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Organoleptic and Biochemical Analysis of Traditional and Customized Product of *Shidhils*

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Abstract

A detailed survey was conducted to collect information on the present status of traditional preparation procedure of *Shidhil* at the Northern region of Bangladesh. A total of 10 samples of traditionally prepared *Shidhil* was collected from Rangpur, Kurigram and Nilphamari districts and brought to the Department of Fisheries Technology in zipper polythene packets. Proximate composition of the traditionally prepared *Shidhil* showed that, percent moisture content in Rangpur samples was higher than other samples whereas the percent protein found higher in kurigram samples. Customized product of improved *Shidhils* were prepared in the same laboratory with kachki (*Corica soborna*), mola (*Amblypharyngodon mola*), punti (*Puntius ticto*) and mixture of these three species of fishes. The survey on traditional preparation procedure of *Shidhil* revealed that the traditional preparation procedure of *Shidhil* is quite similar among the districts though there were some differences in shape and weight. Variations were observed in the price of *Shidhils* per piece and it ranged from 10 to 40 taka/piece. No wholesaler could be found in the marketing channel of *Shidhil* and it is prepared mostly for home consumption. The biochemical study of the improved *Shidhils* showed that the percent mean value of moisture, protein lipid and ash of dried fishes obtained at the initial stage changed while *Shidhil* was prepared using these dry fishes. In the case of kachki fish percent moisture content increased from were 16.12 to 23.84. The percent mean value of protein of dried punti fish were 51.48 which decreased to 41.07% after preparing *Shidhil*. On the other hand, the percent lipid value was 15.08 for dried mola which increased to 24.25 in mola *Shidhil*. In the case of mixture of three species of these fishes the percent mean value of ash was 12.73 which decreased 10.38 after preparing *Shidhil*.

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Introduction

Fermentation is a process which offers a wealth of possibilities and plays an important role in improvement of nutritional and functional properties of food. The WHO food safety unit has given high priority for the research in food fermentation, as it will improve the food safety by controlling the growth and activity of pathogens in foods.

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Moreover, fermented food products are a good source of peptides and amino acids (Rajapakse *et al.,* 2005, Sathivel *et al.,* 2003). The calcium, phosphorus, magnesium and iron contents of Chepa Shutki were reported to be higher than those of similar kinds of Japanese processed fish and was regarded as a high quality protein food (Khanum, 1999).

Indigenous fish products, such as *Shidhil* is a salt-free, solid, semi-fermented one, prepared from small sized fish along with Kachu Data/Taro or other plants which is a specialized fish product of the northern region of Bangladesh (Gaibandha, Kurigram, Lalmonirhat, Rangpur, Nilphamari, Dinajpur, Thakurgaon). It has several local names such as Shidal, Hidal, Hentak etc. which varies from district to district. Beside this, another type of fish product called Sidal (sounds similar) or Cheapa shutki is prepared in other parts of Bangladesh (in many parts of greater Mymensingh) which totally differs from *Shidhil* in terms of processing and cooking.

Shidhil is prepared by the application of traditional method of drying followed by fermentation. A characteristic taste and flavor develops in the final product which is a delicacy. The process of *Shidhil* preparation does not cost much and it does not demand high technical knowledge. But *Shidhil* preparation procedure is usually carried out under an unhygienic condition and it is confined to some particular groups of people. Further, its marketing condition is also poor. Literature available on the various aspects of preparation of this product is scanty (Muzaddadi and Basu, 2003).

In Bangladesh, the nutritional deficiency has become more acute because of tremendous rate of population growth without any significant increase in animal protein production. In this regard, Nowsad (2007) reported, raw material quality is not often maintained during *Shidhal* or other fermented products such as- *Nga-pi* preparation. Till now, research on *Shidhil* preparation, its marketing channel are scare. Therefore, it is very important to investigate the present status of the product, it's preparation process, marketing channel and nutritional quality of this product. At the same time, it is also necessary to build up awareness about the practice of basic hygiene during manufacturing of the product and safety of the finishes one. A detailed study on traditionally produced *Shidhil* can provide valuable information in the use of the product on a wider scale. Formulation of new techniques to increase the shelf life would help in the commercialization of these products.

The present study was carried out to assess the present status and nutrition quality of the fermented product, *Shidhil* collected from Northern region of Bangladesh and improved *Shidhil* was prepared at laboratory maintain hygienic condition. Quality assessment of the laboratory prepared *Shidhil* was also done under various storage conditions.

