Triglyceride changes during two elaboration process of spanish cured ham

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SUMMARY: Triglyceride changes were studied during two elaboration process, short (6 months) and long (12 months). The main triglycerides in fat and muscle fat (semimembranosus and biceps femoris) were POO, POS, POL, OOO, SSO and PPO. Muscle fat showed lower POL percentages than subcutaneous fat. In salting step were observed the more important changes with similar results for subcutaneous fat and semimembranosus samples characterized by a decrease of OOO and an increase of POO. No significative differences were observed between the two process at the end of curing process excepted for POS. (P, palmitic; S, stearic, O, oleic, L, linoleic).

INTRODUCTION: The development of the organoleptic characteristics of cured ham is related with the breakdown of protein and lipids. Cured ham can be elaborated by short (4-6 months) and long (12-18 months) procedures; these different process can produce hams with different organoleptical properties; so, in long procedures a more intensive breakdown of protein and lipids can be related with an increase of compounds affecting flavour. Neutral lipids are an important component of total lipids as in subcutaneous fat as in muscle fat and triglycerides are the main components of neutral lipids, contributing to define the structural properties of fat and lipolytic changes. However the studies about lipid changes have been carried out in basis to fatty acids (CANTONI et al. 1970; FLORES et al. 1986, 1987, 1988). The results reported did not show important changes among the process, affecting mainly to more insaturate fatty acid (e.g. linoleic). The possibility of triglyceride determination by capillary gas chromatography (CGC) in basis to number of unsaturated fatty acids (NUFA) and number of double bounds (NDB) (GEERAERT and SANDRA, 1985; TERMONIA et al. 1987) allows a new evaluation system to study in a more appropiate way lipids changes in cured meat products. In a previous work (GARCIA-REGUEIRO et al. 1989) studied the changes of neutral lipids during a short process, showing a depletion in percentages of LOL and OSL in subcutaneous fat. In the present work a comparison of triglyceride changes between two process has been evaluated.

MATERIAL and METHODS: 80 animals were sampled. Hams were refrigerated (2 days) after selection to avoid PSE and DFD animals. Hams were cured with a mixture of salt (40 g/Kg) and nitrate in a ratio of 100:1. Fifteen days later the hams were washed and hung at 5°C for 30 days, after the temperature was increased: short procedure, 1,5°C/weekly until sixth month and long procedure, 0,6°C/weekly until twelth month. Five samples of subcutaneous fat of ham semimembranosus and biceps femoris muscles were taken for analysis at different stages of elaboration procedures: fresh ham and salting were common for both process; short, post-salting

(T2) and aging 2 (T3), 4 (T4) and 6 (T6) months; long, post-salting (T2) and aging, 4 (T3), 6 (T4) and 12 (T6) months. Triglyceride analysis: 1 g of subcutaneous fat and 20 g of muscle samples were extracted with chloroform:methanol 2:1 (FOLCH et al. 1957). An aliquot of 50 mg of extractable fat was evaporated to dryness and redissolved in 1 ml chloroform, this solution was applied to an aminopropylsilica minicolumn (Analytichem). Neutral lipids were recovered with 3 ml chloroform:isopropanol 2:1. This fraction was evaporated to dryness and redissolved in 10 ml isooctane. High temperature capillary gas chromatography (HTCGC) was performed in the following conditions: a capillary FSOT column 25 m x 0.25 mm (0.15μm) coated with 50% phenylmethylsilicone (Rescom, Belgium) was used, carrier gas helium at 45 cm/sec, temperature program 335°C-1.5°C/min-365°C, detector FID at 380°C and 0,4μl were injected via an on column injector equipped with secondary cooling. The statistical analysis applied was carried out with SAS system by ANOVA procedure and Tukey test was used.

RESULTS and DISCUSSION: The identification of triglycerides was carried out in basis to retention times of standards and other well known triglyceride profiles, however the analytical technique used cannot establish the position of fatty acid in triglyceride molecule (so, it is not possible distinguish between POO, OPO); despite of this it is possible to separate triglyceride in basis to NUFA and NDB (e.g. POL, POS, POO, PLS) into a same carbon number (CN) (GEERAERT and SANDRA, 1985). Tables 1 and 2 show the results obtained for the two elaboration process refered to main triglycerides presents in fat and muscle samples: PPO, POS, POO, POL, SSO and OOO. Subcutaneous fat showed higher POL percentages (13.59) than muscle fats (9.54 semimembranosus, 10.66 biceps femoris), this fact was observed in other studies (GARCIA-REGUEIRO et al. 1989), on the other hand PPO had higher percentages (10.76) in biceps femoris than fat and semimembranosus samples (7.12 and 7.75, respectively). The main triglyceride POO did not present differences between the three type of samples.

