FATTY ACID PROFILE OF PORK LIVERS AS RAW MATERIAL FOR PETFOOD PALATABILITY ENHANCERS

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Abstract – Fat content and fatty acid (FA) composition of three pork liver homogenates (A, B and C) were determined to evaluate their suitability in petfood industry as palatable ingredients. Fat content of homogenates was not significantly different ($p > 0.05$). In term of total fatty acids (TFA), the homogenates were different in monounsaturated (MUFA) ($p < 0.05$) and polyunsaturated fatty acid (PUFA) ($p < 0.001$) contents. In order to evaluate the lipolysis process in pork liver homogenates, the free fatty acid (FFA) content was studied. One of the homogenates showed high release of saturated (SFA), MUFA and PUFA free fatty acids that indicated a higher lipolysis process since all the homogenates were handled under the same conditions. These FFA can contribute to petfood product flavour by the generation of volatile compounds through oxidation reactions.

Key Words – Pet food, Palatability, Fat, Fatty acid, Liver.

I. INTRODUCTION

The pet food industry is constantly innovating to offer new products and improve the taste of food and well-being of pets. Palatability enhancers are key ingredients for this improvement. By-products of animal origin are commonly used as raw material for palatability enhancers production. Among these raw materials, pork liver is one of the most used for cat food formulation due to its high protein content and its ability to enhance palatability. To understand the pets' preferences, sensory analyses are conducted with animals and can be completed by biochemical analyses. Most of the published research has been focused on proximal composition of raw material, protein quality of by-products [1], [2] and characterization of volatile compounds from moist food [3] and kibbles [4]. In fact, the contribution of fatty acids to cat food palatability is still not well understood. Therefore, the objective of this study was to determine the fatty acid composition of three pork liver homogenates and to understand their potential contribution when used as raw material for producing cat food palatability enhancer.

II. MATERIALS AND METHODS

Material

Three fresh pork liver homogenates (A, B and C) were supplied by DIANA Petfood (Elven, France). Each homogenate was composed of three pooled livers picked directly from a local slaughter house and grinded at DIANA Petfood as usually done for palatability enhancers' production. Animals used for each homogenate received the same diet, were from the same breed and were slaughtered at the same age. The three homogenates differed in terms of diet, age and breed. All animals slaughtering conditions were the same.

Fat content

Total lipids were extracted from pork liver homogenates according to Folch *et al.* [5].

Total fatty acid analysis

TFA were analysed by GC-FID separation after extraction and methylation according to Berry *et al.* [6].

Free fatty acid analysis

FFA were analysed by GC-FID separation after ion exchange resin extraction and BF_3 methylation as described by Needs *et al.* [7].

The lipolytic activity was evaluated by calculating the ratio of FFA to TFA.

The results are expressed as the mean of at least three replicates. For GC analyses, two injections per sample were done. The differences in composition were obtained by analysis of variance (ANOVA) using the statistic software XLSTAT, 2009.4.03 (Addinsoft, Barcelona, Spain).

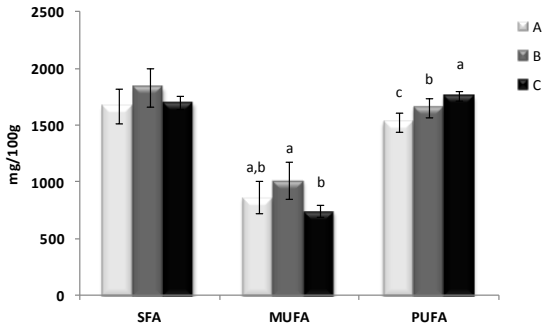
Significant effects ($p < 0.05$) were compared using Fisher's least significant difference (LSD) test ($p < 0.05$).

III. RESULTS AND DISCUSSION

Fat content was determined for each pork liver homogenate. No significant difference ($p > 0.05$) was observed in fat content. A, B and C homogenates contained 5.8, 6.1 and 5.6% of fat, respectively.

FFA and TFA were extracted from pork liver homogenates and analysed by GC-FID. No significant difference ($p > 0.05$) was observed in total fatty acid content which confirms the similar fat content result presented before. Nevertheless, considering each fatty acid class individually, significant differences ($p < 0.001$) were observed for unsaturated fatty acids (Figure 1).

