# EFFECT OF ULTRASONICALLY ASISTED THERMAL AND HIGH-PRESSURE TREATMENTS ON AMINO ACID PROFILE OF DRY-CURED HAM

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## I. INTRODUCTION

Dry-cured ham is a product highly valued by consumers in Spain. A wide variety of physicochemical changes during the elaboration process influence the final product characteristics, such as flavor and texture [1]. In this regard, the proteins undergo an intense proteolysis during the ripening process, which constitutes the most important enzymatic reaction regarding muscle proteins [2, 3]. However, excessive proteolysis may generate the pastiness defect, characterized by excessive softness, mushy texture and unpleasant flavors [4, 5]. To correct this defect, recent research has proposed the use of new technologies such as the application of power ultrasound and high hydrostatic pressure [6, 7]. However, these technologies could produce changes in the membrane of the cellular structures and consequently, changes in the sensory properties of the final product. Thus, the objective of this study was to evaluate the changes produced by the application of high pressure and ultrasonic heating in the profile of free amino acids to assess the possible impact on the final taste.

## II. MATERIALS AND METHODS

For this study, a total of 30 dry-cured hams were used. Ten slices from each ham sample were vacuum packed and store at room temperature for no longer than 4 weeks. Dry-cured ham samples were randomly divided into three groups: control (without treatment), thermal treatment at 50ºC for 5 hours assisted by power ultrasound (UdP) at 600 W for 10 min, and high- hydrostatic pressure (HP) at 600 MPa at 35 ºC for 6 min. The analysis of free amino acids was performed on *biceps femoris* muscle by HPLC with fluorescence detector according to the method described by Dominguez *et al.* [8]. The effect of the treatment was examined by a one-way ANOVA with IBM SPSS Statistics 23.0 program software package.

## III. RESULTS AND DISCUSSION

The free amino acid composition of dry-cured ham samples from the control and HP and UdP treatment is shown in Table 1. Total free amino acids content was significantly higher in UdP treatment compared to the other ones (5101 vs. 4121 vs. 4141 mg/100 g dry matter for UdP, CO and HP treatments, respectively). Except phenylalanine, all the amino acid studied showed significantly ($P$<0.001) differences among groups. The concentration of aspartic acid, serine, glutamic acid, glycine, histidine, taurine, arginine, threonine and lysine increased with HP treatment and decreased with US treatment. On the other hand, HP treatment induced higher values in alanine, proline, valine, methionine, isoleucine and leucine and lower concentration of tyrosine compared to control group. Both treatments, HP and UdP, induced changes in the final taste of dry-cured ham. These differences in the individual free amino acid content among the three ham groups studied could induce differences in flavor. In this regard, dry-cured hams submitted to HP treatment should have a sweeter (Σ of alanine, glycine, threonine, serine and proline) and aged flavor (Σ of lysine, tyrosine and aspartic acid) than the others ones, whereas samples subjected to US treatment showed the lowest acid (Σ of glutamic acid, aspartic acid and histidine) taste (data not shown).

**Table 1.** Effect of treatment on amino acid profile (expressed as mg/100 g dry matter) of dry-cured ham

| | *Treatment* | | | **SEM** | ***P-value*** |
|---|---|---|---|---|---|
| | ***CO*** | ***HP*** | ***UdP*** | | |
| Aspartic acid | 164.98[b] | 240.20[c] | 105.24[a] | 7.674 | <0.001 |
| Serine | 171.22[b] | 251.15[c] | 137.16[a] | 7.633 | <0.001 |
| Glutamic acid | 416.69[b] | 588.97[c] | 322.00[a] | 16.187 | <0.001 |
| Glycine | 174.58[b] | 238.69[c] | 150.09[a] | 5.627 | <0.001 |
| Histidine | 94.00[b] | 127.69[c] | 60.41[a] | 3.990 | <0.001 |
| Taurine | 85.51[b] | 102.21[c] | 66.03[a] | 2.639 | <0.001 |
| Arginine | 356.37[b] | 513.00[c] | 238.92[a] | 16.632 | <0.001 |
| Threonine | 193.43[b] | 254.45[c] | 152.40[a] | 6.683 | <0.001 |
| Alanine | 367.15[a] | 546.58[b] | 347.33[a] | 13.598 | <0.001 |
| Proline | 254.36[a] | 314.32[b] | 249.84[a] | 6.779 | <0.001 |
| Cisteine | 320.16[a] | 553.79[b] | 451.61[b] | 23.445 | <0.001 |
| Tyrosine | 159.62[b] | 121.24[a] | 163.92[b] | 4.194 | <0.001 |
| Valine | 353.00[a] | 441.94[b] | 324.81[a] | 9.764 | <0.001 |
| Metionine | 179.43[a] | 223.19[b] | 172.23[a] | 4.818 | <0.001 |
| Lysine | 234.14[b] | 448.34[c] | 181.72[a] | 15.399 | <0.001 |
| Isoleucine | 306.18[a] | 403.47[b] | 312.41[a] | 9.223 | <0.001 |
| Leucine | 513.88[a] | 664.31[b] | 531.45[a] | 14.504 | <0.001 |
| Phenilalanine | 338.71[a] | 382.06[a] | 357.22[a] | 7.816 | 0.067 |
| **Total Aas** | **4121.49[a]** | **5101.86[b]** | **4141.71[a]** | **86.410** | <0.001 |

[a-c]Mean values in the same row (corresponding to the same parameter) not followed by a common letter differ significantly (P < 0.05; Tukey's Test). SEM: standard error of mean.

## IV. CONCLUSION

The application of power ultrasound and high- hydrostatic pressure as corrective actions to decrease the adhesiveness and pastiness in dry-cured ham produced significant changes in the amino acid profile.


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