Effect of Goraka Concentrate in Curing Mixture on the Quality of Traditional Fermented Fish (Jaadi)

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Abstract

Jaadi is a tropical fermented fish product commonly used to preserve fish during peak seasons. Goraka (Garcinia cambogia) is an acidic fruit added to give a low pH. Studies have shown that the ideal curing mixture should have salt : fish in 1:3 ratio. This study was carried out to establish ideal concentration of goraka in curing mixture.

Jaadi was made in the laboratory using Sardinella longiceps species by altering the concentration of goraka while keeping 1:3 salt : fish ratio. The ratio of weight of fish : weight of goraka used in the four different treatments were 6:1, 10:1, 12:1 and 15:1. The acceptability and shelf life of different treatments were evaluated using chemical and microbiological analyses. Organoleptic tests were carried out by a trained taste panel. The chemical parameters tested were total volatile nitrogen (TVN), tryptophan (TMA), oil and free fatty acid (FFA) contents, peroxide value, pH and dry matter content. Total bacterial counts (TBC) of the samples were also determined. The samples were assessed at monthly intervals for six months.

The TBC decreased during the fermentation period when fish : goraka ratios were 6:1 and 10:1. The pH, oil content, and peroxide value also decreased during the fermentation period. The highest decrease in pH was observed when fish : goraka ratio was 6:1. The dry matter content and TVN increased during the fermentation period. The overall acceptability of the product was higher when fish : goraka ratios were 6:1 and 10:1. Since there is no significant difference in the quality and overall acceptability when fish : goraka ratios are 6:1 and 10:1, considering the cost of preparation, it appears that 10 : 1 fish : goraka ratio would be the ideal treatment.

Introduction

The fermentation is one of the earliest known methods of preservation of fish. The action of salt is coupled with acidity of goraka (Garcinia cambogia) in jaadi preservation. Jaadi is a traditional fermented popular preservation product in Sri Lanka. Fermentation activity leads to transformation of the organic substances into simpler compounds by the action of enzymes. The fruit of goraka is used to maintain low pH level during the fermentation process (Subasinghe 1992). Goraka contains several organic acids such as
(Balachandran 1975). Studies have shown that ideal curing mixture should have salt : fish in 1:3 ratio (Jayasinghe 1996). This study was carried out to find the ideal concentration of goraka to give an end product with best organoleptic quality and a reasonably long storage life with a low processing cost.

Materials and Methods

Fresh *Sardinella longiceps* was obtained from the fish landing site at Negombo. The fish was transported to the laboratory within two and half hours in ice storage condition. This raw material was used to manufacture.

The fresh fish were descaled, gutted and washed in sea water and mixed with salt and goraka obtained from retail vendors. The ratios of weight of fish to weight of goraka used in the four treatments i.e., treatment A, B, C and D were 6:1, 10:1, 12:1 and 15:1 respectively. The weight of fish : weight of salt in all treatments was 3:1. The prepared curing mixture was arranged in alternative layers of fish and was packed in plastic containers, presssed and sealed. A weight was kept on the containers to make good contact of the fish with the salt/goraka mixture during the fermentation.

Samples were tested in monthly intervals for six months for organoleptic characters, total bacterial counts (TBC), total volatile nitrogen content (TVN), dry matter content, oil content, pH, and peroxide value. Organoleptic evaluation was carried out by a panel of seven trained judges, giving scores ranging from 0 (very poor) to 5 (excellent). TBC were determined by serial dilution spread on Nutrient Agar duplicate plates incubated at 30°C as described by Busta (1984). TVN was determined by Conway/Byrne method. Dry matter content, oil content and peroxide value were determined by Anon. (1980), Hans & Olli (1963) and Anon. (1992) respectively. The pH was measured using a pH meter (Copenhagen model). The experiments were carried out in triplicate at ambient temperature of 30°C.

A one-way analysis of variance was used to determine whether TBC, TVN, dry matter content, oil content and pH after the incubation period of six months significantly differ in the four treatments. Bonferroni’s multiple comparison test was used to identify the means which were significant different from each other.

Results

Fig. 1 indicates change of TBC (5% salt content) at different goraka concentration of jaadi. The TBC values decreased with time when fish : goraka ratios were 6:1 and 10:1. However, when fish : goraka ratios were 12:1 and 15:1, the TBC values increased after 2 months. After the fermentation period of 6 months, the TBC at 6:1 and 10:1 fish : goraka ratios were significantly different from those at 12:1 and 15:1 ratios (p<0.05).

Change in pH value during fermentation of jaadi with varying goraka concentrations is presented in Fig. 2. During the study period, the pH value gradually decreased. The lowest pH value after 6 months was observed when fish : goraka ratio was 6:1. However the pH values in different treatments at the end of the fermentation period were not significantly different from each other (p>0.05).

Changes of oil content at of jaadi at different fish : goraka ratios are indicated in Fig. 3. The initial oil content was 4.7% in all the treatments. The oil content gradually decreased during the fermentation period. A rapid decrease in oil content was observed when fish : goraka ratio was 6:1. The final oil contents in the four treatments however, were not significantly different from each other (p>0.05).

