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Production of *Jaadi* using Tilapia (*Oreochromis niloticus*) and determination of its physcio-chemical and sensory properties

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Abstract

Consumption of *Tilapia* is restricted due to its muddy flavour and colour. This study was aimed to develop *jaadi,* a fermented fish product, using *Tilapia* (*Oreochromis niloticus*) and to determine suitable salt and goraka *(Garcinia gambodiea)* combination for its preparation. The experiment was arranged in a Randomized Complete Block Design with four replicates. First experiment was aimed at determining the suitable salt content for *jaadi*. There were four treatments having salt contents of 200 g, 300 g, 400 g and 500 g per 1 kg of deskined fish without head while keeping goraka *(G. gambodiea)* content at 100 g. The most suitable salt content was determined according to sensory evaluation results, which in turn was used for second experiment, for the determination of suitable goraka *(G. gambodiea)* content, the goraka *(G. gambodiea)* content was changed as 100 g, 150 g, 200 g and 250 g per 1 kg of fish keeping the salt content constant. Results for the first experiment indicated that the highest preference for sensory attributes was from combination of 500 g of salt with constant goraka *(G. gambodiea)* per 1 kg of fish. Results of second experiment indicated that there was a higher preference for the combination of 100 g of garcenia *(G. gambodiea)* with 500 g salt per 1 kg of fish compared to other treatments. The study clearly revealed that 500 g of goraka *(G. gambodiea)* and 100 g of salt with 1 kg of deskined *Tilapia* (*O. niloticus*) fish without head can effectively used to produce *jaadi*.

Key words: Tilapia, Goraka, Salt, Storage

Introduction

Fish is considered as an important food item in the diet of South East Asian people particularly as a source of protein. Over 96% of Sri Lankans consume fresh or processed fish, which provide an estimated 65-70% of the mean annual protein intake (Gunerathne and Samarajeewa, 1994). More than 95% of the fish production in Sri Lanka is from capture fisheries; the rest is from aquaculture (FAO, 1996). The introduction of exotic fish tilapia species has increased the fish yields from 1 kg/ha to 227 kg/ha per year and has contributed towards establishment of capture based culture fisheries (De Silva, 1981).

As *Tilapia* is produced in seasonal tanks, over production result during in the peak season and leads to post harvest losses. Hence, proper application of post harvest technology is needed to overcome this problem. Direct consumption of *Tilapia* is restricted due to lack of taste leading for a less popularity of *Tilapia* among consumers except in Dry Zones. Therefore, value added product with good physico-chemical properties could be used to attract and encourage people to consume *Tilapia* as a good protein source. The *jaadi* is wet cured traditional fermented fishery product and creates a pleasant, mouth watering sensation in our tongues (Weerasinghe, 1991). *Jaddi* is a Tamil word and its means huge pots. Indian people also call 'Thaadi'. In pali it is known as 'Thathi' (kariyawasam, 2007). Therefore, this study was undertaken develop a fermented fish product, *jaadi,* using *Tilapia (O. niloticus),* to evaluate sensory properties of the product and changes in pH value of product during storage.

Materials and Methodology

Preliminary processing of fish

This study was carried out at Aquaculture laboratory, Department of Animal Science, Faculty of Agriculture, University of Peradeniya, Preradeniya, Sri Lanka. Approximately, 300-350g of weight and 25cm (from snout to base of the caudal fin) of total length fish were selected for processing. Pre-processing inspection of fish was done to select fish without any defects like cuts, bruises, cruises or discolouration. The belly area was cut opened and the internal organs like digestive track, uro-gentital systems were removed. Body cavity was cleaned using clean water. All the fins were removed except the caudal fin. Deheading of fish were done by cutting the head as canting the head as a contoured cut which run perpendicular to the fish's backbone and then at an angle of 45 ° manually. Pectoral bones were also removed along the head. Skinning was done to reduce microbial count and to remove scales. Finally caudal fin was removed and carcasses were washed using clean water. During processing period, contamination by flies was never allowed. 0.3 m diameter and 0.25 m height clay pots were taken and washed thoroughly by using tap water and sterilized by boiling water. Goraka *(G. gambodiea)* was also washed and sterilized with boiling water before using.

Preparation of *jaadi*

The experiment was arranged in a Randomized Complete Block Design with four replicates. Salt and goraka *(G. gambodiea)* were mixed well, produce as curing mixture and packed in previously washed and sterilized

clay pots in alternative layers of fish and prepared curing mixture. It would be noted that salt and goraka *(G. gambodiea)* mixture was thickly sprinkled between each layers and also the top most layer s of fish and the bottom of the container was covered with salt and goraka *(G. gambodiea)* mixture. Clay pots were covered by using cleaned banana leaves and tied up with threads to avoid any possible contaminations and set a side for natural fermentation to proceed uninterrupted for a period of three months.

Determination of suitable salt quantities for preparation of *jaadi*

Four *jaadi* samples were prepared based on recipe given in Table 1. Sensory evaluation (colour, flavour, odour and over all acceptance) was carried out at the end of the experiment to find out the optimum salt content to produce good quality *jaadi*.

Table 1: Combination of Goraka and Salt Content for 1kg of Fish

Treatments	Goraka content (g/kg of fish)	Salt content (g /kg of fish)
T_1	100	200
T_2	100	300
T_3	100	400
T_4	100	500

Determination of the suitable goraka (*G. gambodiea*) quantities for preparation of *jaadi*

Based on the results of sensory evaluation for determining the optimum quantity salt for the preparation of *jaadi,* optimum quantity of goraka (*G. gambodiea*) was determined using treatments as shown in Table 2. At the end of three months period a sensory evaluation was carried out to determine the optimum quantity of goraka (*G. gambodiea*).