Materials and Methods

Study area

For this study the survey was carried out on the present status of traditional preparation procedures of *Shidhil* practiced at Northern districts of Bangladesh, specially Rangpur, Kurigram and Nilphamari districts.

Survey on traditional Shidhil

The survey was carried out on a total of 10 retailers, 8 producers and 6 consumers of each district to collect relevant information by interviewing them individually using prescribed questionnaire. The informations were collected using a survey form where the questions were arranged under eight different sections like- general Information: (of producer / retailer / consumer), information of raw fish collector / producer / wholesaler / retailer, information of *Shidhil* seller, information about capital involved and cost-benefit, information about socio-economic condition of *Shidhil* traders, information about production, information about marketing and information obout sanitation and hygiene. At the time of interview each question was explained to the interviewee clearly and asked systematically. During interview tape-recorder and video camera were used whenever it was necessary for keeping the record.

Plate. 1. Questionnaire interview with *Shidhil* Traders.

Observation of traditional Shidhil preparation procedure and collection of traditionally prepared Shidhil sample

To observe the traditional production procedure of *Shidhil* at Northern region of Bangladesh (Rangpur, Kurigram and Nilphamari area) several producer's houses were visited. The traditional preparation procedure of *Shidhil* is presented in Plate-2.

During the survey traditionally prepared *Shidhils* were collected for laboratory analysis. From Rangpur district 4 types of traditional *Shidhils*, 3 types from Kurigram district and 3 types from Nilphamari district were collected (Plate 3). A total of 10 types of samples were packed in zipper polythene packets and stored at room temperature (28 to 32°C) in food grade plastic container to bring them to the Fish Processing and Quality Control Laboratory of Department of Fisheries Technology, Bangladesh Agricultural University.

Processing of giant taro | Dried fish

Mixing of dried fish and grinded taro by traditional mortar

Fish paste covered with taro leaf and kept in dark place for 3 days for fermentation | Shaping of *Shidhil* after fermentation

Traditionally prepared *Shidhil*

Plate. 2. Traditional preparation procedure of *Shidhil.*

Shidhil (Rangpur) | *Shidhil* (Kurigram) | *Shidhil* (Nilphamari)

Plate. 3. Traditional *Shidhils* collected from different districts.

Preparation procedure of customized products of Shidhil (improved Shidhil).

Collection of fish and taro samples

To prepare improved *Shidhil* in the laboratory, three species of fishes- kachki (*Corica soborna*), mola (*Amblypharyngodon mola*) and punti (*Puntius ticto*) and Taro (*Colocasiae sculenta*) were collected in fresh condition from the local market of Mymensingh city (Plate 4).

Kachki Mola Punti Taro

Plate. 4. The fishes and taro used to prepare improved *Shidhil* in the laboratory.

Preparation of fish sample

The gut content of collected fish samples were removed and washed properly using potable water. Fishes were then dried directly under sunlight for 5 days. Bamboo basket (locally called *kula*) was used to dry the fishes. Sun drying reduced the moisture content of fish samples. After completion of drying, the dried fish samples were packed in zipper polythene packets until further use (Plate- 5).

Kachki Mola Pun

Plate. 5. The dried fishes in zipper polythene packets.

Preparation procedure of improved Shidhil

The dried fish samples of Kachki (*Corica soborna*), Mola (*Amblypharyngodon mola*) and Punti (*Puntius ticto*) were grinded to prepare fish powder of each species and kept in separate plates until mixing with taro (Plate- 6).

(a) Preparation of taro paste

(b) Mixing of fish powder and taro paste (c) Sample in giant taro leaf for fermentation

(d) Mixing of turmeric powder and mustard oil to fermented sample (e) Shaping of sample

(f) Drying of Improved *Shidhil* under the sunlight

(g) Dried Improved *Shidhil* produced with three species of fish

Plate. 6. Preparation procedure of improved *Shidhil* in laboratory.

On the other hand, taro were peeled off, cut into small pieces and steamed for few minutes. The steamed taro pieces were poured on a clean-soft net to remove water. After removal of water the steamed taro was grinded to prepare taro paste. The powder of dried fishes were then mixed with taro paste and this mixture was kept in folded giant taro leaf for overnight to allow fermentation. Next day a little amount of turmeric powder and mustard oil (Table-1) were mixed with the fermented sample and a definite shape was given (patty shape). This patty shaped improved *Shidhil* were then dried under sunlight for 7 days (Plate 4). After draying these Improved *Shidhil* samples were stored in zipper polythene packets until analysis at different temperatures.

