

Development and evaluation of canned pâté-based tilapia MSM

Daniela De G. C. Freitas^a, Alda L. Santos^b, Angela A. L. Furtado^a, Marília P. Stephan^a, Ana Lucia Penteadó^a

^a *Embrapa Food Technology, Rio de Janeiro, Brazil (daniela@ctaa.embrapa.br; afurtado@ctaa.embrapa.br; stephan@ctaa.embrapa.br; analucia@ctaa.embrapa.br)*

^b *Federal Rural University of Rio de Janeiro, Seropédica, Brazil (aldaleticia@yahoo.com.br)*

ABSTRACT

The mechanically separated tilapia meat (tilapia MSM), obtained after a standardized filleting process, was used in this study aiming to investigate the viability of the tilapia pâté submitted to sterilization processing in autoclave further to assess its acceptance by consumers. Two formulations of pâté were prepared varying the type of commercial salt used: spiced salt (SSP) and pure salt (PSP). Consumers (112) evaluated overall liking, spreadability, appearance and flavour acceptability on 9-point hedonic scales. The formulation that presented the highest consumer acceptability was also evaluated in a shelf life study, being stored at 22°C during six months. The samples were withdrawn for quality assessment in relation to the microbiological analysis (commercial sterility), protein quantification and sensory evaluation (Qualitative Descriptive Analysis). After the storage period an acceptance test it was also conducted by 119 consumers. A good consumers' acceptance was observed for the tilapia MSM pâtés. However, the sample SSP was preferred to the sample PSP with regard to all attributes evaluated. The pâté-based tilapia MSM remained stable in terms of microbiological analysis and protein profile along the 180-days shelf life, indicating that the thermal processing (115 °C for 15 minutes) was appropriate. There was no change in the sensory characteristics of pâté during storage, except for the attributes "spreadability" and "creaminess", which showed significant variation in their QDA averages. After 180 days of storage, the frequency of acceptance among 119 consumers of pâté was 95% for "overall acceptability". The results confirmed the technical feasibility of canned pâté-based tilapia MSM, since the microbiological, nutritional and sensorial acceptance after processing was kept for 180 days.

Keywords: tilapia fish, canned processing; food quality; shelf-life

INTRODUCTION

The progress of tilapia production worldwide is being intensified mainly due to the decline in marine fisheries and to its healthy meat quality. Tilapia, one of the most suitable fish species for intensive farming and trade, has typical characteristics that are preferred by the market, such as white meat, firm texture, delicate taste, easy filleting and no bones in "Y", in addition to their high growth rate and adaptability to different conditions. On the other hand, about 70% of the carcass from tilapia meat processing has been largely used in Brazil to produce flour for animal feeding. The mechanically separated tilapia meat (tilapia MSM), that consist of parts of the fillet obtained due to the standardization of the format in the filleting process, is an alternative for diversification of fish products and for using the filleting industry waste. The tilapia MSM was utilized in this study aiming to investigate the viability of the tilapia pâté submitted to sterilization processing in autoclave further to assess the acceptance by consumers of this potentially new product.

MATERIALS & METHODS

Pâté Preparation

Tilapia MSM was obtained from Cooperativa Regional de Piscicultores e Ranicultores do Vale de Macacu e Adjacências LTDA (Cachoeiras de Macacu-RJ/Brazil). The material was transported in a polystyrene box with ice to Embrapa Food Technology and was stored at -18°C. After preliminary tests, two formulations of pâté were prepared varying the type of commercial salt used: spiced salt (SSP) and pure salt (PSP) as shown in Table 1. Figure 1 outlines the processing steps of tilapia pâté. The binomial time and temperature used to sterilize the product was equal to 115°C for 15 minutes, a value that resulted in F_0 of 7.14 minutes.

