

TECHNOLOGICAL FEATURES AND NUTRITIVE VALUE OF TRADITIONAL ITALIAN HAM: THE MICRONUTRIENT PROFILE

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Abstract – Ham is a typical Italian meat product with a wide variety of local products characterized by a specific geographical identity and traditional preparation techniques. This study extensively sampled and analyzed three types of Italian hams: dry cured ham (Modena, Parma, San Daniele, Nazionale), cooked ham (Cooked, Scelto, Alta Qualità) and smoked ham (Speck from Alto Adige). Data is reported on micronutrient content in traditional Italian hams, both trace elements (Fe, Zn, Cu, Mn, Se) and vitamins (B1, B2, PP, B6, B12, vitamin E). Dry cured ham and smoked ham were a rich source of trace elements, by contrast cooked ham showed lower amounts of Fe, Zn and Se. Cooked and smoked hams showed lower levels of vitamins compared to that found in dry cured ham. Ham represents an important food item in the Italian diet, therefore the contribution of ham's portion to the recommended dietary allowances (RDA) for vitamins and trace elements was also estimated.

Key Words – daily supply, ham, trace elements, vitamins

I. INTRODUCTION

The traditional Italian meat products constitute a cultural and commercial wealth to be protected and improved especially when, as in recent years, together with market expansion there is a trend towards a leveling out of the organoleptic and nutritional quality of food products. Ham is a typical meat product of the Italian food tradition which shows a great variety of local products characterized by specific geographical identity and traditional preparation methods. Furthermore, among the traditional Italian hams, several exhibit the PDO (Protected Designation of Origin) or the PGI (Protected Geographic Indication) recognition according to EU rules (EUR 2081/92), all having therefore a consolidated preparation technique and providing quality and safety assurances. The

present study was undertaken to describe the nutritive value of the Italian typical hams, in terms of micronutrient level: vitamins (B1, B2, PP, B6, B12, vitamin E) and trace elements (Fe, Zn, Cu, Mn, Se). Several samples of the most representative Italian ham, 4 PDO dry-cured hams (Modena, Parma, San Daniele, Nazionale), 3 cooked ham, 1 PGI smoked ham (Speck from Alto Adige), were selected. Ham is among the most consumed traditional Italian cured meats and, consequently, can be an important source of micronutrients in the Italian total diet. Therefore the contribution of a ham portion to both vitamins and trace elements recommended dietary allowances (RDA) was also estimated.

II. MATERIALS AND METHODS

An extensive sampling of Italian hams was carried out analyzing samples representative of the three types of Italian ham: *dry cured ham* (ingredients are only meat and salt), *cooked ham* (the recipes include the addition of salt, pepper, bay leaves, juniper; the product is then steam cooked at about 70°C), *smoked ham* (obtained from the deboned pig leg, seasoned with a mixture of spices and prepared by the combination of two preservation methods: smoking and salting). The selected ham samples were: 4 dry cured hams (Modena, Parma, San Daniele, Nazionale), 3 cooked hams (cooked, scelto, alta qualità), 1 smoked ham (Speck from Alto Adige) The ham samples were provided by five manufacturers.

Analyses:

Trace Elements (Fe, Zn, Cu, Mn, Se) analyses were performed by ICP-Plasma on a Perkin-Elmer (Norwalk, CT 06859, USA) Optima 3200XL. Samples were previously ashed (4ml HNO₃+1ml H₂O₂) in a microwave digestion system. Standard Reference Material: Bovine muscle (BCR 184,

Community Bureau of Reference, Brussels) and Bovine liver (NBS 1577°; National Bureau of Standards, Gaithersburg, MD, USA) were analysed as a control of the accuracy of the analysis.

B Vitamins (B1, B2, PP, B6) were determined by HPLC as described by Ndaw et al. [1]. Vitamin B12 content was assessed by the performance of a fully automated chemiluminescence analyser [2].

Vitamin E was separated and quantified by LC-MS/MS (Agilent serie 1200, 6410) following the method of Lanina et al. [3] with some modifications.

III. RESULTS AND DISCUSSION

Table 1 shows the trace elements content of the traditional Italian hams studied. Dry-cured ham (about 47% moisture) was a rich source especially of zinc (2.37 mg/100g), iron (0.96 mg/100g) and selenium (14 µg/100g). Cooked ham (about 70% moisture) showed lower amount of zinc (1.3 mg/100g), iron (0.60 mg/100g) and Se (11 mg/ 100 g) compared to dry cured ham. Smoked ham (about 44 % moisture) was generally richer in trace elements than the other hams analyzed, this

Table 1 Trace elements content in the traditional Italian hams

Ham names	Fe	Zn	Cu	Mn	Se
	mg/100			µg/100g	
Dry-cured Ham					
Modena	1.05	2.72	0.06	0.01	17
Parma	0.90	2.30	0.03	0.01	11
San Daniele	0.92	2.38	0.04	0.01	14
Nazionale	0.80	2.10	0.05	0.01	15
mean value	0.96	2.37	0.04	0.01	14
Cooked Ham					
Cooked	0.49	1.10	0.08	0.01	10
Scelto	0.60	1.30	0.07	0.01	11
Alta Qualità	0.70	1.50	0.09	0.01	11
mean value	0.60	1.30	0.07	0.01	11
Smoked Ham					
Speck	1.42	2.46	0.07	0.04	15

was especially true with regard to the iron content (Table 1). The concentration of B vitamins and

vitamin E is reported in Table 2. Pork meat is a good source of hydrosoluble vitamins especially thiamin [4], ham is characterized by a high content of B vitamins as well. Current analyses showed a high mean content of B1 (0.68 mg/100g), PP (5.5 mg/100g), B6 (1.04 mg/100g) and B12 (0.46 mg/100g) in dry cured ham. On the other hand both Cooked ham and Speck showed lower amount of vitamins compared to the dry-cured ham (Table 2).