Table 1. Ingredients used in *Shidhil* preparation.

Fish Name	Amount of Fish Powder/100 g	Amount of taro paste/100 g	Amount of Turmeric powder/100g	Amount of Mustard Oil/100g
Kachki *Shidhil*	40	58	1.5	0.5
Mola *Shidhil*	43	55	1.5	0.5
Punti *Shidhil*	42	56	1.5	0.5
M ixed *Shidhil*	45	53	1.5	0.5

Quality assessment of Shidhil

Quality assessment of both traditionally prepared *Shidhil* and improved *Shidhil* was done in the laboratoriy of Department of Fisheries Technology, Bangladesh Agricultural University.

Sensory assessment of the Shidhil samples

A panel of nine-members (students, teachers and staffs of the Department of Fisheries Technology, Bangladesh Agricultural University) was selected for the sensory assessments of the products (method described by Nowsad *et al.,* 2000). The *Shidhils* were evaluated for preference of color, flavor, odor, texture, taste and overall acceptability on the basis of defect points as describe in Table-2 and 3.

Table 2. Determination of organoleptic quality according to Howgate Method (1992) with certain modification.

Characteristics of Shidhil	Defect characteristics	Defect points	Quality
1. Appearance	Bright, shining blackish	1	Excellent
	Slight dullness	3	Acceptable
	Dullness	4	Fare
	Definite dullness, weight loss	5	Reject
2. Colour	Gray blackish color	1	Excellent
	Brown or gray color	4	Poor
	Colo r become black	5	Reject
3. Odour	Good odor	1	Excellent
	Slight off sour odor	3	Acceptable
	Faint sour odor	4	Poor
	Strong sour odor	5	Reject
4. Texture	Very good	1	Excellent
	Softness	2	Acceptable
	Some loss of elasticity	3	Acceptable
	Melting, easily broken	5	Reject
5. Consistency of paste	Soft	1	Excellent
	Paste somewhat hard	2	Acceptable
	Paste become hard	3	Acceptable
	Loss of water absorption	4	Poor

Table 3. Grading of *Shidhil.*

Grade	Defect point	Degree of freshness
A	<2	Excellent
B	2 to <4	Acceptable
C	4<5	Poor
D	5	Reject

Biochemical analysis

Proximate composition (moisture, crude protein, lipid and ash) of *Shidhils* was carried out according to the methods given in AOAC (2000) with certain modifications. Triplicate samples were taken to carry out the experiment.

Statistical Analysis

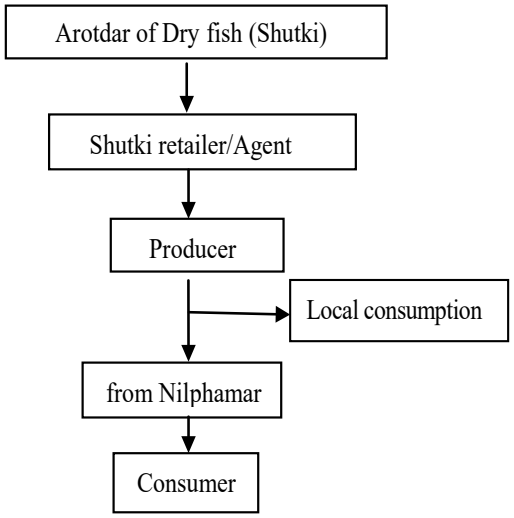
Data from different biochemical measurements was subjected to statistical analysis. The statistical analysis package SPSS 11.5 (SPSS Inc, Chicago, IL, USA) was used to calculate mean values.

Results and Discussion

Survey on traditional Shidhil

Marketing chain of Shidhil

Marketing is the connecting link between the producers and consumers. The study on the marketing system of traditionally prepared *Shidhil* (Flow chart) showed that there is no specific marketing channel; it varies depending on the place and season of the year. Producers collect raw materials of *Shidhil* from shukti arotdar or shutki retailer. In most cases, the shutki retailers produce *Shidhil* with the help of women of their own house. After making *Shidhil*, the shutki retailers takes it to his own shop and sell *Shidhil* directly to the consumers.