POL and OOO showed a decrease in percentages in salting period in fat samples but it was not important in muscle fat. OOO percentages at the end of process were lower than initial values in fresh hams, this fact was observed in both process but it was more remarkable in long process (Table 1 and 2). Also POL percentages were lower, than in fresh hams at the end of two process for both muscles. Significative differences between process were observed in the following stages: postsalting, POL and PPO percentages in fat samples were lower in long procedure; in T3 stage POL showed a similar behaviour that in T2 stage in fat samples; in T4 stage OOO percentage in biceps femoris was lower in long procedure and POS showed a lower percentage in muscle samples at the end of short procedure.

The results obtained for the total profile of the triglycerides determined did not show important differences, this fact to point out that degradation affect in a similar way to all triglycerides. It was observed a more intensive change for more insaturate triglycerides (OSL, LOL) in fat samples, but their evaluation was very difficult due to low percentages and great

variability that did not allow a correct statistical study. Also because these triglyceride were presents in a low percentages their depletion did not affect to percentages of other triglycerides, similar results were reported by ANTEQUERA (1990) in a study about iberian hams. In a parallel study with the same samples (DIAZ and GARCIA-REGUEIRO, 1991) it was observed a more pronunciated oxidation rate in fat than in muscle fat, this could explain the more intense OOO depletion in fat during salting in comparison with muscle.

CONCLUSIONS: Triglyceride analysis is a promising technique to study the true changes that affecting to neutral lipids in curing process, however it is necessary to establish the position of fatty acid into the triglyceride molecule to make a more accurate exploration about lipids breakdown in cured meat products.

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TABLE 1. Triglyceride Percentages in Subcutaneous Fat of Cured Ham

Stage	Process	PPO	POS	POO	POL	SSO	OOO
Fresh	B	8.02	17.27	27.95	13.59	5.04	7.75
Salting	B	8.33	19.43	30.71	11.29	5.30	6.46
T2	S	6.83	15.26	27.70	16.82[a]	5.40	6.51
	L	7.73	20.29	31.15	11.93[b]	5.03	6.05
T3	S	8.15	14.60	26.83	15.79	5.28	7.00
	L	8.51	18.25	31.49	110.8	4.89	6.75
T4	S	7.75	15.36	25.86	17.64	4.69	5.94
	L	8.95	19.16	30.98	13.18	4.95	5.58
T6	S	9.51	16.04	28.81	14.31	4.71	6.01
	L	9.51	21.00	29.80	12.03	4.34	5.09

B, common both process.
S, short.
L, long procedures.
Means of five samples.
T2, T3, T4, T6 (see material and methods).
Means with different superscripts are significant different ($p<0.05$).

TABLE 2. Triglyceride Percentages in Muscle Fat of Cured Ham

Stage	Process	PPO	POS	POO	POL	SSO	OOO
Fresh	B/SM	9.84	17.10	31.26	9.54	4.05	7.12
	B/BF	9.63	14.69	28.79	10.66	5.24	10.76
Salting	B/SM	9.46	16.45	29.75	8.98	5.33	8.48
	B/BF	9.01	17.70	29.87	10.35	4.82	8.02
T2	S/SM	9.57	15.01	29.08	11.31	5.04	8.72
	L/SM	11.32	16.05	26.22	11.96	4.92	8.28
	S/BF	9.76	15.81	28.94	11.05	4.73	8.00
	L/BF	10.96	15.27	26.48	10.71	5.14	8.43
T3	S/SM	10.15	15.39	29.88	9.09	4.95	7.96
	L/SM	11.71	19.37	27.82	9.65	4.59	7.35
	S/BF	9.65	15.31	27.90	9.63[a]	4.61	8.74
	L/BF	10.60	18.56	26.59	8.91[b]	4.86	9.01
T4	S/SM	10.56	16.01	29.80	12.08	4.60	6.22
	L/SM	9.76	15.50	28.87	14.59	3.95	7.01
	S/BF	10.02	14.83	28.07	11.14	4.72	7.98[a]
	L/BF	7.99	14.10	30.97	13.30	5.26	6.73[b]
T6	S/SM	10.23	14.97[a]	29.35	11.31	4.36	7.34
	L/SM	10.49	18.64[b]	28.85	9.92	4.29	6.86
	S/BF	10.51	14.60[a]	28.24	11.49	4.89	7.98
	L/BF	9.67	17.64[b]	31.33	9.13	4.78	7.15

For abbreviations see Table 1. Means of five samples. SM, semimembranosus. BF, biceps femoris

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