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Storage characteristics of fish ball prepared from minced meat of Tilapia (*Oreochromismossambicus*) at 0 to 2^{o}C

R. R. Mugale, S. T. Sharangdhar*, M. T. Sharangdhar J. M. Koli, S. B. Patange

Department of Fish processing Technology and Microbiology, College of Fisheries, Ratnagiri, India.

Correspondence Address: *S. T. Sharangdhar, Department of Fish processing Technology and Microbiology, College of Fisheries, Ratnagiri, India.

Abstract

The storage characteristics of fish balls prepared from minced Tilapia meat at 0-2^{o}C upon treatment with preservative such as potassium sorbate (2%) were studied. The levels of different parameters like FFA, pH, moisture, TVB-N and microbiological parameters like TPC, *E. coli* and *S. aureus* during storage period as well as the organoleptic changes were observed to be within the acceptable limit. It revealed that the product treated with potassium sorbate (2%) had a better acceptability upto 20 days compared to control upto 12 days.

Keywords: Fish balls, storage characteristics, *Oreochromismossambicus*

Introduction

Tilapia is one of the low cost fish therefore is an ideal fish.For converting into value added products. TilapiaFish is available in abundance in local market. Fetches meager price in fresh conditions.It is rich in protein,3.73% fat and 1.04% ash(Fohetal, 2011). Fish ball is popular fish based product, commonly consumed as noodle in the south-east Asian region (Dutta, 2009). The fish balls were successfully prepared from minced meat of fresh water bream, Abramisbrama (Lazos, 1996). The main problem during fish ball preparation from sea-fish was fish flavor, odour and high fat content (Tidholm-bengtsson, 1992). So, fresh water fish spices might be more promising in producing such products.

Huda *et al.* (2001) studied physicochemical properties of Malaysian fish balls. Noitup&Raksakulthi (1997) studied the production process and formulation of fish cuttle fish balls & the effect of different kinds of starch on product quality. Kamruzzaman*et al*. (2006) studied consumer's acceptance & market test of fish sausage and fish balls preparedfrom sea catfish, (*Tachsurusthalassinus*). Balange*et al*. (2002) studied standardization of fish ball in curry at pasteurization temperature. Ninan*et al*. (2011) studied effectiveness of spices on the quality & storage stability of freeze dried fish balls.

In the present work, an attempt was made to prepare fish ball from tilapia fish and studying storage characteristics of this fish ball at 0-2^{0}c for 20 days.

Materials and methods

Standardized methods for ball preparation of fish

The different ingredients used in the fish ball were standardized after preparing the fish ball several times and organoleptic evaluation at each storage. The quantity of ingredients used in fish ball is given in table 1. For preparation of fish ball 100g of fish meat was mixed and homogenized with other ingredients namely salt, corn starch, cinnamon papper, garlic, ginger paste, chilly powder, preservatives such as potassium sorbate (2%), fish meat with ingredients are homogenize to form a dought and then make a 10 mm size of fish balls and steamed in a domestic pressure cooker for 10 minuts and then packed in stand pouch of 100g capacity.

Table 1: Standardized ingredients for the preparation of fish ball.

Sr. No.	Ingredients (Uncoated fish balls)	Quantity (g)
1	Fish meat	100
2	Salt	1.0
3	Starch	5.0
4	Pepper	0.4
5	Cinnamon	0.4
6	Chilly powder	2.4
7	Garlic	0.8
8	Ginger	0.8
9	Potassium sorbate	2

Standardized method for preparation of coated fish ball

The different ingredients used in the batter were standardized after preparing, the coated fish ball several times and organoleptic evaluation at each stage. The quantity of ingredients used in batter is given in table 2. For preparation of batter mix different ingredients are used namely, rice flour, corn flour, Bengal gram flour. Roasted Bengal gram, maida,Chilly powder, salt, gour gum and bread crumb for breading of fish ball after battering.

Storage studies

The storage study of fish ball (uncoated) was under taken. The fish ball was packed in a(HDPE, 400 guage) with 100g capacity stand pouches sealed and kept at $0\text{-}2^0$c for shelf life studies. The studies included organoleptic biochemical and microbiological evaluation of untreated and treated fish ball at 2 days of intervals of 20 days.

Table 2: Standardized method for preparation of coated fish ball.