Fig. 4 indicates changes of peroxide value of jaadi at different fish : goraka ratios during the storage period. The peroxide value was initially 371.5 meq/kg in fresh fish. During storage this value gradually increased in all the samples up to end of second month. The maximum level was recorded when fish : goraka ratio was 15:1. Then in all treatments, Peroxide value decreased with storage and finally value dropped below 100 meq/kg. At the termination of the experiment after six months, the peroxide value in all samples was around 80.5 meq/kg. The statistical analysis however, showed that there was no significant difference among the mean peroxide values of different treatments (p>0.05).
Fig. 1. Changes of Total Bacteria Counts (TBC) at different fish:goraka ratios

Fig. 2. Changes of pH value of jaadi at different fish:goraka ratios
Fig. 3. Changes of oil content of jaadi at different fish : goraka ratios

Fig. 5. Changes of peroxide value of jaadi at different fish : goraka ratios
The changes of dry matter content of *jaadi* at different fish : goraka ratios are shown in Fig. 5. The dry matter content which was initially at 28.23% in all the samples, gradually increased during the storage. Rapid increase during the first month indicates that at early stage of fermentation, rapid hydrolysis takes place. At the end of the experimental period, high dry matter content was recorded in the samples where fish : goraka ratio was 6:1. However, there was no significant difference in the dry matter content among the different treatments (p>0.05).

![Graph showing changes in dry matter content](image)

**Fig. 5.** Changes of percentage dry matter content in *jaadi* at different fish : goraka ratios

Fig. 6 shows that changes of TVN content of *jaadi* at different fish : goraka ratios. The TVN of fresh fish was 4.03 mg/100 g. In all treatments, the TVN content increased gradually during fermentation. The lowest TVN value after the experimental period of 6 months was recorded when fish : goraka ratio was 6:1. This was significantly lower than the TVN values in other treatments (p<0.05).

Fig. 7 indicates the overall acceptability of *jaadi* at different fish : goraka ratios during the storage. The treatments where fish : goraka ratios were 6:1 and 10:1, were judged to be the best treatments. The treatment where fish : goraka ratio was 12:1, was judged to be of satisfactory quality while the quality of the treatment where this ratio was 15:1, was to be poor. In treatments 12:1 and 15:1, fungus appeared after five months of storage.

**Discussion**

High goraka content maintains the low pH of the product, which inhibits the growth of microorganisms (Subasinghe 1992). In this study, the TBC were observed to be low when high concentrations of goraka were used. The initial rapid decrease in pH in the treatments where fish : goraka ratios were 6:1 and 10:1, may have resulted in maintaining the TBC at low level during storage. Slow decrease of pH in other treatments (12:1 and 15:1) may have allowed the development of acid resistant forms which may have resulted in an increase in TBC during storage. Behanar et al. (1992) reported a similar reduction in TBC in pickled fish prepared using fruit juice when pH of the product was 3.8-4.5.
Fig. 6. Changes of total volatile nitrogen (TVN) content at different fish : goraka ratios.

Fig. 7. Changes of overall acceptability of jaadi at different fish : goraka ratios.
Quality of traditional fermented fish

The pH of the products investigated in the present study was very low and such products are reported to have a long shelf life more than six months (Abraham & Setty 1994). Further, pH value observed in the study are reported to be adequate to suppress growth of pathogenic bacteria.

The increase in dry matter content during the initial period of storage indicates that hydrolysis of protein may be rapid in the initial part of the storage resulting in the formation of soluble organic compounds. Reduction of moisture content and increase in dry matter have also been reported for cured fish during storage (Gupta & Chakrabarti 1994).

TVN value is considered as an index of spoilage in fish. Gupta & Chakrabarti (1994) have shown that commercially cured fish products have a TVN value in the range of 36.2 - 140.9 mg/100 g. The values of TVN observed in the present study were 30 to 110 mg/100 g throughout the storage period. The TVN level of the sample progressively increased. The lowest TVN values after the storage period of 6 months recorded when fish : goraka ratios were 6:1 and 10:1 indicate that these high concentrations of goraka help to maintain the product in a good state.

Orihnomoletic analysis showed that this method of preservation using high concentration of goraka and salt does not yield a palatable product. High salt content resulted in tough and fibrous texture and strong sour taste is resulted due to goraka. However, when fish : goraka ratios were 6:1 and 10:1, overall acceptability of the product is higher than when that ratio was either 12:1 or 15:1. Considering the cost factor too 10:1 fish : goraka ratio could be recommended as the ideal treatment for jaadi processing.

Reference

Abraham T. J. & T.M.R. Setty 1994,
Anonymous 1980,
Anonymous 1992,
Peroxide value, Official Methods and Recommended Practices Cd 8 53 (89). American Oil Chemists' Society, Champaign, Illinois, USA.
Balachandran K. K. & V. Muraleedharan 1975,
Beharan L., S. Mathew, D. Sudharma, M.K. Mukudan & V. Malik 1992,
Effect of fruit juices with acetic acid on the quality and storage stability of pickle fish. Fishery Technology 29: 40-44.
Busta F. 1984,
Gilberg A. 1992,
Gupta S. & R. Chakrabarti 1994,
Jayasinghe P. 1996,
Subasinghe S. 1992,