Flow chart. Marketing channel of *Shidhil.*

From the study it was also observed that, no license is required for *Shidhil* business (Table 4). *Shidhil* is prepared almost round the year but the mostly prepared during the winter season due to having enough sunlight. The survey also showed that, almost in all villages of North Bengal and some houses in urban area, *Shidhil* are made for their own consumption not for sell. Some times on the basis of consumers demand the producers of urban area sell their *Shidhil*.

Table 4. Different aspects of *Shidhil* marketing in Rangpur, Kurigram and Nilphamari districts.

Sl No.	Major aspect	Status/Description		
		Producer	Wholesaler	Retailer
1.	Marketing of *Shidhil*	Producer sold their products to the retailers	There was no wholesaler in *Shidhil* marketing.	Retailer sold their products to the local consumers and other consumer of the other cities.
2.	Major region of *Shidhil* supply	Northern region of Bangladesh. (Rangpur, Dinajpur, Kurigram, Nilphamari)		Mainly local consumer
3.	Tax for communication	No tax required		No tax required
4.	Loan taken from -	Loan taken from NGO's and Govt. Bank		Loan taken from NGO's and Govt. Bank
5.	Marketing problem of *Shidhil*	Sell price of *Shidhil* is very low		Sell price of *Shidhil* is low
6.	Need any license for this business	No license required		Trade license required from municipal Corporation

Cost and benefit analysis

A simple cost and benefit analysis was done for *Shidhil* preparation and sell (Table 5). The cost is more or less same round the year except the raw material cost varies depending on the season and availability. Study showed that, 400-450 pieces *Shidhil* are made from 10 kg small dry fish/shutki. The price of *Shidhill* varies from place to place. In Rangpur sadar, the price of *Shidhil* is 30 to 40 Taka per piece whereas in Kurigram, the price is 10 to 15 Taka per piece and in Nilphamari, the price is 25 to 30 taka per piece *Shidhil*. The price of 10 kg small dry fish/shutki is about 2500 taka in local dry fish arot. According to the *Shidhil* retailers, the consumer for *Shidhil* in local markets are very few, sometimes even a single piece of *Shidhil* is not sold in a day. Retailers also informed that, sometimes some consumers buy *Shidhil* to send

Table 5. Cost and benefit analysis of *Shidhil* marketed in Rangpur, Kurigram and Nilphamari districts.

Sl No.	Major aspects	Status/Description		
		Producer	Wholesaler	Retailer
1.	Business capital	Borrow from NGO and money lander and Govt.Bank.	There was no wholesaler in *Shidhil* marketing	Borrow from Govt. Bank and NGO's.
2.	Raw material/ *Shidhil* purchases at the price	10 kg=300 -350 TK		10 Kg=350 - 400Tk
3.	*Shidhil* sold per 10 kg	10kg=700 -800 Tk		10kg=900 - 1000Tk
4.	Net profit per 10 kg	400 -500Tk/10kg		600 -700Tk/10kg
5.	*Shidhil* produced/sold per week (7days)	400 -500 pieces		200 -300pieces
6.	Net profit per week (7days)	6000 -8000Tk		3000 -5000Tk

abroad to their relatives who are very much fond of *Shidhil* as traditional product of Northern districts of Bangladesh. The *Shidhil* retailers added, though *Shidhil* is a traditional food of Northern districts of country but the popularity of this product is increasing day by day. If the nutritional quality can be maintained properly the market of *Shidhil* will expand throughout the country.

During survey, information on price, shape, weight of *Shidhil* and spices used in *Shidhil* production in the study area were also collected. These information are presented in Table 6. Among the three districts the price/ piece of *Shidhil* was highest at Rangpur and was lowest at Kurigram. The shape of *Shidhil* was little different at Kurigram (diamond shape) but weight of the *Shidhil*/piece was highest (27 to 30 g/piece). Almost similar kinds of spices were used in Shidhil preparation except Rangpur district.

Table 6. Survey result on the price, shape, weight of *Shidhil* and the spices used in *Shidhil* production in Rangpur, Kurigram, Nilphamari districts.

