PHYSICOCHEMICAL AND SENSORY CHARACTERISATION OF A TYPICAL SPANISH COOKED BLOOD SAUSAGE CALLED "MORCILLA DE BURGOS"

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Background
"Morcilla de Burgos" is a popular cooked blood sausage in Spain. It consists of a mixture of onion (between 25% and 55%), rice, animal fat, blood and different spices and curing salts stuffed in natural casings. The product is cooked for one hour at 94-95°C, air cooled to 8-10°C and finally chilled stored at 4°C. Consumption of this kind of blood sausages is quite popular in many European countries. However, the characteristics of these products are not well known. Nowadays, European Union is more involved in the protection of high quality traditional foods from specific regions or areas as a trend to promote rural areas and support that population. In this way especial labels, Protected Designation of Origin (PDO) and Protected Geographical Indication (PGI), have been created according to the European Regulation 2081/92. Producers of "Morcilla de Burgos" are considering the possibility to apply for a PGI. In order to access to this kind of protection, physicochemical and sensory characterisation of the product is essential to initiate the proceeding.

Objectives
The aim is to go deeply into the main characteristics of the "morcilla" produced by different manufacturers in the region of Burgos, since physicochemical and sensory characterisation is the first step to obtain a PGI for this unknown product.

Material and Methods
Physicochemical methods: Samples were collected from fourteen industrial processing plants at four different periods, 24 hours after elaboration. Due to the heterogeneity of this product, previously to each analysis 500g of sample were ground and homogenised sample from a total of eight randomly selected items. The pH, water activity (Aw), moisture, total fat, protein, starch, total sugar, ash and fibre were determined by duplicate according to AOAC (1990) procedures.

Sensory analysis: 1-cm slices of "morcilla" were evaluated by a 8 member trained panel. Two open-discussion sessions and 10 training sessions were held to familiarise the judges with the attributes to evaluate and the scale to use, respectively. Quantitative Descriptive Analysis was carried out by the panel scoring on a five point scale, where 1 corresponded to absence and 5 to maximum intensity of each parameter. The sensory profile consisted of 22 descriptors grouped in 3 blocks:
a) Visual attributes (compactness, colour, cooking grade, appearance and presence of spices)
b) Olfactory attributes (onion, fat, blood, pepper, paprika and cumin smell and odour intensity)
c) Texture and flavour attributes (crumbliness, softness, presence of onion, fat sensation, saltiness, hot taste, and onion, blood, pepper, paprika and cumin flavour).

Statistical tests: were conducted using the statistical package Statgraphics Plus for Windows ver. 2.1.

Results and Discussion
The mean values of physicochemical parameters as well the minimum and maximum values obtained during the study are shown in the table 1. This product is characterised by a pH near to 6.5, Aw higher than 0.95 and high moisture, which make the "morcilla" a perishable product with a short shelf life (Santos et al., 1998). The noticeable variability among the physicochemical and sensory data led to the establishment of three groups that coincide with three geographical zones in the region of Burgos.

Group I: "morcillas" from Northeast of the region.
Group II: "morcillas" from the South of the region.
Group III: "morcillas" from the Centre and West of the region.

Physicochemical and significant sensory parameters according to the origin are shown in tables 2 and 3, respectively. The analysis of variance revealed that the pH, Aw and protein content were significant higher for "morcillas" from group I, while "morcillas" from group III showed the lowest pH, Aw, moisture and starch content and the highest content of total sugar and fibre. Physicochemical characteristics of group II presented intermediate values, being placed between the groups previously mentioned. Regarding to sensory parameters, significant differences were found due to the origin of the samples. Product from the Northeast had a darker colour and a stronger blood smell and blood and pepper flavour than the rest. "Morcillas" from the South possessed a significantly higher softness and cumin smell and flavour. A stronger onion smell and a higher presence of onion as well as a lower softness were the typical characteristics for "morcilla" from group III. Discriminant analysis was applied to the physicochemical data and to the total (physicochemical and sensory) data in order to confirm the groups established (Fig 1 and 2). The percentage of cases correctly classified using all physicochemical variables was 80.36%. Using a stepwise selection algorithm it was determined that 14 variables (sensory variables from table 2 together with pH and protein content) were significant predictors of group. In this case, 100% of the cases was correctly classified.

Conclusions
"Morcilla de Burgos" has been physicochemically and sensorially characterised and three geographical zones or groups have been established. Physicochemical parameters are not enough to classify the product in the correspondent zone, being the most discriminant sensory parameters. "Morcillas" from Northeast of the region are characterised by a remarkable blood smell and blood and pepper flavour. "Morcillas" from the South have a strong cumin smell and flavour and in the Centre and West of the region, "morcillas" presented a high onion smell and high presence of onion.

References

AOAC (1990) Official Methods of Analysis. 15th edition. Association of Official Analytical Chemists Inc. Arlington. Virginia.

Santos EM, Jaime I, Rovira J. (1998) Use of modified atmosphere packaging to extend the shelf-life of "morcilla". 44th International Congress of Meat Science and Technology Vol I, Barcelona. España, 448-449.