Sr. No.	Ingredients (Coated fish balls)	Quantity (g)
1	Rice flour	25
2	Corn flour	50
3	Bengal gram flour	50
4	Roasted Bengal gram	50
5	Maida	50
6	Chilly powder	30
7	Salt	5
8	Gour gum	10
9	Ingredients:water	1:2

Moisture was estimated by the method of AOAC (2005) Fat by Soxhlet extraction, crude protein by kjeldhal's method & the ash was determined as per AOAC (2005). p^H of homogenate recorded by using p^H meter (sentex USA)(AOAC, 2005). The TVB-N values were estimated by convey micro diffusion method (beatty and Gibbons, 1936) and expressed as mg. %N/100g fish meat. Free fatty acid values were determined by using (AOAC, 2005). The TPC plate count agar media and pour plate technique. For staphylococcus count, egg yolk free baired-parker agar plates medium (Lachica1984) and incubated at 37^0c for 40 hr. E-coli was estimated as per APHA (1992) using Tergitol-7 agar plate medium for organoleptic evaluation, various sensory characteristics such as appearance, colour, taste, consistency, odour and over all acceptability were evaluated during the

standardization by a group of ten trained panelists using a ten point hedonic scale.

Results and discussion

Changes in biochemical characteristics of fish ball

Moisture content

In the present study, the moisture content of treated fish balls stored in chill storage showed decreasing values in the range of 72% on study 67.2% 20th day of storage whereas moisture content of untreated fish balls stored in chilled storage also showed decreasing trend in the range of 72.12% 1st day to 67.33% 12th day of storage Ninan*et al* (2008) reported the moisture content of fish ball increased from 64% on 1st week to 75% on 21st week of storage. Joseph &Perigreen (1983) reported the moisture content of fried cutlet increased from 62-65% on 0 day to 63.98% on 7th day chilled storage whereas in raw cutlet moisture content decreased from 66.39 % on 0 day to 65.74% on 7th day of storage.

Table 3: Changes in moisture content during storage of control and treated fish ball.

Storage (in days)	Untreated (Control)	Treated
0	70.48±0.81	70.21±0.90
2	67.69±0.42	69.32±0.69
4	68.04±0.80	68.05±0.90
6	65.40±0.60	66.11±0.54
8	66.88±0.28	67.85±0.68
10	65.39±0.66	67.54±0.68
12	66.66±0.41	67.41±0.26
14	-	66.13±0.35
16	-	66.01±0.28
18	-	67.41±0.26
20	-	67.66±0.33

pH

In the present study, the treated fish balls showed slight increased pH from 6.5-6.8 whereas untreated fish balls also showed slight increased pH from 6.5-6.9. The increase in pH content may be due to increases in moisture and bacterial activity (Fields, 1979). Kolekar (2012) reported the decrease in pH values in the range from 6.38 at 0th day & 6.07 at 12th day of chilled stored fish ball in curry prepared from (*Catla catla).* Balange (1999) reported pH values decreased in the range of 5.90 at initial & 4.20 at 40th day of chilled storage of fish ball in curry prepared from pink pearch (*Nemipterusjaponicus*).

Table 4: Changes in pH during storage of control and treated fish ball.

Storage (in days)	Untreated (control)	Treated
0	6.46±0.03	6.46±0.03
2	6.43±0.03	6.4±0.05
4	6.56±0.08	6.5±0.05
6	6.56±0.03	6.6±0.05
8	6.73±0.03	6.46±0.08
10	6.6±0.05	6.7±0.05
12	6.83±0.06	6.46±0.08
14	-	6.53±0.03
16	-	6.46±0.08
18	-	6.53±0.08
20	-	6.73±0.03

TVB-N

In the present study, the TVB-N values of treated fish ball stored in chilled conditions showed increasing tend from 4.67 mg% on 1st day & 11.3 mg% on 20th day of storage. Whereas in untreated fish balls TVB-N levels increased from 4.8 mg% on 1st day to 11.45 mg% on 12th day of storage of storage. The TVB-N values are commonly used chemical index to determine spoilage of fish. The TVB-N in fresh water fish comes from ammonia (Tokur*et al*, 2004).

Ninan*et al*. (2008) reported the TVB-N values increased in the range from 8.4 mg% at 1st week & 25.2 mg% at 21st week of frozen storage of fish ball prepared from Tilapia. Kolekar (2012) reported the TVB-N

values increased in the range from 5.04mg% on 1st day to 17.64mg% on 12th day of chilled stored fish ball prepared from catla.Dutta (2009) reported similar observation for fish balls prepared from rohu (*Labeorohita*).

Table 5: Changes in TVB-N during storage of control and treated fish ball.

Storage (in days)	Untreated (control)	Treated
0	4.53±0.08	4.49±0.10
2	6.46±0.12	5.25±0.22
4	7.04±0.09	6.3±0.11
6	8.2±0.17	7.74±0.13
8	9.78±0.19	8.10±0.15
10	10.3±0.18	9.57±0.15
12	11.4±0.16	10.12±0.15
14	-	10.16±0.37
16	-	10.8±0.26
18	-	11.2±0.52
20	-	11.31±0.22

FFA content

In the present study, the FFA content of treated fish balls stored in chilled storage showed increasing trend from 3.4 mg% oleic acid on the 1st day to 5.4 mg% oleic acid on the 20th day of storage whereas untreated fish balls stored in chilled storage showed increasing values from 3.5 mg% oleic acid on 1st day to 5.6 mg% oleic acid on 12th day of storage. Joseph et al. (1984) reported FFA content in flash fried & raw cutlet in the range of 0.98 & 2.03 mg% oleic acid on 0 day of storage & the FFA content of fried & raw cutlet in the range of 1.49 & 2.82mg% oleic acid. Ninan et al, (2008) reported that the FFA contents in fish ball increased from 4-10 mg% oleic acid upto 12 weeks & there after it gradually decreased from 10-2 mg% oleic acid. Similar observation has been noted prepared from rohu (*Labeorohita*).

