EFFECT OF MEAT ORIGIN AND FROZEN STORAGE ON SOME TECHNOLOGICAL PARAMETERS OF RAW MATERIALS AND FINAL QUALITY OF MORTADELLA BOLOGNA P.G.I.

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Background

In 1998 Bologna Mortadella was entitled as typical Italian product (P.G.I.); the quality of this product is assured by the rigorous rules of the disciplinary, but this is not enough. In fact only an appropriate selection and storage of raw materials can guarantee the typical sensorial properties and safety parameters.
In manufacturing process of Mortadella raw materials must undergo freezing: the temperature range from initial grinding (-10°C) must raise at most until –1°C at the stuffing phase (1). The effects of frozen storage on meat quality are well known for bovine and primary muscles of pork comparing their quality with fresh meat, while there are few references in literature with regard to meat raw materials of Mortadella. In our Institute a preliminary work in 1998 has been carried out demonstrating that the quality of these raw materials is very influenced by storage conditions (2). This work is part of further specific researches conducted on this subject by the authors.

Objectives

This study has been carried out with the aim of defining some measurable parameters in order to qualify raw meats for Mortadella and monitoring the changes of its main components during storage time. Moreover the quality of product has been evaluated according to the changes of raw materials.

Methods

Experimental Design
After Belgian and Holland porks have been slaughtered, the pH_{45} of *Semimembranosus* muscle has been measured and the main mortadella typical formulation raw materials have been selected, chilled for five days, polyethylene wrap vacuum packaged and frozen at two different temperature (-15°C and –30°C).
At fixed storage intervals (13, 114 and 237 days) the parameters of quality of all raw materials have been monitored, while Bologna Mortadella has been produced by the typical formulation from each of the four different meat constituents (two proveniences x two freezing conditions) and its quality has been evaluated.

Analysis of raw materials and finished products
The covering fat was taken from each sample of raw material at each time of evaluation, then the lean meat was ground and the oxidative state was monitored, while it was evaluated both lean component and the whole of Mortadella. It was estimated the colour by a Datacolor tristimulus spectrocolorimeter, equipped with a measuring head having a diffused-geometry standard illuminant D65 that recorded the coordinate L, Chroma and hue. The content of total pigments was estimated by method of Hornsey (3). The oxidative rancidity was controlled by TBARS content according to the method of Tarladgis (4). An experienced panel test evaluated the presence of off-odours in raw meat and some organoleptic parameters in finished product (luminosity, aroma and taste) (6).

Results and discussion

Table 1 shows the observed values of some examined parameters for Belgian and Holland shoulder (frozen at –15°C and –30°C) and derived mortadella at three different storage intervals. The performed packaging and freezing treatments allowed little changes in raw materials. It is observed for all samples a gradual increase of the saturation of colour and decrease of the tinta, while the luminosity increases especially for Holland shoulder; moreover it is found a significant oxidative stability.
Although in the product the oxidative rancidity doesn't increase considerably, there is a remarkable deterioration of product with regard to the changes of colour (the tinta of all products decreases rapidly, while the luminosity increases) and sensorial parameters when storage time is prolonged to 237 days.

Conclusions

These results emphasize for raw meats of both sources the importance of frozen storage to preserve meat quality. However huge storage time may be dangerous for a good quality of product, if the process is not well controlled. A faster freezing rate by advanced technology could overcome this problem getting better results.

Pertinent litterature

1) Pedrielli R., Master " Technology of mortadella production" (1991)
2) Pizza A., Pedrielli R., Bergamaschi M. and Guzzon C. (1999), Industria Conserve, 3, 211-222
3) Hornsey H.C. (1956), J. Sc. Food Agric., 7, 534
4) Tarladgis B.G., Watts B.M. (1981), Fish Technology Paper, 22, 210
5) ISO n° 2918 Method for fresh meat and meat products (1975)
6) Pedrielli R. and Pizza A. (1985), Industria Conserve, 60, 111-119

Table 1: means* and standard deviations of evaluated parameters for the different frozen and thawed shoulder and mortadelle at different storage times.

