Aminoacid evolution during two elaboration processes of spanish dry-cured ham

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SUMMARY: Organoleptical characteristics are influenced for the aminoacids produced by protein breakdown during the aging of dry-cured ham. Aminoacid formation at different periods in two elaboration processes (short and long) in muscles semimembranosus and biceps femoris was evaluated.

Results showed different aminoacid profiles between fresh and cured hams. An increase of Tyr and Lys percentages between processes were observed. Concentrations were similar in both processes, but significative differences for Lys, Pro (semimembranosus) and Asp (semimembranosus and biceps femoris) at the end of the process were found.

INTRODUCTION: Protein breakdown is an important process during the elaboration of dry-cured ham. Aminoacids, as a result of proteolytic activity, contribute to develope the organoleptical characteristics. Several procedures, short (4-6 months) and long (≥ 12 months), are used to elaborate dry-cured hams, which may affect its organoleptical quality. Aminoacids can be used as an indicator of proteolytic activity and at different aging periods can be used to establish differences between processes. Several studies showed an aminoacid increase during aging (McCAIN et al. 1968; AMBANELLI et al. 1969; GIOLITTI et al. 1971; BUTZ et al. 1974; BALDINI et al. 1974). On spanish dry-cured ham have not been carried out many studies. De Prado Malagon (1988) and Cordoba (1990) reported similar results with highest concentrations of Ala, Glu and Lys at the end of the process. Cordoba (1990) reported higher values than previous works in a 18 months procedure with iberian hams. Comparation between different processes of dry-cured ham elaborated with white pigs had not been made. A comparison based in aminoacids releasing between two standard processes (short and long) was carried out in this study.

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 salt mixture (40 g/Kg) and nitrate in a ratio 100:1. Fifteen days later hams were washed and hung at 5°C for 30 days. The temperature was increased in short procedure 1,5°C/weekly until the sixth month and in long procedure 0,6°C/weekly until the twelth month. Five samples of each muscle were taken for analysis at different aging period: fresh ham and salting were common in both processes. In the short procedure samples were taken in post-salting (T2) and at 2 (T3), 4 (T4) and 6 (T6) months of aging and in the long procedure in post-salting (T2) and at 4 (T3), 6 (T4) and 12 (T6) aging months. Aminoacids were extracted from 5 g of an homogenated sample at 4°C with 100 ml perchloric acid 0.6M during 60 minutes. Extraction solution was neutralized with KOH and

filtered. An aliquot was evaporated to dryness in nitrogen stream. 200 µl of 3M HCl in n-Butanol were added. Solution was heated at 110°C during 20 minutes. After evaporation to dryness in nitrogen stream, 200 µl of heptafluorobutiric anhidre (HFBA):acetonitril (1:4) were added. Second reaction was made at 140°C during 20 minutes. The residue after dryness was redissolved in 100-200 µl acetonitrile. Aminoacid determination was made by Capillary Gas Chromatography (CGC). A FSOT capillary column (25mx0.25mm; 0.15 um) coated with 5% phenylmethylsilicone (SE-54) (Rescom, Belgium) was used and helium at 30 cm/seg as a carrier gas; Programm temperature 80°C-5°C/min-250°C. Detector FID at 260°C, programmed temperature vaporizer (PTV) injector was used in the mode cold split (60-250ºC,20 sec). Statistical analysis with SAS system was applied (ANOVA, Tukey test).

RESULTS AND DISCUSSION: Capillary gas chromatography (CGC) allows a reliable aminoacid determination (JAEGER et al. 1981). Ala, Gly, Val, Thr, Ser, Leu, Ile, Pro, Met, Asx, Glx, Phe, Lys and Tyr were evaluated in this study by CGC. Hys and Cys were not analized for their great variability. Cordoba (1990) pointed out that Hys did not present remarkable changes during the elaboration of iberian hams.

Table 1 shows the aminoacid concentration with significative differences among the elaboration procedures. Tyrosine was included for its relation with white film. A no lineal increase during the different stages was observed. Great changes were produced between T4 and T6 stages. Significative differences between processes at the end of the process for Asp (semimembranosus and biceps femoris) and Lys (semimembranosus) were found. Post-salting had not influence in the elaboration procedure. T3 showed higher values in short than in long procedure, but long process presented in T4 and T6 similar or higher concentrations.

Aminoacid percentages, not presented, were similar in muscle semimenbranosus during both procedures until T6, where significative differences were found for Ala, Gly, Val, Pro, Asp and Lys. Howewer same differences were done in T4 for BF.

Values obtained are similar to those reported by other authors, but lower than those reported in iberian hams (CORDOBA, 1990). This effect could be related with the long procedure used in iberian hams. In spite of inicial concentration of Lys were similar or lower than the other aminoacids, at the end of the process Lys concentration was higher, except for Glu, than the other aminoacids.