Table 2 B Vitamins and Vitamin E content in the traditional Italian hams (mg/100g)

Traditional Italian Hams (mg/100g)	B1	B2	PP	B6	B12	Vit. E
	µg					
Dry-cured Ham						
Modena	0.59	0.20	5.57	1.00	0.33	0.11
S. Daniele	0.68	0.20	5.13	1.04	0.47	0.13
Parma	0.90	0.22	5.90	1.13	0.67	0.22
Nazionale	0.58	0.19	5.45	1.00	0.38	0.24
mean value	0.68	0.20	5.51	1.04	0.46	0.17
Cooked Ham						
Cooked	0.67	0.12	4.40	0.37	0.09	0.09
Scelto	0.54	0.13	4.70	0.43	0.13	0.13
Alta Qualità	0.69	0.14	4.70	0.44	0.13	0.13
mean value	0.63	0.13	4.60	0.41	0.12	0.12
Smoked Ham						
Speck	0.41	0.16	4.10	0.47	0.33	0.11

Meat Products represent an important voice in the Italian food consumption pattern [5]. In the frame of the last Italian food consumption survey [6], ham represented about 55% of the Meat Products daily consumption; thus ham could be an important vehicle of some micronutrients in the Italian diet. Figure 1 shows the percentage of the Recommended Daily Allowances (RDA) calculated for both trace elements and B vitamins, provided by one portion of ham (50g) (calculated on the basis of the mean value of all types of ham). A 50g ham portion contributes for about 26% to the RDA of B1 and for about 23% of B6 vitamins; as far as trace elements are concerned, one portion of ham contributes for 10 and 12 %, respectively, to zinc and selenium RDA.

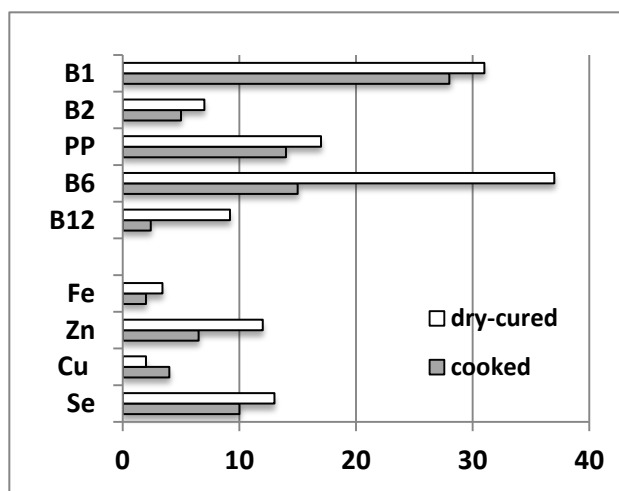


Figure 1. Percentage of RDA for trace elements and B vitamins provided by one portion (50g) of dry-cured ham and cooked ham.

IV. CONCLUSION

Our findings indicated that the traditional Italian hams analyzed (dry-cured, cooked, smoked) were a rich source of both trace elements and B vitamins. However, cooking and smoking procedures induced losses especially in vitamin content compared to the dry cured ham. Taking into account that ham represents an important item in the Italian diet, one portion of ham (50g) makes a good contribution to the daily intake of some of the micronutrients analyzed in this study, playing an important role in the achievement of the RDA for these nutrients. In conclusion, the updating of nutritional data provided by this study can offer important information to both consumers and dieticians, making it possible for them to make informed dietary choices and to supply correct data for the set-up of appropriate and balanced diets.

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REFERENCES

1. Ndaw S., Bergaentzle M., Aoudè-Werner D. Hasselmann C. (2000). Extraction procedures for the liquid chromatographic determination of thiamine, riboflavine and vitamin B6 in foodstuffs. *Food Chemistry*, 17: 129-138.
2. Saccani G. (2011). Vitamin B12 in muscle foods. Comparison of a microbiological assay and a fully automated chemiluminescence system for the determination of vitamin B12 in fresh and processed meat. In *Proceedings 57th International Congress of Meat Science and Technology* (p.148), 7-12 August 2011, Ghent.
3. Lanina S. A., Toledo P., Sampels S., Kamal-Eldin A., Jastrebova J. A. (2007). Comparison of reversed-phase liquid chromatography-mass spectrometry with electrospray and atmospheric pressure chemical ionization for analysis of dietary tocopherols. *J. Chrom. A*, 1157:159-170
4. Lombardi-Boccia G, Lanzi S, Lucarini M, Di Lullo, G. (2004) Meat and Meat Products Consumption in Italy: Contribution to Trace Elements and selected B Vitamins Supply. *Int. J. Vit. Nutr. Res.* 74(4): 247-251.
5. Lombardi-Boccia, G., Aguzzi, A., Cappelloni, M., Di Lullo, G., Lucarini M. (2003). Total Diet Study: Daily Intakes of Minerals and Trace Elements in Italy. *Br. J. Nutr.* 90, 1117-21.
6. Leclercq, C., Arcella, D., Piccinelli, R., Sette, S., Le Donne, C. and Turrini A. (2008). The Italian Food Consumption Survey INRAN-SCAI 2005-06: main results in terms of food consumption. *Public Health Nutrition*, 12 (12): 2504-32.