Parameters	storage time (days)	Meat provenience and storage temperature (°C)							
		Belgian -15°C		**Belgian -30°C**		**Holland -15°C**		**Holland -30°C**	
		Mean	s.d.	Mean	s.d.	Mean	s.d.	Mean	s.d.
Shoulder									
L	13	49.12^{b}	3.80	49.12^{b}	3.80	43.63^{a}	4.96	43.63^{a}	4.96
	114	45.03^{a}	2.22	45.54^{a}	1.75	44.03^{a}	1.71	45.66^{a}	2.34
	237	41.20^{a}	2.48	48.30^{b}	1.40	47.68^{b}	2.95	52.21^{c}	0.91
C	13	12.71^{a}	0.96	12.71^{a}	0.96	11.80^{a}	1.45	11.80^{a}	1.45
	114	15.66^{a}	1.26	15.39^{a}	2.00	15.93^{a}	1.08	15.03^{a}	1.65
	237	15.64^{a}	1.20	19.16^{a}	1.02	17.76^{a}	1.95	20.96^{a}	0.99
h	13	71.64^{b}	1.61	71.64^{b}	1.61	69.56^{a}	2.12	69.56^{a}	2.12
	114	52.22^{ab}	2.03	52.89^{ab}	2.33	51.23^{a}	1.45	53.95^{b}	1.73
	237	48.43^{a}	1.66	51.90^{b}	1.63	51.97^{b}	1.82	52.61^{b}	0.94
Total pigments	13	60.18^{b}	1.09	60.18^{b}	1.09	54.40^{a}	1.45	54.40^{a}	1.45
	114	93.50^{c}	1.82	88.06^{b}	1.09	112.88^{d}	0.73	84.66^{a}	0.36
	237	106.76^{c}	0.96	106.08^{b}	0.96	93.84^{a}	0.96	116.96^{d}	0.00
TBA	13	0.08^{a}	0.00	0.08^{a}	0.00	0.17^{b}	0.04	0.17^{b}	0.04
	114	0.21^{c}	0.00	0.14^{a}	0.00	0.16^{b}	0.03	0.51^{d}	0.01
	237	0.14^{a}	0.04	0.23^{b}	0.02	0.13^{a}	0.05	0.13^{a}	0.01
Aroma	31	4.00	0.00	4.00	0.00	4.00	0.00	4.00	0.01
	132	4.00	0.00	4.00	0.00	4.00	0.00	3.00	0.00
	195	3.50	0.00	3.50	0.00	3.00	0.00	3.00	0.00
Mortadella									
L	13	59.13^{a}	0.84	60.03^{b}	0.70	58.83^{a}	0.69	59.34^{ab}	0.60
	114	61.01^{b}	0.45	61.10^{b}	0.91	59.42^{a}	0.59	59.39^{a}	0.66
	237	61.37^{b}	0.56	61.28^{b}	1.05	61.12^{b}	0.36	60.26^{a}	0.20
C	13	16.02^{b}	0.24	15.37^{a}	0.45	15.75^{b}	0.29	16.38^{c}	0.28
	114	14.45^{a}	0.18	14.71^{a}	0.63	15.89^{c}	0.36	15.13^{b}	0.17
	237	13.51^{a}	0.33	13.91^{b}	0.29	13.73^{ab}	0.34	14.53^{c}	0.32
h	13	57.45^{bc}	0.84	56.09^{a}	0.72	56.9^{b}	0.46	57.68^{c}	0.47
	114	51.36^{a}	0.25	54.68^{b}	1.32	54.34^{b}	0.47	54.18^{b}	0.93
	237	50.98^{b}	0.69	52.05^{c}	0.64	51.75^{c}	0.61	49.70^{a}	0.61
Total pigments	13	78.88^{c}	0.00	74.8^{ab}	2.18	74.12^{a}	1.45	75.82^{b}	1.82
	114	69.02^{b}	1.82	64.94^{a}	0.36	76.84^{c}	0.73	69.7^{b}	0.36
	237	65.28^{b}	0.73	63.92^{a}	0.00	69.7^{d}	1.09	67.66^{c}	0.36
%Conversion	13	67.10	0.00	72.50	0.00	70.82	0.00	72.48	0.00
	114	79.20	0.00	78.15	0.00	70.76	0.00	73.23	0.00
	237	78.85	0.00	76.22	0.00	74.06	0.00	71.58	0.00
TBA (lean component)	13	0.17^{a}	0.02	0.26^{c}	0.01	0.18^{b}	0.01	0.18^{ab}	0.00
	114	0.16^{b}	0.02	0.14^{a}	0.02	0.14^{a}	0.00	0.15^{ab}	0.01
	237	0.18^{a}	0.01	0.20^{b}	0.01	0.19^{ab}	0.00	0.30^{c}	0.00
Total TBA	13	0.14^{c}	0.02	0.21^{d}	0.01	0.13^{b}	0.00	0.11^{a}	0.01
	114	0.12^{a}	0.01	0.13^{b}	0.01	0.14^{c}	0.01	0.14^{c}	0.01
	237	0.18^{a}	0.00	0.21^{c}	0.00	0.20^{b}	0.02	0.28^{d}	0.01
Nitrites (residue)	13	7.75^{a}	0.14	10.47^{c}	0.43	8.02^{b}	0.14	8.02^{b}	0.14
	114	6.07^{a}	2.06	5.38^{a}	0.15	9.10^{b}	2.06	5.31^{a}	0.07
	237	10.50^{a}	0.15	11.18^{c}	0.29	10.91^{b}	0.00	13.64^{d}	0.00
Nitrates (residue)	13	32.87^{d}	1.96	18.71^{a}	0.59	23.15^{c}	0.98	20.95^{b}	0.20
	114	19.44^{d}	1.05	11.33^{a}	2.44	15.90^{ab}	0.85	15.61^{ab}	2.13
	237	12.41^{a}	2.94	12.68^{a}	2.26	13.62^{ab}	2.50	15.28^{b}	0.63
Luminosity	13	6.78	1.09	6.67	1.12	7.00	1.00	6.81	1.04
	114	7.38	0.64	7.13	0.79	7.19	0.59	7.19	0.65
	237	7.75	0.65	7.31	0.70	7.19	0.84	7.06	0.86
Aroma	31	6.67	1.15	7.39	0.70	7.06	0.68	7.17	0.87
	132	7.56	0.78	7.44	0.94	7.06	0.78	7.19	0.84
	195	6.06	0.18	5.38	1.13	5.75	0.76	6.00	0.76
Colour	31	6.72	1.33	7.50	0.56	7.17	1.09	7.06	1.13
	132	7.88	0.35	7.19	1.16	7.25	0.65	7.13	0.58
	195	7.38	0.74	7.06	0.56	6.81	0.75	6.75	0.89

*Means in the same raw bearing different letter to the right of the number differ significantly ($p < 0.001$).