Table 1. Tilapia MSM pâté formulations

Ingredients (%)	PSP (pure salt pâté)	PSS (spiced salt pâté)
Tilapia MSM	60.0	60.0
Spiced salt*	-----	1.1
Pure Salt	1.6	0.5
Others ingredients (water, oil, starch)	38.4	38.4

* spices: polyphosphate, monosodium glutamate, coriander, sugar, dye carmine, lemon essence (Temperart Ind. Com. Ltda. São Paulo, Brazil)

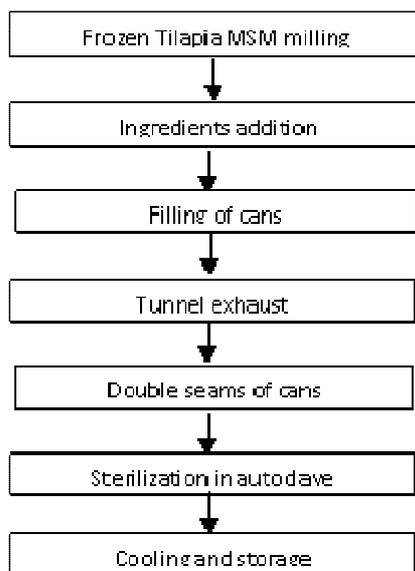


Figure 1. Processing flow chart of tilapia MSM pâté.

Shelf-life study

The formulation that presented the highest consumer acceptability was also evaluated in a shelf life study, being stored at 22°C during 180 days. The samples were withdrawn for quality assessment in relation to the microbiological analysis (commercial sterility), protein quantification, centesimal composition and sensory evaluation.

Sensory Analysis

The sensory tests were carried out in the Sensory Laboratory of the Embrapa Food Technology. Consumers (112) evaluated the two formulations regarding to “overall liking”, “spreadability”, “appearance” and “flavour” acceptability on 9-point hedonic scales. The samples were monadically served at room temperature, codified with 3 digit numbers in individual booths under white light. The presentation order followed a balanced complete block design. For the acceptability test, the samples were presented to consumers accompanied by toast.

The tilapia MSM pâté sensory profile during the shelf life study was assessed through Quantitative Descriptive Analysis (QDA) which was performed using seven highly trained panelists between trainees and staff of Embrapa Food Technology. A comprehensive vocabulary of eight descriptors for appearance, aroma, texture and flavor categories was generated. A 9cm intensity scales were used for the sensory evaluation. For descriptive analysis, 30g of the pâté were served at room temperature in a porcelain dish. For consistence evaluation, consumers were instructed to spread the pâté in a toast using a knife. The session was conducted with one repetition and was performed monthly. Data were analyzed by ANOVA using the Tukey test ($p < 0.05$) in XLSTAT program.

At the end of study, a test with 119 consumers was also carried out to evaluate the product acceptability.

Commercial sterility

The commercial sterility of pâté was checked after processing and at the end of the storage period according to the method referenced in the “Compendium of Methods for the Microbiological Examination of Foods” [1].

Physic-chemical analyses

Analyses were performed for centesimal composition and mineral composition of pâté, at the beginning and end of the shelf-life study, according to the methodology described by AOAC [2].

Protein profile

The extraction of sarcoplasmic and myofibrillar fractions of tilapia MSM was done according to Chang-Lee et al. [3]. Molecular assessment was performed using electrophoresis in polyacrylamide gel containing sodium dodecyl sulfate (SDS-PAGE) [4, 5, 6, 7].

RESULTS & DISCUSSION

Sensory Analysis

After consumers' evaluation, a good acceptance (over to 70%) was observed for the tilapia MSM pâtés with respect to all the attributes evaluated. Figure 2 shows that the frequency of acceptance scores (scores > 5.0) for “overall impression”, “spreadability” and “appearance” of pâté formulated with spiced salt (SSP) was higher than those obtained for the pâté formulated with pure salt (PSP). In addition, the sample SSP was preferred to the sample PSP with regard to “overall impression”, “appearance” and “flavor”, showing significant difference ($p < 0.05$) between the global averages (Table 2).