Long procedure did not produce higher quantities of aminoacids, this could suggest that no long time aging is necessary to obtain an intensive proteolysis. Howewer it is clear that aminoacids are only a limited aspect about protein breakdown and organoleptical development. So amines, that were determinated in same samples, showed dispersed values and is not easy relate them with aminoacids results (HORTOS and GARCIA-REGUEIRO, 1991).

CONCLUSIONS: Long procedure did not produce higher quantities of aminoacids, showing the

posibility to reduce the elaboration time, but it will be necessary to take into account other factors affecting organoleptical characteristics.

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REFERENCES:

AMBELLINI, G., MOLINARI, C. and PEZZANI, G. (1969): Richerche sulla stagionatura del prosciutto di Parma. Nota II-Variazioni degli amminoacidi liberi. Ind. Conserv. 44: 294

BALDINI, P.,BENARDI, E.P. and RACZYSKI, R. (1977): Indagni sul prosciutto tipico di Parma: influenza della fase di salagione sulli evolutione dei parametri chimico-fisici e della populazione batterica. Ind. Conserv. 52: 16-23

BUTZ, R.G., BLUMER, T.N., CHRISTIAN, J.A. and SWAISGOOD, H.E. (1974): Factor responsible for white film formation on cut surfaces of dry-cured hams. J. Food Sci. 39: 516-519

CORDOBA, J.J. (1990): "Transformaciones de los componentes nitrogenados durante la maduracion del jamón de cerdo ibèrico". Tesis. Universidad de Extremadura. Cáceres. pages 320

De PRADO MALAGON, C. (1988): "Maduración del jamón de cerdo ibèrico (jabugo): fenómenos proteoplíticos". Tesis. Universidad de Leon. pages 330

GIOLITTI, G. CANTONI, C., BIANCHI, M.A., RENON, P. and BERETTA, G. (1971): Microbiologia e cambiamenti biochemici nei prosciutti crudi durante la stagionatura. Arch. Veter. Ital. 22: 61-69

HORTOS, M. and GARCIA REGUEIRO,J.A. (1991) Unpublished results

JAEGER, H. KLOER, H.U., DITSCHUNEIT, H., FRANK, H. (1981): "Aplications of Glass Capillary Chromatography". ERd. W.G. Jennings. Marcel Dekker. New York. Pages: 331-364.

McCAIN, G.R., BLUMER, T.N., CRAIG, H.B. and STELEL, R.G. (1968): Free aminoacids in ham muscle during successive aging periods and their relation to flavor. J. Food Sci. 33: 142

Table 1. Aminoacid concentration (mg/100g) during two elaboration processes of dry-cured ham

Stage	Process	Ala	Leu	Asp	Phe	Glu	Lys	Tyr
Fresh	B/SM	24.63	10.15	7.42	9.43	38.83	10.89	8.73
	B/BF	30.77	10.45	16.80	26.74	47.45	15.37	12.41
Salting	B/SM	40.24	20.82	14.31	21.74	63.89	29.09	20.60
	B/BF	28.21	18.27	9.47	13.10	48.27	19.57	12.61
T2	S/SM	42.42	24.51	12.44	25.67	72.38	35.69	29.10
	L/SM	52.32	30.56	11.60	26.59	71.70	39.87	22.14
	S/BF	55.27	35.56	27.75	37.42	102.17	58.28	54.81
	L/BF	43.56	34.26	30.99	43.37	100.36	61.92	33.72
T3	S/SM	132.92[a]	78.87[a]	33.78	75.43[a]	195.96[a]	128.69	46.80
	L/SM	74.57[b]	44.15[b]	25.99	43.05[b]	98.43[b]	65.90	39.47
	S/BF	101.60	80.64	60.84[a]	80.13[a]	173.76	133.00[a]	72.65
	L/BF	77.67	65.12	48.88[b]	60.34[b]	148.81	94.56[b]	58.27
T4	S/SM	175.18	116.17	42.97[a]	86.10	227.47	155.97	74.17
	L/SM	119.46	89.76	60.12[b]	86.01	221.93	117.07	50.01
	S/BF	89.78[a]	91.27	76.95[a]	104.19	272.68	188.52[a]	91.38
	L/BF	116.53[b]	109.62	100.58[b]	89.76	270.12	210.21[b]	73.91
T6	S/SM	227.19	171.62	89.06[a]	145.25	363.90	265.07[a]	123.97
	L/SM	218.50	187.01	188.85[b]	155.96	454.86	395.05[b]	166.64
	S/BF	205.51	182.50	118.23[a]	154.82	379.99	249.43	101.90
	L/BF	192.24	178.92	183.34[b]	200.66	456.28	319.64	131.73

B, Common both process
S, Short process
L, Long process
SM, Muscle Semimembranosus
BF, Muscle Biceps femoris
T2,T3,T4 and T6, see material and methods
Means with different superscripts are significant different ($p<0,05$)