No.	Districts	Price	Shape	Weight	Spice used
1	Rangpur	30 -40 Tk/per piece	Patty/Round Shape	16 -18gm/per *Shidhil*	Turmeric powder, chili powder, ginger,garlic,mustard oil.
2.	Kurigram	10 -15Tk/per piece	Diamond shape	27 -30gm/per *Shidhil*	Turmeric powder and mustard oil.
3.	Nilphamari	25 -30 Tk/per piece	Patty/round shape	14 -20gm/per *Shidhil*	Turmeric powder and mustard oil.

Organoleptic assessment of traditionaland improved Shidhils

The results of organoleptic quality study of traditional and improved *Shidhils* are presented in Table-7 and Table 8. The *Shidhils* of bright brown color is considered most acceptable to the consumers. In case of odor, strong dried fishy odor is considered best and it is rejected when it smells rancid off odor. The hard texture of *Shidhil* is preferred by the consumers and considered excellent.

The defect point of traditional *Shidhil* collected from Rangpur district named as R1. R2 and R3 were found acceptable (Table 7) but the sample named as R4 was of excellent quality. Traditional *Shidhils* collected from Kurigram and named as K1, K2 and K3 and the *Shidhils* collected from Nilphamari (N1, N2 andN3) were also of excellent in quality.

Table 7. Organoleptic characteristics of traditionally prepared *Shidhils* collected from Rangpur, Kurigram and Nilphamari districts.

Product type	Characteristics	Defect Characteristics	Defect points*	Average Defect points	Grade/Comments
		Shidhils collected from Rangpur			
R1	Color	Brown or gray color	4	3.33	Acceptable
	Odor	Faint sour odor	4		
	Texture	Softness	2		
R2	Color	Brown or gray color	4	3.0	Acceptable
	Odor	Slight off sour odor	3		
	Texture	Softness	2		
R3	Color	Brown or gray color	4	2.33	Acceptable
	Odor	Good odor	1		
	Texture	Softness	2		
R4	Color	Gray blackish color	1	1.66	Excellent
	Odor	Slight off sour odor	3		
	Texture	Very good	1		

Continued

		Shidhils collected from Kurigram			
K1	Color	Gray blackish color	1	1	Excellent
	Odor	Good odor	1		
	Texture	Very good	1		
K2	Color	Gray blackish color	1	1	Excellent
	Odor	Good odor	1		
	Texture	Very good	1		
K3	Color	Brown or gray color	4	1.33	Excellent
	Odor	Good odor	1		
	Texture	Very good	1		
		Shidhils collected from Nilphamari			
N1	Color	Brown or gray color	4	1.33	Excellent
	Odor	Good odor	1		
	Texture	Very good	1		
N2	Color	Brown or gray color	4	1.33	Excellent
	Odor	Good odor	1		
	Texture	Very good	1		
N3	Color	Gray blackish color	1	1.66	Excellent
	Odor	Slight off sour odor	3		
	Texture	Very good	1		

Here, R1, R2, R3, R4= *Shidhils* collected from four (4) sources of Rangpur district; K1, K2, K3= *Shidhils* collected from three (3) sources of Kurigram district and N1, N2, N3= *Shidhils* collected from three (3) sources of Nilphamari district

Table 8. Organoleptic characteristics of improved *Shidhils* prepared from kachki, mola and punti and mixed species of fishes along with taro.

Product type	Characteristics	Defect Characteristics	Defect points*	Average Defect points	Grade/Comments
Kachki *Shidhil*	Color	Brown color	2	1.66	A (Acceptable)
	Odor	Mild fishy odor	2		
	Texture	Hard texture	1		
Mola *Shidhil*	Color	Bright brown color	1	1.33	A (Acceptable)
	Odor	Strong dried fishy odor	1		
	Texture	Less soft texture	3		
Punti *Shidhil*	Color	Bright brown color	1	1.33	A (Acceptable)
	Odor	Strong dried fishy odor	1		
	Texture	Fragile texture	2		
Mixed *Shidhil*	Color	Bright brown color	1	1.33	A (Acceptable)
	Odor	Mild fishy odor	2		
	Texture	Hard texture	1		

Proximate composition of traditional Shidhils

Proximate composition of traditionally prepared *Shidhil*s collected from survey area is presented in Table 9. The obtained results showed that, percent moisture content of *Shidhils* collected from Rangpus was in higher range (26.45 to 32.60) and was in lower range in *Shidhils* collected from Kurigram (10.96 to 17.78). On the other hand, the percent protein range was higher (42.75 to 50.83) in *Shidhils* collected from Kurigram and in lower range (25.49 to 38.80) collected from Rangpur. Percent lipid content was in lowest range (11.30 to 13.29) in *Shidhils* collected from Nilphamary district.This variation in the proximate composition among the traditionally prepared Shidhil samples of three districts of study area might be due to differences in amount of ingredients used by the local producers.