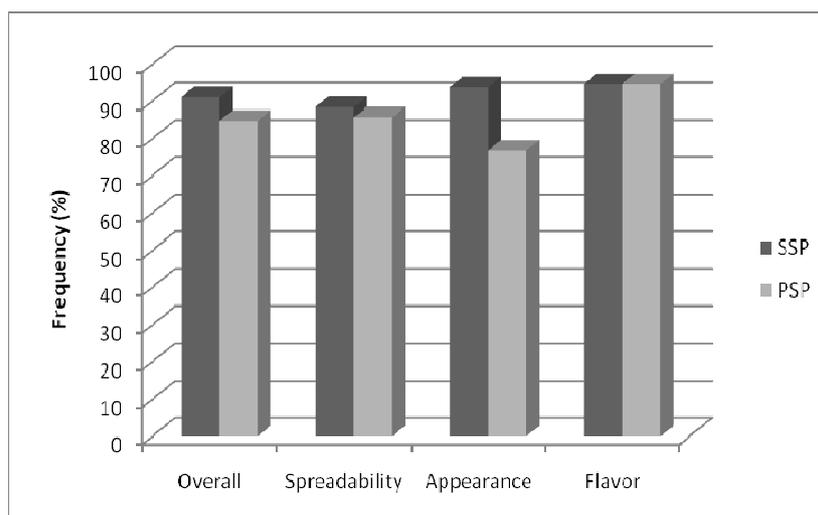


Figure 2. Frequency (%) of acceptance scores for tilapia MSM pâté. SSP: spiced salt pâté; PSP: pure salt pâté.

Table 2. Average acceptance scores for tilapia MSM pâté

Sample	Overall liking	Spreadability	Appearance	Flavor
SSP	7.56 ^a	7.41 ^a	7.61 ^a	7.73 ^a
PSP	6.99 ^b	7.32 ^a	6.69 ^b	7.28 ^b

Different superscripts within column indicates significant ($p < 0.05$) differences. SSP: spiced salt pâté; PSP: pure salt pâté.

The sensory profile of SSP was described through eight attributes elicited by the panel, as shown the Table 3. No change was observed in the sensory characteristics of SSP pâté during storage, except for the attributes "spreadability" and "creaminess", for which a significant variation in the QDA averages were detected (Table 3). These variations were already expected since there was loss of moisture along the storage period. After 180 days of storage, the frequency of acceptance among 119 consumers for SSP was 95% for "overall liking", 91% for the attribute "flavour", 89% for the "spreadability" and 80% for "appearance". As shown in Table 4, the average acceptance was around 8.0 (except for appearance) and may be considered high,

especially when compared to the literature. Minozzo et al. [8] developed two kinds of pasteurized pâté-based tilapia MSM: creamy and pasty. The creamy pâté showed an acceptability rate of 7.40, while the pasty pâté showed an average of 6.50.

Table 3. Sensory attributes of tilapia MSM pâté during storage

Attributes	SSP0	SSP1	SSP2	SSP3	SSP4	SSP5	SSP6
<i>Appearance</i>							
Color	4.39 ^a	4.68 ^a	4.83 ^a	3.19 ^a	5.48 ^a	5.17 ^a	4.02 ^a
Wet look	7.21 ^a	7.19 ^a	7.50 ^a	6.49 ^a	6.94 ^a	7.49 ^a	7.27 ^a
<i>Aroma</i>							
Characteristic of tilapia	5.35 ^a	4.78 ^a	5.14 ^a	3.86 ^a	3.59 ^a	4.57 ^a	4.33 ^a
<i>Consistence</i>							
Spreadability	7.03 ^a	7.14 ^a	6.42 ^{ab}	5.01 ^b	6.83 ^{ab}	6.45 ^{ab}	6.27 ^{ab}
Consistence in the mouth	3.48 ^a	4.98 ^a	4.38 ^a	5.67 ^a	5.02 ^a	4.63 ^a	3.00 ^a
Creaminess	5.23 ^a	3.06 ^b	3.93 ^{ab}	2.68 ^b	3.78 ^{ab}	2.93 ^b	3.15 ^{ab}
<i>Flavor</i>							
Characteristic of tilapia	4.50 ^a	4.09 ^a	4.96 ^a	3.95 ^a	3.38 ^a	4.53 ^a	4.05 ^a
Salty taste	5.59 ^a	5.18 ^a	5.64 ^a	5.71 ^a	5.59 ^a	5.29 ^a	5.45 ^a