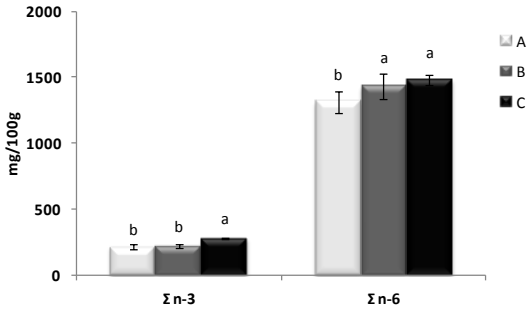
Figure 1. Total fatty acid content of pork liver homogenates



Monounsaturated fatty acid (MUFA) content was higher in B than in A and C homogenates (1012.9 *vs.* 865.6 and 747.0 mg/100 g of liver, respectively). Also, polyunsaturated fatty acid (PUFA) content was higher in C than in A and B (1760.4 *vs.* 1529.5 and 1654.3 mg/100 g of liver, respectively). In all samples, the sum of MUFA and PUFA represented 59.0% of TFA.

Significant differences were observed for n-3 ($p < 0.01$) and n-6 ($p < 0.001$) PUFA (Figure 2). N-3 FA content was higher in C than in A and B. This fact confirms that the differences in PUFA are mainly due to the composition in n-3 fatty acids.

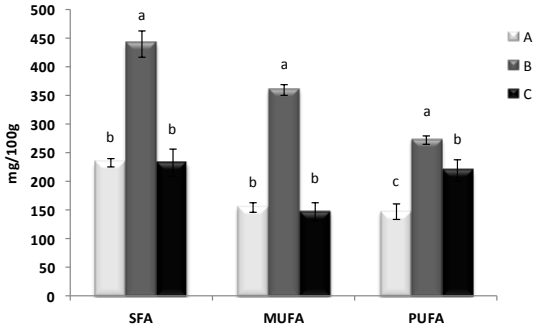
Figure 2. n-3 and n-6 total fatty acid content of pork liver homogenates



Several studies showed the impact of diet and breed on pig meat fat composition. The fatty acid composition of pig meat was reported to be related to the rearing conditions of pigs, diets and genetic lines [8]. In our study, animals used for each homogenate received a different diet so the differences observed for PUFA content can be a consequence of the diet. On the other hand, the differences observed in TFA may be due to the different genetic lines of the pigs.

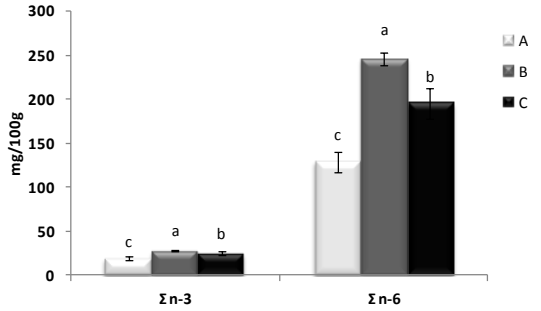
Regarding the FFA content of pork liver homogenates, differences were detected and the content was higher in B than in A or C (1054.3 *vs.* 526.1 and 583.8 mg/100 g of liver, respectively) as shown in Figure 3. As a consequence, the percentage of FFA compared to TFA was higher in B (23.4%) than in C (14.0%) and A (13.0%). This result indicated a higher lipolytic activity in B homogenate and a more active fat metabolism as all the homogenates were handled under the same conditions.

Figure 3. Free fatty acid content of pork liver homogenates



Lipolysis is influenced by various factors such as refrigeration period, thermal treatments, pig breed and diet [9], [10]. In our study, all samples were handled in the same way so the difference of FFA content cannot be due to the storage conditions but probably to diet and breed.
N-3 and n-6 FFA content was higher in B than in the other homogenates confirming that the lipolysis (and thus lipolytic activity) was the highest in the B homogenate.

Figure 4. n-3 and n-6 free fatty acid content of pork liver homogenates



Little is known about cat preferences for one class of fatty acid or another. Meat-based diets supplied essential fatty acids to cats [11]. Fat provides most of the energy to carnivores but it could also improve the palatability of food [11], [12]. Nevertheless, cats rejected diet containing medium-chain triglycerides and caprylic acid [13]. No caprylic acid was detected in our sample supporting pork liver as a suitable raw material for cat food. Minimum requirements of fatty acids for cats are still not well known. Because of a little Δ6 desaturase activity, cats required foods of animal origin as a source of arachidonic acid, eicosapentaenoic acid and docosahexaenoic acid.

IV. CONCLUSION

Pork liver homogenates were characterized by a high FFA content probably modulated by pigs' diet and breed. FFA represented 12.95%, 23.44% and 13.97% of TFA in A, B and C, respectively. These fatty acid profiles may be then related directly to the cat's taste perception and nutritional requirements or indirectly to the aroma generation after process.

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