Table1. Physicochemical characterisation of "morcilla de Burgos".

pH	Aw	Moisture (%DM)	Fat (%DM)	Protein (%DM)	Starch (%DM)	Ash (%DM)	Total Sugar (%DM)	Fibre (%DM)
6.39±0.35	0.984±0.004	62.20±4.05	28.83±5.34	13.09±2.30	46.39±6.07	4.26±0.49	4.42±1.71	2.07±0.96
(5.75-7.32)	(0.974-0.992)	(51.8-70.44)	(19.35-47.40)	(9.10-19.94)	(33.27-58.12)	(2.97-5.38)	(1.09-9.95)	(0.31-4.16)

DM: dry matter

Table 2. Chemical composition of "Morcilla de Burgos" according to the three groups established.

Group	pH	Aw	Moisture (%DM)	Fat (%DM)	Protein (%DM)	Starch (%DM)	Ash (%DM)	Total Sugar (%DM)	Fibre (%DM)
I	6.9 ±0.03[a]	0.988±0.001[a]	65.05±0.62[a]	28.13±1.00[a]	15.33±0.40[a]	48,34±1.15[a]	4.22±0.10[ab]	2.92±0.28[a]	1.52±0.11[a]
II	6.35±0.03[b]	0.985±0.000[b]	64.51±0.53[a]	26.05±0.86[a]	12.52±0.35[b]	48.57±1.00[a]	4.46±0.08[a]	4.16±0.24[b]	1.95±0.10[b]
III	6.19±0.02[c]	0.982±0.000[c]	59.66±0.41[b]	30.72±0.66[b]	12.44±0.26[b]	44.30±0.78[b]	4.16±0.06[b]	5.20±0.18[c]	2.34±0.07[c]

DM: dry matter

Means in the same column with different superscripts are significantly different (P<0.05).

Table 3. Sensory attributes of "Morcilla de Burgos" according to the three groups established.

Group	Colour	Cooking grade	Onion smell	Blood smell	Cumin smell	Odour intensity	Presence of onion	Softness	Blood flavour	Hot taste	Pepper flavour	Cumin flavour
I	3.70[a]	3.55[a]	1.95[a]	2.39[a]	1.00[a]	2.77[a]	2.20[a]	3.47[a]	2.24 [a]	3.14[a]	2.39[a]	1.00[a]
II	2.45[b]	3.09[b]	1.90[a]	1.11[b]	2.98[b]	3.05[b]	2.49[b]	4.25[b]	1.18[b]	2.03[b]	1.01[b]	2.97[b]
III	3.12[c]	2.98[b]	3.11[b]	1.17[b]	1.00[a]	3.13[b]	3.20[c]	2.83[c]	1.17[b]	2.94[a]	1.19[b]	1.00[a]

Means in the same column with different superscripts are significantly different (P<0.05).
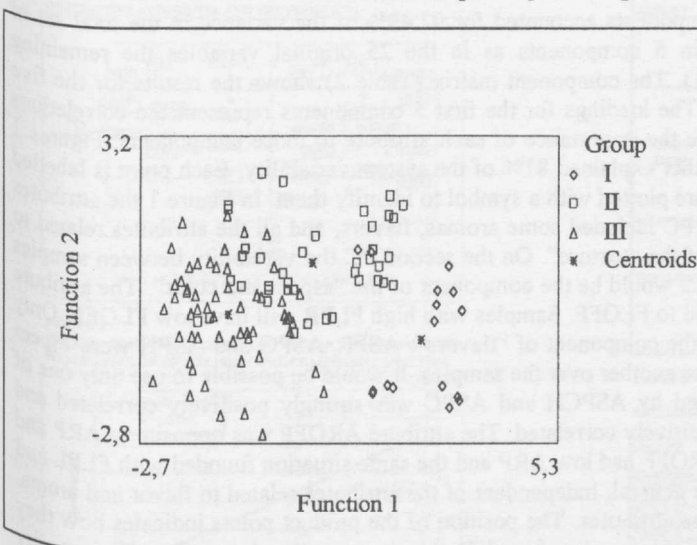

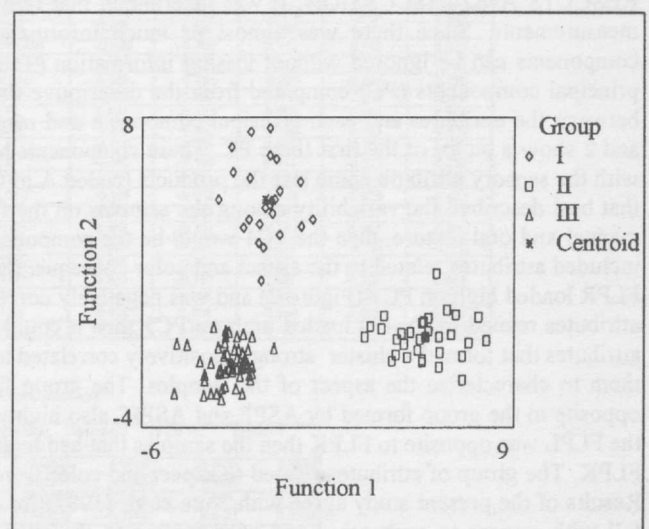Fig 1. Discriminant analysis applied to physicochemical parameters

Fig 2. Discriminant analysis applied to all parameters.