RELATIONSHIP BETWEEN TOTAL DIETARY FIBRE AND THE AMOUNT OF ONION USED IN MANUFACTURE OF "MORCILLA OF BURGOS".

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Introduction

"Morcilla de Burgos" is a popular, cooked blood sausage produced in the province of Burgos in the North of Spain. It consists of a mixture of chopped onion, rice, animal fat, blood, salt and different spices such as black pepper, paprika and oregano. Previous studies have pointed out the sensory importance of the amount of onion in "morcilla" (Santos *et al.*, 2003). Onion is a major source of water, sugars and fibre. Water is released from the onion during cooking and is absorbed by the rice starch, while most of the sugars and fibre remain in the final product. EU regulation 2081/92 established two regulations to protect traditional foodstuffs in Europe; these are the protected designation of origin (PDO) and the protected geographical indication (PGI). "Morcilla de Burgos" producers want to apply for a PGI designation. The draft regulation considers three different types of "morcilla" based on the amount of onion, with a minimum value of 35% w/w. For this reason, the amount of fibre found in the "morcilla" could be of interest as an indicator of the amount of onion used in its manufacture. The aim of this study is to evaluate the feasibility of using total dietary fibre (TDF) content as indicator of the amount of onion in a "morcilla" sausage.

Materials and Methods

Although raw fibre content has previously been determined in "morcilla" (Santos *et al.*, 2003), in this study, total dietary fibre (TDF) has been considered. This is because raw fibre only includes in its definition hemicelluloses, celluloses and lignins while TDF includes the above plus pectins, gums, nondigestible oligosaccharides and waxes. Total dietary fibre has been analysed by the gravimetric enzymatic method described by the AOAC (1997). This consists of weighing out 1.0000 ± 0.0005 g in duplicate of freeze-dried, ground sample. Each sample is suspended in Mes-Tris buffer (40ml) and three different enzymes (α-amylase, protease and amyloglucosidase) are added to hydrolyse starch, protein and amylose respectively. Next, ethanol (78%) is added to precipitate soluble dietary fibre. The remaining material is filtered and washed with ethanol (96.5 %) and acetone after which it is dried and weighed. One of the duplicates is used to measure residual protein and the other for ash determination. Total dietary fibre content results are calculated as the difference between the weight of the remainder and the residual protein plus ash.To show the influence of fibre content in "morcilla de Burgos", two experiments were performed: (1) Two batches of three different "morcilla de Burgos" sausages elaborated with 20%, 35% (minimum to be considered "morcilla de Burgos") and 47% w/w onion were analysed for TDF; data obtained from those analyses were statistically analysed (Statgraphics plus v.5.1). Different statistical models (polynomial, lineal regression and inverse of Y) were investigated to correlate the amount of fibre present in the sample with the amount of onion added by producers. (2) Eleven "morcilla" sausages from different geographical areas of the Burgos province were analysed for TDF content and, the statistical models developed previously were used to predict the amount of onion in each sample.

Results and Discussion

The best predictive model uses the "inverse of Y" and produced the regression equation - $Y= 1/(0.635539-0.0082758X)$, [X being the percentage of onion] with a correlation coefficient R= 0.9791 (Figure 1). The other models studied produced lower correlation coefficients.

Santos *et al.*, (2001) established that it was possible to distinguish between three different types of "morcilla" in the Burgos region according to their manufacturing process, level and type of spices and percentage of onion employed. , These different types were located in different geographical parts of the region; in the North, less onion is used (around 20-25%), in the South the usage level is around 35-40% and in the Centre more than 45% w/w. Table 1 shows the percentage of TDF (expressed on a dry matter basis) found in different "morcilla" products. Using only natural components, the amount of fibre found in this kind of products is remarkable. Among the eleven products analysed, 6 belonged to the Centre of the region, 2 to the South (products 10 and 23), and 2 to the North (18 and 24). In the same table, the estimated percentage of onion content in the different products is alos shown. Taking into account the minimum percentage of TDF detectable by the model (2.87% w/w), all produtrs have higher amounts of fibre except number 24 (2.367% w/w).

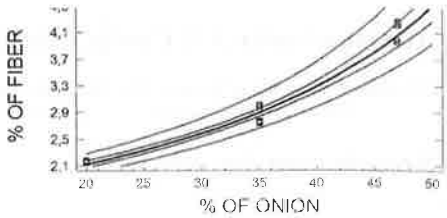

Figure 1: Inverse of Y correlation between percentage onion content and percentage fibre.

When a cluster analysis is applied to all fibre data obtained (see Figure 2), it is possible to distinguish four differe groups. In group 1 two products from the Southern part of the region are included; in group 2, which is split in tw subgroups, all producers from the Centre of the region are concentrated. All members of group 3 are products located i the same village, also located in the Centre, and finally group 4, which is different from the others, comprises product from the Northern part of the region. When fibre data from this latter group is analysed (Table 1), a paradox arise because this group contains products with higher and lower amounts of fibre in the "morcilla". These data suggest tha this group is formed by outliers. However, the amount of onion predicted for product 24 is in the range of that describe by Santos *et al.* in their work (2001). In the case of product 18, it is possible to suggest that there it contains sources o fibre other than those derived from onion.

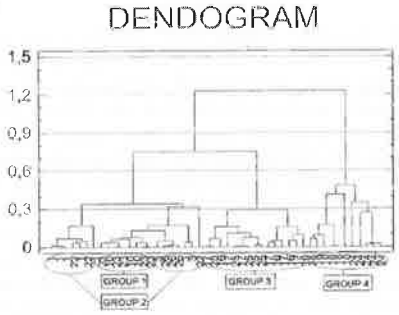

Figure 2: Cluster analysis according to percentage TDF content in different "morcilla" products.

Table 1: Prediction of onion content from analysed fibre content (dry matter basis).

PRODUCT	% FIBRE	% ONION
1	6,080^{d}	52,811
3	3,542^{bc}	39,969
10	4,265^{b}	45,406
23	4,489^{b}	46,742
22	4,336^{b}	45,621
25	6,251^{d}	53,863
16	5,630^{cd}	51,724
17	5,876^{d}	52,668
18	7,542^{e}	56,887
24	2,367^{a}	24,128
26	4,176^{a}	44,866

Conclusions

According to these results, the best model for explaining the correlation between percentage onion and percentage TDF in dry matter is the inverse of Y. Using the proposed model, the minimum detectable amount of TDF in "morcil de Burgos" is approximately 2.9%, which corresponds to the minimum amount of onion (35% w/w) established in th draft PGI regulation. Cluster analysis of TDF data reveals that products of groups 1 to 3 are very similar to each othe but those in group 4 are different from the others.

The content of TDF alone is not a good predictor for the amount of onion employed in the manufacture of "morcilla Burgos". This is because other sources of fibre, arising for example from higher inclusion rates of spices or the use rice with higher bran content, can increase its value.

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