Table 2: Combination Goraka Content for 1kg of Fish

Treatments	Goraka content (g/kg of fish)
T_1	100
T_2	150
T_3	200
T_4	250

Determination of pH of the final products during storage

The final product was prepared using the optimum salt and goraka (*G. gambodiea*) contents found in the study. The product was storage for period of four months at ambient temperature 27 °C and pH value of the product was determined using a digital Hanna pH meter at one month interval to find out mould with storage.

Sensory Evaluation

Acceptability of the product was tasted by preparing a curry of *jaadi* samples and randomly coded and served to a panel of 30 in-house untrained 25 years male and female panellists from Faculty of Agriculture, University of Peradeniya, Peradeniya, Sri Lanka. They assessed colour, odour, flavour and overall acceptability of each sample supplied. Each parameter was ranked on a 5-point Hedonic scale (5- Like very much 1- Dislike very much).

Statistical Analysis

The results of sensory evaluation were analyzed by Friedman test using MINITAB statical package á = 0.05 and means were separated by multiple comparison. Data related to the pH changes were separated according to the Duncan's Multiple Ranges Test (DMRT).

Results and discussion

Determination of suitable salt content

Result revealed that there was a significant deference ($P< 0.05$) for taste and overall acceptable of treatment T_4 having 500 g goraka (*G. gambodiea*) (Table 3). T_1 containing 200 g salt and 100 g goraka (*G. gambodiea*) was the least preferred one. Therefore, 500 g salt level was selected as the optimum salt level and used for the next experiment to determine optimum goraka (*G. gambodiea*) content. Weerasinghe (1991) reported a different finding for preparation of *jaadi* from marine fish that 100 g of salt could be used for 300 g of fish. Salt to fish ratio for *Tilapia Jaadi* was 1:2 while Weerasinghe (1991) used 1:3 salt to fish in his study to have a good quality *jaadi*.

Table 3: The median values for determination of suitable salt content

Treatments	Median Values				
	Colour	Taste	Odour	Texture	Overall acceptability
T_1	2.70^a	3.0^a	3.2^a	2.93^a	3.0^a
T_2	2.20^a	3.0^a	3.0^a	2.56^a	3.0^a
T_3	3.30^b	4.0^{ab}	3.3^a	3.00^a	3.0^a
T_4	3.59^b	4.0^b	3.5^a	3.10^a	4.0^b

Note: Median Values in columns with the same letter are not significantly different (á = 0.05).

Determination of suitable goraka (*G. gambodiea*) content

Results indicated that there was no difference (p>0.05) for colour, odour and texture of treatments (Table 4). Taste and overall acceptability of treatment T_5 having 100 g goraka (*G. gambodiea*) and 500 g salt were significant from other treatments at á = 0.05. Therefore, 100 g goraka (*G. gambodiea*) was selected as the optimum goraka (*G. gambodiea*) content resulting premium quality *jaadi*. The final *jaadi* samples were prepared with 500 g salt, 100 g goraka (*G. gambodiea*) and 1 kg of deskined Tilapia without their heads. A similar result for *jaadi* was reported by Weeerasinghe (1991). Furthermore indicated that 100 g goraka (*G. gambodiea*) could be effectively used with 1 kg of marine fish to have very good quality *jaadi.* Result further revealed that goraka (*G. gambodiea*): fish ratio for both studies was 1:10.

Table 4: The Median Values for Determination of Suitable Goraka Content

Treatments	Median Values				
	Taste	Colour	Odour	Texture	Overall acceptability
T_1	4.0^a	3.75^a	3.75^a	3.62^a	3.75^a
T_2	3.0^b	3.25^a	3.25^a	3.37^a	3.50^a
T_3	3.0^b	3.50^a	3.50^a	3.37^a	3.50^a
T_4	2.0^b	3.50^a	3.50^a	3.12^a	3.25^a

Note: Sums of Ranks in columns with the same letter are not significantly different (á = 0.05).

Changes in pH values of *jaadi* samples stored at ambient temperature 27 °C

pH level of *jaadi* samples did not changed significantly (P> 0.05) for a period of 4 months (Table 5). It proves that there are quality changes in prepared *jaadi* during storage especially growth of harmful microorganisms like mould. Goraka (*G. gambodiea*) was used as a souring agent for this experiment because it contains gambogic acid, which helps in preservative action by reducing pH (Amarasinghe and Jayaweera, 1994). Further it acts as an antimicrobial agent retarding the microbial growth due to forming acidic medium. Pathmalatha (2001) indicated that pH of goraka (*G. gambodiea*) is around 4 and it can inhibit undesirable microbial growth. Weersinghe (1991) indicated different results for pH in marine *jaadi* that was around 4.2. This difference may be due to higher salt content used in this study. The remarkable feature of this study was that there was no any mould growth or bad smell in *jaadi* even after 4 months of storage.

Table 5: The pH Values during Storage

Months	pH Value
1	5.08[a]
2	5.06[a]
3	5.09[a]
4	5.07[a]

Note: Sums of Ranks in columns with the same letter are not significantly different (á = 0.05).

Conclusions

The Premium quality *jaadi* could be prepared by using 1 kg of deskined *Tilapia* (*O. niloticus*) without head, 500 g salt and 100g goraka (*G. gambodiea*). There was no change in pH level of stored *jaadi* samples for 4 months period at ambient temperature 27 °C.

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