Quality Loss Assessment of Ready-To-Eat Seafood Products Marketed in Spain under Refrigerated Conditions

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Abstract. *This research focuses the quality loss assessment of three different ready-to-eat fish foods (tuna burger, TB; salmon burger, SB; cod mousse, CM) obtained in a local market and kept under refrigerated (4ºC) conditions up to 60 days. Different and complementary analytical methods were applied such as sensory (general aspect, consistency, colour, odour and texture), microbiological (TVC, coliform bacteria, aerobic spores, Listeria monocytogenes, Salmonella, Shigella, Clostridium, coagulase positive Staphylococci and E. coli), physical (colour and water holding capacity) and chemical (lipid hydrolysis and oxidation and non-protein nitrogen compound). Results from sensory analyses showed good values for all samples during the period of study. Microbiological results showed an increasing content in aerobic spore forming bacteria with storage, mainly in TB and SB products. Within the pathogens group, L. monocytogenes was detected in all the SB products analysed. Microbiological activity led to increasing total volatile amine and trimethylamine contents in SB and CM products with storage time. Regarding physical changes, a slight increase in a* and b* colour parameters could be observed for TB and SB products, while a slight increase was obtained for L value in CM-samples; further, an increasing texture value was obtained in the case of the SB product. Concerning chemical changes, a marked lipid oxidation (thiobarbituric acid reactive substances, TBARS; fluorescent compound formation, FCF) was detected in all products with storage time; peroxide content was also shown to increase for CM product. Throughout the refrigerated storage, sensory assessment did not prove significant differences in any of the three products, so that acceptable quality was maintained till their respective expiry dates.*

Keywords: *Seafood, ready-to-eat, refrigeration, quality, microbiological, sensory, chemical, physical.*

Introduction

Marine foods are known to provide valuable constituents for human health and nutrition. A strategic solution to increase their distribution according to modern consumer's demands is represented by ready-to-eat products. Novel and attractive preparations are constantly being provided to the market and restorer sectors, all of them requiring a strict safety control (Gilbert, de Louvois, Donovan, Little, Nye, Ribeiro, Richards, Roberts, & Bolton, 2000; CEC, 2005; CEC, 2007).

The present research addresses the quality loss assessment of three different ready-to-eat marine fish foods (tuna burger, TB; salmon burger, SB; cod mousse, CM) obtained in a local market and kept under refrigerated (4ºC) conditions up to 60 days.

Material and Methods

Different and complementary analytical methods were applied:

- sensory (general aspect, consistency, odour and texture).
- Microbiological analyses: TVC (ISO 4833:2003), coliform bacteria (BAM, FDA), aerobic spores (*Bacilllaceae*) (ISO 15213:2003), anaerobic spores (ISO 15213:2003), *Listeria monocytogenes* (ISO 11290-1 and 2), *Salmonella* (ISO 6579:2002), *Shigella* (ISO 21567:2004), *Clostridium* (ISO 7937:1997), coagulase positive *Staphylococcus* (ISO 6888-2:1999) and *E. coli* (BAM, FDA). Counts are expressed in all cases as CFU/g muscle in all cases, except for coliforms (MPN/g).
- physical (colour, water holding capacity).
- chemical (lipid hydrolysis and oxidation; non-protein nitrogen compounds) (Vyncke, 1970; Aubourg, 1999)

Results and Discussion

Comparison among the three types of products studied showed that the one having the highest levels of TVC and other microorganism indices was SB (Tables 1 and 2). Microbiological analysis detected an increase in aerobic spore forming bacteria during storage, mainly in the two burger products (TB and SB). The highest quality product according to microbiological criteria was accorded to the CM one. From all pathogens analysed like *Clostridium*, *Salmonella*, *Shigella*, *Staphylococcus* and *E.coli*, the only one detected was *L. monocytogenes*, appearing in all the SB products above the levels established in foods (100 CFU/g) (Commission Regulation № 2073/2005 and its modification № 1441/2007). *L. monocytogenes* is a human pathogen widely distributed in the environment and very difficult to eradicate from food processing plants. Microbiological activity led to increasing total volatile amine and trimethylamine contents with storage in SB and CM products.

Related to physical changes, a slight increase in a* and b* colour values could be observed for TB and SB products, while a slight increase was obtained for L* value in the case of CM product. Further, an increasing texture value was obtained in the case of SB product.

Concerning chemical changes, a marked lipid oxidation development (TBARS and FCF assessments; Table 3) was produced in all products with storage time; peroxide content also showed to increase for CM product. Throughout the refrigerated storage, sensory assessment did not provide significant differences in the three products so that an acceptable quality was maintained till their respective expiry dates.

Conclusions

Shelf life extension and safety guaranty are nowadays mandatory in foods to be included in the human diet. Results obtained in this work make evident the need of checking refrigerated ready-to-eat seafoods products to asses the possible quality loss and assure the consumer's health.

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Table 1. Microbiological analyses (log CFU/g) of tuna burger and cod mousse products

Refrigeration time (days)	Tuna Burger			Cod Mousse	
	Total Viable Counts	Aerobic spores	Total coliforms	Total Viable Counts	Aerobic spores
0	$9.98*10^6$ (1.10)	$6.25*10^2$ (0.69)	$1.87*10^2$ (0.69)	$6.06*10^5$ (1.10)	0
15	$3.37*10^7$ (1.10)	$2.07*10^4$ (1.10)	$1.06*10^2$ (1.10)	$8.62*10^4$ (1.10)	0
28	$7.00*10^6$	$8.81*10^5$ (1.10)	$0.19*10^2$ (0.69)	------	------
60	-----	------	------	$3.86*10^4$ (1.10)	$1.83*10^5$

Table 2. Microbiological analyses (log CFU) of salmon burger products

Refrigeration time (days)	Total Viable Counts	*Listeria monocytogenes*	Aerobic spores	Total coliforms	*Escherichia coli*
0	$7.18*10^5$ (0.69)	$2.00*10^3$ (0.69)	$2.73*10^3$	$2.30*10^1$ (0.00)	2.00 MPN/g
15	$3{,}47*10^7$	$9.51*10^3$ (1.10)	$›3/10^4$	$1.21*10^2$ (0.69)	0
28	$›3/10^7$	$1.02*10^3$ (0.69)	$1.17*10^6$ (1.10)	$1.65*10^1$ (0.69)	0

Table 3. Lipid oxidation assessment in TB, SB and CM products

Parameter	Refrigeration time (days)	TB	SB	CM
TBARS (mg malodialdehyde/ kg product)	0	1.09 (0.04)	0.86 (0.04)	0.47 (0.05)
	15	1.09 (0.03)	0.94 (0.01)	0.54 (0.10)
	28	1.20 (0.04)	0.99 (0.05)	-----
	60	-----	-----	0.93 (0.16)
Fluorescent Compound Formation (FCF)	0	8.81 (0.35)	2.86 (0.07)	2.28 (0.05)
	15	9.69 (0.17)	3.42 (0.02)	2.34 (0.01)
	28	10.46 (0.84)	4.05 (0.11)	-----
	60	-----	-----	2.43 (0.05)