SSP0, SSP1, SSP2, SSP3, SSP4, SSP5 and SSP6 correspond to pâté with 0, 30, 60, 90, 120, 150 and 180 days of storage, respectively. Different superscripts within row indicates significant ($p < 0.05$) differences.

Table 4. Consumers' acceptance of tilapia MSM pâté at the end of storage (SSP6)

	Attributes			
	Spreadability	Appearance	Flavor	Overall liking
Frequency (%)	89.0	80.0	91.0	95.0
Mean	7.77	7.15	7.77	7.77
Standard Deviation	1.62	1.74	1.40	1.17

Commercial Sterility

The pâté-based tilapia MSM remained stable in terms of microbiological analysis along the 180-days shelf life, indicating that thermal processing (115 °C for 15 minutes) was appropriate. The results of commercial sterility analysis at the beginning (SSP0) and the end (SSP6) of the study can be seen in Table 5.

Table 5. Commercial sterility of tilapia MSM pâté

Sample	Initial pH	Final pH (55°C/5days)	Final pH (35°/10 days)
SSP0	6.28	6.22	6.23
SSP6	6.13	6.01	6.05

SSP0 and SSP6 correspond to pâté with 0 and 180 days of storage, respectively.

Physical-chemical analysis

The centesimal composition of tilapia MSM pâté at the beginning (SSP0) and the end (SSP6) of the storage time is presented in Table 6.

Table 6. Centesimal composition of tilapia MSM pâté

Constituents (%)	SSP0	SSP6
Ether extract	19.45	19.45
Protein	9.94	9.44
Moisture	63.08	61.05
Ash	2.41	2.41

SSP0 and SSP6 correspond to pâté with 0 and 180 days of storage, respectively.

During the 180 days of storage, the product was within the quality standards set by the Brazilian legislation [9] for pâté-based meat products, which determines the maximum limits for moisture and fat content as 70 and 32%, respectively. The results were similar to those found by Minozzo et al. [10] in the formulation of pâté-based tilapia fillets (8.53, 59.47 and 2.20% for protein, moisture and ash, respectively) and lower with respect to the ether extract content (27.41%).

Protein profile

Figure 3 represents the gel electrophoresis over the stored period. Figure 3 shows that the protein composition was not significantly changed after the storage period (up to 180 days), except for the weak staining observed in the gel, referring low molecular weight proteins, such as troponin T (27.47 kDa) and myosin light chain (20.88 kDa) at the beginning of storage. In this way, these results show that the storage time did not significantly affect the protein profile of tilapia MSM pâté.