Table 9. Proximate composition of traditionally prepared *Shidhils* collected from Rangpur, Kurigram and Nilphamari districts.

District	Sample type	Moisture (%)	Protein (%)	Lipid (%)	Ash (%)
Rangpur	R1	32.60	25.49	21.93	16.77
	R2	30.68	35.16	9.63	20.16
	R3	29.54	38.80	13.62	16.96
	R4	26.45	37.75	12.96	18.53
Kurigram	K1	10.96	49.83	15.28	21.67
	K2	13.86	50.83	15.95	15.91
	K3	17.78	42.75	16.28	21.76
Nilphamari	N1	17.97	39.50	13.29	23.91
	N2	18.16	42.56	11.30	23.95
	N3	24.92	33.56	13.29	22.90

Proximate composition of different samples used to prepare improved Shidhils

Proximate composition of taro, raw fish and taro

Analysis of proximate composition i.e. percent moisture, protein, lipid and ash contents of taro, three species of raw fishes, dried fishes, *Shidhils* prepared from these dry fishes was done and the obtained result is presented in Table-10.

Table 10. Proximate composition of taro, three species of fresh fishes, dried fishes, dried mixed fishes and different *Shidhils.*

Sample name	Moisture%	Protein%	Lipid%	Ash%
Taro	75.54	7.28	2.42	11.85
Fresh Kachki	85.27	11.21	1.87	1.92
Dried Kachki	16.12	58.22	10.15	12.52
Kachki *Shidhil*	23.84	43.95	19.89	8.98
Fresh Mola	78.38	11.12	5.66	2.45
Dried Mola	13.83	55.42	15.08	12.84
Mola *Shidhil*	18.27	44.25	24.25	11.58
Fresh Punti	75.38	15.55	4.35	1.87
Dried Punti	20.12	51.48	13.05	12.23
Punti *Shidhil*	14.52	41.07	28.90	12.57
Dried mixed fishes	13.25%	59.13%	12.66%	12.73%
Mixed fish *Shidhil*	22.59%	39.18%	24.52%	10.38%

Results of the proximate composition analysis of the fresh fish, dry fish and *Shidhils* (prepared with improved techniques) showed that- the percent moisture content increased in all samples after preparing *Shidhils* than the moisture content in the dried fishes (i.e., percent moisture content in dried kachki was 16.12 whereas the value was 23.84 in kachki *Shidhil*). On the other hand, the percent protein content decreased after preparing *Shidhil* than the protein content originally was in dry fishes (i.e., percent protein content in dried dried mola was 55.42 whereas the value was 44.25 in mola *Shidhil*). In the case of percent

lipid content in the *Shidhil* samples turned almost double than in the dry fish samples (i.e., percent lipid content in dried punti was 13.05; whereas the value was 28.90 in punti *Shidhil*). Rahman *et al.* (2016) reported a range of protein and lipid content of '*Shidhil'* produced from punti 31.3 to 51.32% and 5.81 to 6.71%, respectively. and for '*Shidhil'* produced from silver jew fish with taro the lipid and protein content ranged from 30.54 to 49.4% and 5.03 to 6.45% , respectively. These values are quite nearer to the obtained values in the present experiment. The moisture content increased in the *Shidhil* samples than in the dry fishes in this study might be due to the addition of taro during the product preparation, as because taro contains more than 75% moisture content. On the other hand, the increment in the percent lipid content in the *Shidhil*s might be contributed by the addition of mustard oil during product preparation procedure.

Conclusions

Through the survey it was found that, most of the producers and retailers have little or no knowledge about maintenances of quality of the *Shidhil*. Traditional *Shidhil* are stored in unhygienic condition by the retailers and marketed without proper packaging. Customized products of Improved *Shidhils* can be prepared of attractive color and flavor by maintaining the hygienic condition, using good quality taro and mustard oil along with different species of fishes like kachki, mola, puti or mixed species of these fishes by which percentage of protein ranges from 39.18 to 44.25.

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