, SN: Conceptualization; BR: Writing original draft; SN: Review and editing; SN, SC: Supervision; SC: Formal analysis; PM: Acquisition & resources.

Data availability statement: This is a review of literature; references are enlisted above. There is no context of generation of data set.

Ethical approval: The study does not involve direct research on animals/zebrafish that needs ethical approval.

Use of artificial intelligence tools: During the preparation of this work, there was no usage of artificial intelligence during the research study. The author(s) reviewed and edited the content as needed and take(s) full responsibility for the content of the publication.

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Received - 26.06.2025, *Accepted - 20.11.2025*, *Published - 27.11.2025 (Online), 01.12.2025 (Print)*
Section Editor: Prof. Thangapalam Jawahar Abraham, Editorial Board Member