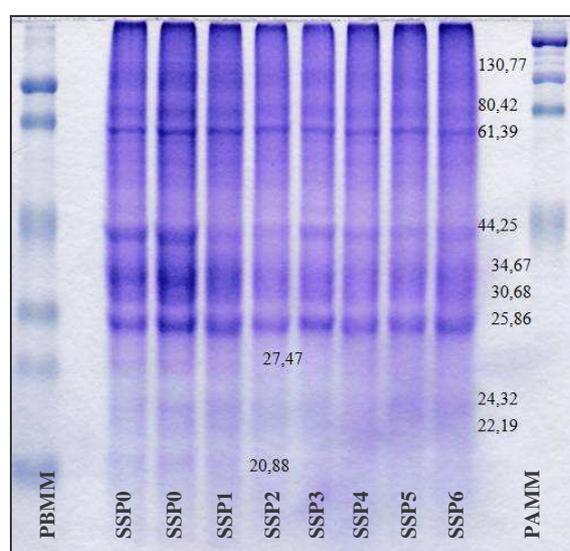


Figure 3. SDS-PAGE electrophoresis of proteins during storage from tilapia MSM pâté. SSP0, SSP1, SSP2, SSP3, SSP4, SSP5 and SSP6 correspond to pâté with 0, 30, 60, 90, 120, 150 and 180 days of storage, respectively. PBMM and PAMM correspond to solutions of protein patterns gels of low and high molecular weight, respectively.

CONCLUSION

The pâté-based tilapia MSM remained stable in terms of microbiological analysis and protein profile along the 180-days shelf life, indicating that the thermal processing (115 °C for 15 minutes) was appropriate. There was no change in the sensory characteristics of pâté during storage, except for the attributes "spreadability" and "creaminess", which showed significant variation in their QDA averages. These variations were already expected since there was loss of moisture along the storage period. After 180 days of storage, the frequency of acceptance among 119 consumers of pâté was 95% for "overall acceptability", 91% for the attribute "flavour", 89% for the "spreadability" and 80% for "appearance". These results show that microbiological and nutritional characteristics and sensorial acceptance of the canned pâté-based tilapia MSM was kept for 180 days, showing to be feasible to use the tilapia filleting residue as an alternative to the fish industries, adding social and environmental value to the supply chain.

REFERENCES

- [1] Deibel, K.E., & Jantschke, M. (2001) Canned foods – Tests for commercial sterility. In: Dowens, F.P.; Ito K. (ed.). Compendium of methods for the microbiological examination of foods. 4th ed. Washington, D.C.: American Public Health Association (APHA), 577-582.
- [2] AOAC (2005). Official Methods of Analysis of AOAC International. CD-ROOM. 18th edition, AOAC International.
- [3] Chang-Lee, M.V., Lampila, L.E., & Crawford, D.L. (1990). Yield and Composition of Surimi from Pacific Whiting (Mercurius products) and the effect of various protein additives on gel strength. *Journal of Food Science* 55, 83-86.

- [4] Weber, K. & Osborn, M. (1969). The reability of molecular weight determinations by dodecyl sulfate-polyacrylamide gel electrophoresis. *Journal of Biological Chemistry*, 244 (16), 4406-4412.
- [5] Laemmli, U. K. (1970). Cleavage of structural proteins during the assembly of the head of bacteriophage T4. *Nature*, 227, 680-685.
- [6] Porzio, M. A., & Pearson, A. M. (1977). Improved resolution of myofibrillar proteins with sodium dodecyl sulfate-polyacrylamide gel eletrophoresis. *Biochimica et Biophysica Acta*, 490, 27-34.
- [7] Huidobro, A., Monteiro, P., & Borderias, A. J. (1998). Emulsifing properties of an ultrafiltered protein from minced fish wash water. *Food Chemistry*, 61 (3), 339-343.
- [8] Minozzo, M. G., Waszczynskyj, N., & Boscolo, W. R. (2008). Utilização de carne mecanicamente separada de Tilápia (*oreochromis niloticus*) para a produção de patês cremoso e pastoso. *Alimentos e Nutrição*, 19 (3), 315-319.
- [9] BRASIL (2003). Resolução-RDC nº 12, de 2 de Janeiro de 2001. Regulamento Técnico sobre os padrões microbiológicos para alimentos. Agência Nacional de Vigilância Sanitária-ANVISA. pp54.
- [10] Minozzo, M. G., Waszczynskyj, N., & Beirão, L. H.. (2004). Características físico-químicas do patê de tilápia do nilo (*Oreochromis niloticus*), comparado a produtos similares comerciais. *Alimentos e Nutrição*, 15 (2), 101-105.