Changes in microbial characteristics of fish ball

Total plate count (TPC)

In the present study, the TPC of the potassium sorbate treated fish ball in chilled storage increased from $1.1x10^3$ on first day and $2.8x10^3$cfu/g on 20th day of storage. The TPC of untreated fish ball increased significantly from $1.1x10^3$cfu/g on 1st day and $3.1x10^3$cfu/g on 12th day of storage. Other pathogenic bacteria *viz.S.aurius, E. coli* were not detected in the samples throughout the storage period.Potassium sorbate when used in conjunction with other measures such as cooling, it has a good antimicrobial action on fish products. It therefore also reduces the formation of volatile amines and other undesired odors as well as the growth of pathogenic micro-organisms (Thakur and Patel, 1994).

Mote (2001) reported that the TPC of chilled stored fish ball in spinach curry showed variation from $6.4x10^3$ to $6.7x10^9$and $2.1x10^4$ to $4.4x10^9$cfu/g respectively. The product was free from *E. coli*,faecal streptococci and coagulase positive staphylococcus.

Table 6: Changes in FFA during storage of control and treated fish ball.

Storage (in days)	Untreated (control)	Treated
0	3.43±0.03	3.4±0.05
2	3.6±0.05	3.36±0.08
4	3.9±0.05	3.7±0.05
6	4.06±0.05	3.39±0.05
8	4.9±0.05	4.1±0.11
10	5.1±0.05	3.7±0.25
12	11.4±0.08	4.66±0.08
14	-	4.93±0.08
16	-	5.1±0.11
18	-	5.2±0.11
20	-	5.4±0.12

Pathogenic organism

The pathogenic organisms such as *E.coli, S. aureus*were found to be absent during entire course of storage study. This may owe to the

perfect hygiene maintained during the entire process of fish ball preparation.

Table 7: Changes inTotal plate count during storage of control and treated fish ball.

TPC (cfu/g)		
Storage (in days)	Untreated (control)	Treated
0	$1.1x10^2$	$1.1x10^2$
2	$2.3x10^2$	$2.5x10^2$
4	$2.8x10^2$	$3.1x10^2$
6	$3.9x10^2$	$4.5x10^2$
8	$2.5x10^3$	$4.4x10^3$
10	$4.5x10^2$	$5.4x10^2$
12	$3.1x10^3$	$2.3x10^3$
14	-	$3.5x10^3$
16	-	$4.5x10^3$
18	-	$3.2x10^2$
20	-	$2.8x10^3$

Table 8: Changes in pathogenic organism during storage of control and treated fish ball.

E.coli, S. aureus (cfu/g)		
Storage (in days)	Untreated (control)	Treated
0	ND	ND
2	ND	ND
4	ND	ND
6	ND	ND
8	ND	ND
10	ND	ND
12	ND	ND
14	-	ND
16	-	ND
18	-	ND
20	-	ND

Changes in organoleptic quality characteristics

Organoleptic analysis during the storage of fish ball at 0-2^{O}C indicated that there was declining overall quality characteristics namely appearance, color, odour, taste and overall acceptability etc. during storage. Compared to treated fish balls the declining quality was faster in untreated fish balls. Declining quality was slowest in sample of treated fish balls with potassium sorbate that of untreated fish balls.

Similar results with slight variation were recorded by Kamat (1999), she reported that fish ball in curry prepared from bleached mackerel mince did not show much changes in appearance, color, texture during chilled storage at 0-2^{o}C changes were more prominent in odour, taste and overall acceptability which decreased gradually from 2nd day to 12th day of storage. Dagare (2001) reported organoleptic analysis of fish ball with green leaf vegetable during storage at 0-2^{o}C. It was noticed that there was gradual reduction in quality characteristics of the product stored at 0-2^{o}C from 1st to 16th day upto they were acceptable. It was observed that there was loss of original flavour on 18th day. Joseph *et al.* (1984) reported a self-life of 19 weeks for raw cutlets in frozen condition prepared from the cooked mince of different marine fishes.

Conclusion

From the organoleptic, biochemical as well as microbial evaluation, it was concluded that the fish balls treated with Potassium sorbate (2%) kept in chilled storage were acceptable upto 20th day, whereas untreated fish balls were acceptable upto 12th day of storage.

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